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RESEARCH ARTICLE

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Relationship between health-related quality of life and emergency department visit reduction in older adults

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ABSTRACT

The aim of this study is to assess the relationship between health-related quality of life (HRQoL) and the incidence of emergency department (ED) visits in a population of home-dwelling 75-year-olds. This study included home-dwelling older adults aged 75 in Western Finland, who participated in health screenings between 2020 and 2021, which included laboratory tests, self-reported questionnaires, and nurse interviews. HRQoL was measured using the 15D instrument, and participants were grouped into tertiles based on HRQoL scores. Demographic and clinical characteristics were analyzed, and ED visit incidence was evaluated per 1000 person-years (pyrs) over two years. Relationships between HRQoL dimensions and ED visits were presented as incidence changes and rate ratios with 95% confidence intervals (CIs). The study included 953 participants. Compared to those with lower HRQoL scores, participants with higher scores were more often male and married, made less frequent use of support services, had better mental health, were less frail, and functionally more independent. Improved nutritional status and hemoglobin levels, while fall risk, urogenital distress (UDI-6), and medication use decreased across tertiles. ED visit incidence decreased from over 300 per 1000 pyrs at low HRQoL (0.5) to about 50 per 1000 pyrs at high HRQoL (1.0). Improvements in specific HRQoL dimensions, especially sleeping and breathing, were significantly associated with fewer ED visits. Higher HRQoL has a relationship with fewer ED visits among home-dwelling older adults. Improvements in specific HRQoL dimensions, particularly sleeping and breathing, significantly reduce ED visit rates. These findings emphasize the importance of targeted HRQoL enhancements, comprehensive screenings, and preventive care to lower unplanned healthcare utilization.

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Health-related quality of life (HRQoL); emergency healthcare utilization; preventive care; older adults; health screening

Introduction

Older adults represent a growing proportion of emergency department (ED) users (Braes et al., 2010), accounting for one-third of all visits (Puig-Campmany and Ris-Romeu, 2022). Compared to younger patients, older adults often present with chronic diseases, polypharmacy, and functional dependency, which lead to longer ED and hospital stays, higher re-admission, greater functional decline, and increased mortality (Puig-Campmany and Ris-Romeu, 2022). Despite these trends, over 20% of ED visits by older adults are considered potentially preventable (McCusker and Verdon, 2006).

Health-related quality of life (HRQoL) (Sintonen and Pekurinen, 1989) is increasingly used as a health indicator in both clinical and policy decision-making (Kaplan and Hays, 2022; World Health Organization, 1997). It captures a multidimensional picture of physical, mental, and social well-being and reflects how individuals perceive their ability to function in daily life (Sintonen and Pekurinen, 1989). Poor physical HRQoL has been shown to independently predict the risk of ED visits among older adults (Bowling et al., 2007; Phyo et al., 2020). Although HRQoL has been widely studied in relation to mortality and disability among older people (Bally et al., 2024; Hirschman et al., 2020; Sinclair et al., 2024; Naseer et al., 2018),

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it is seldom used in structured population-based screenings or proactively to identify older individuals at risk of ED use (Phyo et al., 2020; Teperi et al., 2009). In addition, the association between HRQoL and ED visits has seldom been examined in a narrowly defined age group of home-dwelling older adults (Phyo et al., 2020).

In Finland, aging and health policies emphasize enabling older adults to live independently at home by identifying health risks early and implementing preventive measures (Teperi et al., 2009; Ministry of Social Affairs and Health and Association of Finnish Local and Regional Authorities, 2020). Understanding how HRQoL affects emergency healthcare utilization is particularly relevant in this context. In response to these policy goals, the city of Pori in Western Finland introduced a health screening procedure in 2019 for home-dwelling residents aged 75 (Kanninen et al., 2023). This screening aims to reduce the need for institutional care by systematically assessing potential health risks and HRQoL, enabling referrals for necessary preventive care. Despite the growing emphasis on preventive care, evidence on how HRQoL relates to ED use among narrowly defined cohorts, such as 75-year-old home-dwelling adults, remains limited. The aim of this study is to assess the relationship between HRQoL and its various dimensions and the incidence of ED visits in a population of home-dwelling 75-year-olds.

Materials and methods

The study population

All home-dwelling older adults who turned 75 between 2020 and 2021 and participated in the health screening were categorized as part of the study population. Older adults aged 75 years in institutional care were excluded. No participants were excluded based on comorbidities, functional status, or other health-related characteristics. Thus, the study represents a population-based cohort of home-dwelling 75-year-olds. This register-based study was conducted with permission from the Wellbeing Service County of Satakunta, using the Auria Data Lake register in accordance with the Act on the Secondary Use of Health and Social Data (The Act on the Secondary Use of Health and Social Data, 2019). The data were extracted anonymously from the data register.

The health screening procedure

All 75-year-old residents were identified from the Population Register Centre, and those living at home received an invitation to participate i a postal letter sent by a trained nurse. The health screening included 30 validated health measures, categorized into three groups: 1) patient-reported outcome measures (PROMs) (nine measures), 2) nurse-conducted screenings (14 measures), and 3) laboratory tests (seven measures) (Kanninen et al., 2023). The measures were divided into three sections, with two of the sections delivered through separate questionnaires.

During the 2-hour appointment, the nurse conducted screenings, verified, and reconciled the medication list with electronic medication records, and documented the outcomes of both PROMs and nurse-conducted screenings in the electronic health records. Prior to the practical nurse (PN) appointment, participants were instructed to complete the PROMs at home, bring them to the appointment, and visit the laboratory as part of the health screening (Kanninen et al., 2023). PNs referred participants with potential health risks to appropriate healthcare professionals based on the cut-off points of health measures. The development of the health screening procedure, including details on selected measures and their optimal cut-off points, has been published elsewhere (Kanninen et al., 2023).

Assessments of health risks

HRQoL was assessed using 15D, which is a generic, comprehensive, 15-dimensional, and standardized measure (Sintonen and Pekurinen, 1989). The 15D(4) score ranges from 1 (the highest possible quality of life) to 0 (being death). According to Alanne et al., the minimum clinically important change in the total

15D score is estimated to be ± 0.015, which represents the minimal difference that is perceptible to people on average (Alanne et al., 2015).

Participants were categorized into three tertiles based on their HRQoL scores using the 15D instrument (Sintonen and Pekurinen, 1989): Tertile 1 (<0.88), Tertile 2 (0.88–0.95), and Tertile 3 (>0.95). Various demographic and clinical characteristics were collected and analyzed across these tertiles.

Demographic data included gender, educational level, marital status, smoking habits, alcohol consumption, and the use of support or services. The educational level was classified into two groups: under or over 10 educational years. Smoking status was categorized as either current smoker or non-smoking, including those who never smoked or had stopped smoking. Alcohol consumption was evaluated using the Alcohol Use Disorders Identification Test (AUDIT-C) (Bradley et al., 2007), in which score ranges 0–12, with a score of 0 reflecting no alcohol use. In addition, in older adults a score of five or higher is considered positive for men, whereas a score of four or higher is considered positive for women (van Gils et al., 2021). The use of different supports and services was categorized into two groups: no use of any support or services, and use of some support or service (including the basic, middle, or highest care allowance, family care allowance, transport services, security phone, or other services or allowances).

Clinical characteristics were evaluated using multiple measures. Cognitive function (memory and reasoning) was assessed using the Mini-Mental State Examination (MMSE) (Folstein et al., 1975). The scale of MMSE is from 0 to 30, and higher scores reflect better function (Folstein et al., 1975). Depressive symptoms were measured using the abbreviated version of the 15-item Geriatric Depression Scale (GDS15) (Arthur et al., 1999; Friedman et al., 2005). The GDS15 has a maximum score of 15, where scores of 0–5 indicate no or low risk depression, 6–10 reflects mild or mildly to moderate depression, and 11–15 signified severe depression (Friedman et al., 2005).

Frailty was assessed using the Fatigue, Resistance, Ambulation, Illness, and Loss of weight (FRAIL) scale (Morley et al., 2012), and was classified into three categories: robust (score of 0 indicating robust health), pre-frail (scores of 1–2), and frail (scores of 3–5) (Morley et al., 2012). The Falls Risk for Older People in the Community (FROP-Com) (Russell et al., 2008) was used to assess fall risk, providing an overall score ranging from 0 to 9, where higher scores indicate a greater risk of falls (Russell et al., 2008). Basic activities of daily living (ADL) were evaluated using the 6-item Katz Index (Katz, 1983), while instrumental activities of daily living (IADL) were measured with the 8-item Lawton and Brody scale (Lawton and Brody, 1969). The ADL index scores range from 0 to 6, and the IADL scale from 0 to 8, with higher scores reflecting better functioning. Urinary incontinence was assessed using the Urinary Distress Inventory (UDI-6) (Uebersax et al., 1995; Utomo et al., 2015). The total UDI-6 score ranges from 0 to 18, with higher scores indicating greater symptom distress. Nutritional status was determined using The Mini Nutritional Assessment (MNA) (Vellas et al., 2006), in which scores were classified as well-nourished (≥ 24 points), at risk of malnutrition (17–23.5 points), or as malnourished (< 17 points) (Vellas et al., 2006).

Furthermore, the total number of regularly used drugs (including both prescription and over-the-counter drugs) was calculated per participant, with food supplements and medicinal products excluded from the study. Laboratory values, including estimated glomerular filtration rate (eGFR), hemoglobin A1c (B-HbA1c), hemoglobin (Hb), and vitamin D (S-25(OH)D), were extracted anonymously from electronic health records. These measurements were originally obtained as part of health screening and analyzed in accredited clinical laboratories using standard diagnostic protocols. The eGFR was calculated by the laboratory using established formulae (CKD-EPI), and all values reflect those recorded in the health records at the time of screening.

Relationship between HRQoL and ED visit incidence

The relationship between HRQoL and ED visit incidence was assessed using the 15D instrument (Sintonen and Pekurinen, 1989). Two main analyses were conducted: the first, the incidence of ED visits per 1000 person-years (pyrs) and incidence rate ratios (IRRs) across the range of HRQoL scores (Figure 1), both 95% confidence intervals (CIs). A second analysis focused on individual dimensions of the 15D instrument (Sintonen and Pekurinen, 1989) (Figure 2). Incidence changes per 1000 people were evaluated for each dimension (15 dimensions), with results presented as point estimates and 95% CIs. Positive values indicate an increase in ED visits, while negative values suggest a reduction.

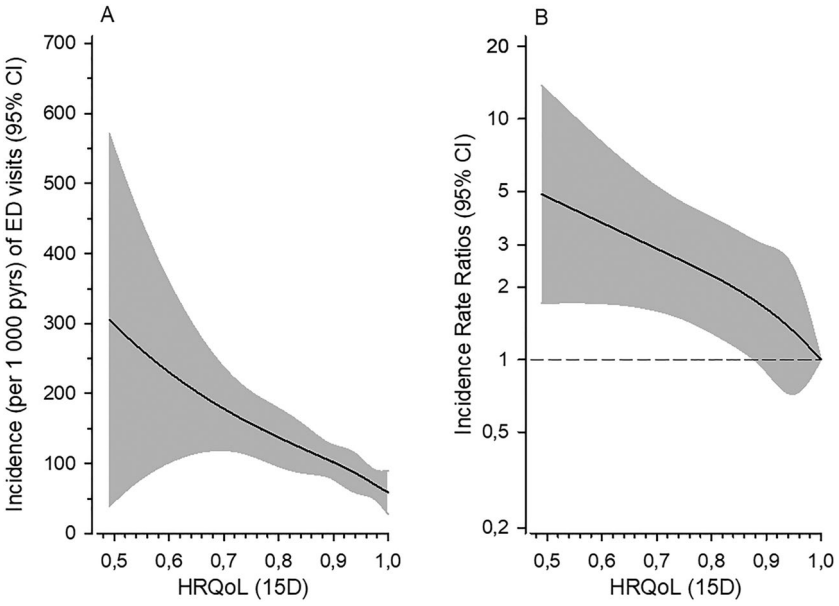

Figure 1. The relationship between health-related quality of life (HRQoL) and the incidence (left) and rate ratios (right) of emergency department (ED) visits two years after the health screening. The shaded area around the curve represents the 95% confidence interval. The curves were derived from a 3-knot restricted cubic splines Poisson regression models. Models adjusted for marital status, gender, AUDIT-C smoking, and amount of all used drugs.

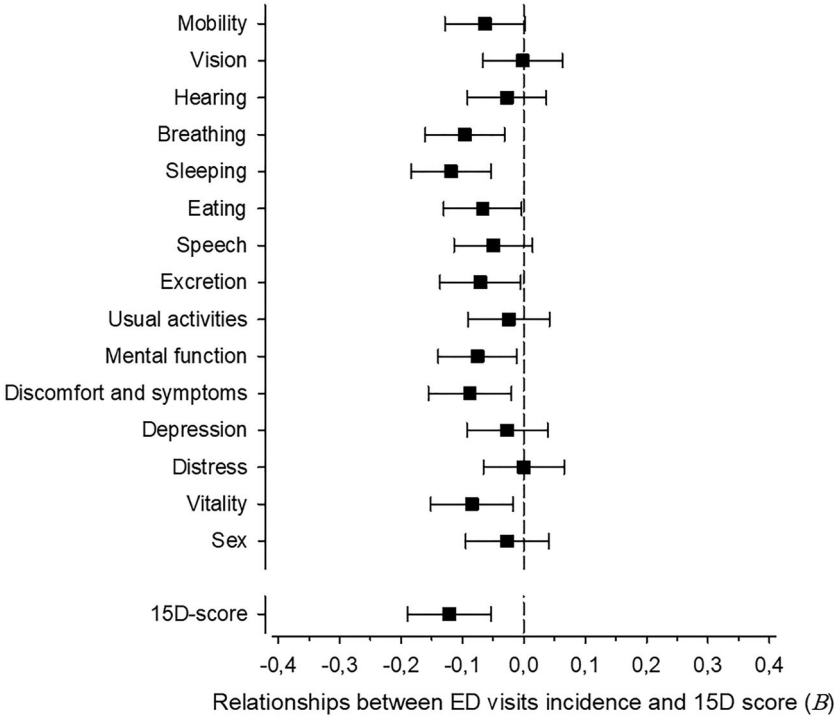

Figure 2. The impact of different dimensions of health-related quality of life (15D) on the incidence of emergency department visits two years after the health screening.

Ethics approval

The study was approved by the Wellbeing Service County of Satakunta (SATSHP/1829/13.01/2019).

Statistical analysis

Statistical analyses were conducted to assess trends across the tertiles, with *p* values reported for each variable. The demographic and clinical characteristics of older adults across HRQoL tertiles 1–3 were

collected at the time of the health screening, and ED visits were assessed two years after the health screening.

Summary statistics were described using mean and standard deviation (SD), or numbers as percentages. The hypothesis of linearity was tested using the Cochran–Armitage test, analysis of variance (ANOVA) or logistic models with an appropriate contrast. A possible nonlinear relationship between ED visits and HRQoL (15D) was assessed by using 3-knot restricted cubic spline Poisson regression models. Regression analysis was used to identify the relationship between EDs and 15D with standardized regression coefficient Beta (β). The Beta value is a measure of how strongly the predictor variable (15D) influences the criterion (EDs) variable. The Beta is measured in units of SD. Cohen's standard for Beta values above 0.10, 0.30, and 0.50 represents small, moderate and large relationships, respectively. Regression models included gender, smoking, marital status, AUDIT-C score, as covariates and the total number of drugs used. In the case of violation of the assumptions (e.g. non-normality) for continuous variables, a bootstrap-type method or Monte Carlo p values (small number of observations) for categorical variables were used. The normality of variables was evaluated graphically and by using the Shapiro–Wilk W test. Stata version 18.0 (StataCorp LP, College Station, TX) was used for the statistical analyses.

Results

All home-dwelling older adults who turned 75 between 2020 and 2021 and participated in the health screening were included in the study ($n = 1094$) and the participation rate was 41%. The 15D instrument data was obtained for 953 participants, of whom 59% were women.

The results demonstrate significant relationship in demographic and clinical characteristics among older adults across HRQoL tertiles 1–3 (Table 1). A clear relationship was observed in the gender distribution, with the proportion of females decreasing from 62% in the lowest tertile (Tertile 1) to 53% in the highest tertile (Tertile 3) ($p = 0.021$). Similarly, marital status showed a significant association with HRQoL; the percentage of married individuals increased remarkably from 57% in Tertile 1 to 73% in Tertile 3 ($p < 0.001$). The use of supports and services was more common among individuals in the lowest HRQoL tertile, with 8% of Tertile 1 participants using such services compared to 1% and 3% in Tertiles 2 and 3, respectively ($p = 0.002$).

Cognitive function (MMSE) improved slightly across tertiles, although the trend did not reach statistical significance ($p = 0.053$). However, depression scores (GDS15) were significantly lower in the higher HRQoL tertiles ($p < 0.001$), indicating better mental health. Frailty was strongly associated with HRQoL from Tertile 1 to Tertile 3 ($p < 0.001$). In Tertile 1, 7% of participants were classified as frail, while no frail individuals were found in Tertile 3. In addition, the proportion of robust individuals increased from 54% in Tertile 1 to 89% in Tertile 3 ($p < 0.001$).

Functional independence (ADL) and IADL improved significantly with higher HRQoL ($p < 0.001$). Similarly, nutritional status (MNA) showed a notable improvement from Tertile 1 to Tertile 3 ($p < 0.001$). Fall risk (FROP-Com) and urogenital distress (UDI-6) decreased significantly across tertiles ($p < 0.001$). In addition, medication use was also significantly associated with HRQoL, with the number of drugs decreasing from 6.5 in Tertile 1 to 4.1 in Tertile 3 ($p < 0.001$). Finally, hemoglobin levels were higher in individuals with better HRQoL, showing a significant increase from Tertile 1 to Tertile 3 ($p = 0.005$).

Figure 1 highlights the relationship between better HRQoL and a lower incidence (on the left) and rate ratio of ED visits (on the right). The graph on the left shows that as HRQoL increases, the incidence of ED visits per 1000 pyrs steadily declines. For individuals with lower HRQoL scores (around 0.5 on the 15D scale), the incidence of ED visits exceeds 300 per 1000 pyrs. In contrast, individuals with higher HRQoL scores (close to 1.0 on the 15D scale) have a significantly lower incidence, approaching 50 ED visits per 1000 pyrs.

Similarly, the right panel of Figure 1 shows a negative relationship, with the IRRs declining as HRQoL improves. An HRQoL of 0.85 or below is statistically significant as a risk factor for ED visits. An HRQoL of 0.5 corresponds to an IRR of nearly 5, indicating that individuals with low HRQoL are approximately 5 times more likely to have an ED visit compared to those with an HRQoL of 1. As HRQoL approaches 1.0, the IRR approaches 1, signifying no increased risk of ED visits.

Table 1. Demographic and clinical characteristics of study group ($n = 953$) by health-related quality of life (15D) tertiles at the time of the health screening.

Variable	Tertile 1 <0.88 $N = 317$	Tertile 2 0.88–0.95 $N = 318$	Tertile 3 >0.95 $N = 318$	p For trend
Demographics characteristics				
Female, *n* (%)	196 (62)	199 (63)	168 (53)	0.021
Education under 10 years, *n* (%)	200 (65)	214 (68)	220 (71)	0.075
Married, *n* (%)	179 (57)	216 (68)	229 (73)	<0.001
Smoking, *n* (%)	22 (7)	20 (6)	24 (8)	0.75
Alcohol (AUDIT-C), mean (SD)	1.8 (1.9)	2.0 (1.8)	1.8 (1.7)	0.55
Supports or services in use*, *n* (%)	22 (8)	4 (1)	8 (3)	0.002
Clinical characteristics				
MMSE, mean (SD)	27.5 (2.8)	28.0 (1.9)	27.9 (1.9)	0.053
GDS15, mean (SD)	6.0 (1.6)	5.4 (1.3)	5.3 (0.9)	<0.001
Frailty, *n* (%)				<0.001
Robust	171 (54)	270 (85)	283 (89)	
Pre-frail	122 (39)	44 (14)	34 (11)	
Frail	21 (7)	4 (1)	0 (0)	
FROP-Com, mean (SD)	1.1 (1.6)	0.5 (0.8)	0.3 (0.6)	<0.001
ADL, mean (SD)	1.1 (2.2)	0.2 (0.7)	0.0 (0.2)	<0.001
IADL, mean (SD)	1.8 (3.6)	0.6 (1.5)	0.5 (1.6)	<0.001
UDI6, mean (SD)	3.7 (2.7)	2.3 (1.9)	1.2 (1.4)	<0.001
MNA, mean (SD)	27 (19)	28 (20)	33 (36)	<0.001
Number of drugs in use, mean (SD)	6.5 (3.8)	5.3 (3.1)	4.1 (2.9)	<0.001
eGFR, mean (SD)	75.1 (12.9)	74.3 (12.5)	75.2 (12.2)	0.93
B-HbA1c, mean (SD) (mmol/mol)	39.1 (6.6)	38.5 (6.9)	37.9 (6.6)	0.11
Hb, mean (SD)	139 (12)	142 (14)	143 (13)	0.005
D-vitamin, mean (SD)	85 (33)	83 (25)	87 (31)	0.67

Reference score of age- and sex-matched general Finnish population (age 75 or older) is 0.836 (30).
*Care allowance at the basic, the middle, and the highest rate, family care allowance, transport service, security phone, or some other service or allowance.

The results of Figure 2 indicate that improvements in several HRQoL dimensions are linked to a significant decrease in the incidence of ED visits. Sleeping showed the strongest negative correlation with ED visits. An increase in sleeping resulted in approximately [Beta −0.12 (95% CI: −0.18 to −0.05)] fewer ED visits per 1000 pyrs. Other factors, such as breathing, excretion, mental function, discomfort and symptoms, and vitality, also contributed to reduced ED visits, though their impact was slightly smaller than that of sleeping. Accordingly, dimensions like mobility, vision, hearing, speech, usual activities, depression, distress, and sex had neutral effects on ED visit rates. An increase in the total 15D score was associated with approximately [Beta −0.12 (95% CI: −0.19 to −0.05)] fewer ED visits per 1000 pyrs.

Discussion

The results of this study highlight a significant inverse relationship between HRQoL and emergency healthcare utilization. Higher HRQoL is strongly linked to a lower incidence and rate ratio of ED visits, suggesting that improving specific HRQoL dimensions could significantly reduce ED visit rates.

The significant differences in demographic and clinical characteristics across HRQoL tertiles in this study reveal potential social and health-related factors that may contribute to quality of life among older adults. The decreasing proportion of females and the increasing proportion of married individuals across HRQoL tertiles may suggest that marital status and gender influence quality of life. This finding aligns with existing literature indicating that social support and marital status positively impact well-being in older populations (Farriol-Baroni et al., 2021; Gutiérrez-Vega et al., 2018). Older adults in the high values demonstrated reduced frailty and fall risk, greater functional independence, and nutritional status. The observed increase in hemoglobin levels in higher HRQoL tertiles may reflect better nutritional and general health in individuals with higher HRQoL. These findings and previous studies (Blanco-Reina et al., 2019; Bullo et al., 2018; Damião et al., 2018; Kunvik et al., 2024) emphasized the importance of physical abilities and nutrition for maintaining HRQoL. In addition, previous studies (Montiel-Luque et al., 2017;

Tegegn et al., 2019) were consistent with our finding that the association between lower medication use and higher HRQoL suggests that polypharmacy might negatively impact older adults' quality of life.

Conversely, individuals in the lowest value of HRQoL were more likely to use supports and services, had poorer mental health outcomes (GDS15), and increases UDI-6. These findings underscore the multi-dimensional nature of HRQoL and the importance of comprehensive interventions that address mental, physical, and social health to improve the quality of life among older adults and reduce healthcare utilization.

The results emphasize the significant inverse relationship between HRQoL and emergency healthcare utilization among older adults. Higher HRQoL scores have relationship with a decreased incidence and rate ratio of ED visits. The substantial difference in ED visit rates between individuals with low and high HRQoL scores supports the value of preventive strategies focused on improving HRQoL in older adults, particularly those with lower HRQoL scores.

The findings highlight the important role of specific HRQoL dimensions in reducing ED visit rates among older adults. Improvements in sleep, breathing, excretion, mental function, discomfort, symptoms, and vitality contributed to reductions in ED visit rates. This suggests that preventive measures targeting specific aspects of HRQoL can lead to significant healthcare savings and enhance the overall well-being of older adults. According to Naseer M. et al., the health promotion counselling in other settings than emergency, such as geriatric centers or primary health care, could help to identify and address risk factors behind poor HRQoL (Naseer et al., 2018). The findings also demonstrate the importance of continuous monitoring of HRQoL, as even small changes in the 15D score were associated with meaningful differences in ED visit rates. Conversely, dimensions like mobility, vision, hearing, speech, usual activities, depression, distress, and sex showed neutral effects on ED visit rates, indicating that their influence may be less direct or less impactful on emergency care needs. These results support the idea that comprehensive strategies targeting various HRQoL dimensions could be effective in improving overall health outcomes and minimizing emergency healthcare use.

A limitation of this study was that it included only 75-year-old residents of Pori, Western Finland, who participated in the health screening, resulting in a 41% participation rate. The COVID-19 pandemic during 2020–2021 may have further impacted this rate, as restrictions and health concerns could have reduced willingness to participate. In addition, the study is based on data from a specific geographical area (Pori, Finland) and age group (75-year-olds), which may limit the generalizability of the findings to other regions and age groups. Although this study comprehensively considered background variables, there may be other confounding factors, such as socioeconomic status, specific diagnoses, or comorbidities, that could influence HRQoL and emergency service use. The HRQoL among the study population was higher compared to the general population; however, the findings remained clearly observable within this cohort as well. Furthermore, the study used data from the health record system without access to social care records, thus all relevant socioeconomic factors were not included.

Finally, the study underscores the importance of a multidimensional approach to enhancing HRQoL among older adults. Targeting specific aspects like sleeping and breathing can improve individual well-being and reduce emergency healthcare demands. These findings support the need for targeted, preventive strategies in primary care settings to help older adults maintain health and independence at home. Future research should investigate the long-term effects of HRQoL improvements on healthcare utilization and develop home-dwelling-based interventions tailored to key HRQoL dimensions.

Conclusion

Higher HRQoL has a relationship with fewer ED visits among home-dwelling older adults. Improvements in specific HRQoL dimensions, particularly sleeping and breathing, significantly reduce ED visit rates. These findings emphasize the importance of targeted HRQoL enhancements, comprehensive screenings, and preventive care to lower healthcare utilization.

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Ethics approval

The study was approved by the Wellbeing Service County of Satakunta (SATSHP/1829/13.01/2019).

Consent for publication

Not applicable.

Disclosure statement

The authors report there are no competing interests to declare. All authors approved the final version to be published.

Authors' contributions

Contributed equally to this work: J.C.K., A.H., H.K.
Contributed to the study concept and design: J.C.K., A.H., H.K.
Acquisition and analysis or interpretation of data: J.C.K., A.H., H.K.
Drafting of manuscript: J.C.K., A.H., H.K.
Critical revision of manuscript for important intellectual content: J.C.K., A.H., H.K.
Have read and approved the final manuscript: J.C.K., A.H., H.K.

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A data availability statement

The data cannot be shared for ethical and security concerns. The data that support the findings of this study are available from the Wellbeing Service County of Satakunta (previously social security center of Pori), but restrictions apply to the availability of these data, which were used under license for this study and so are not publicly available. The permission to use date can be applied from the Wellbeing Service County of Satakunta.

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