Scandinavian Journal of Primary Health Care

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ipri20

Health screening and its association with emergency department visits and related costs among home-dwelling older adults

Jonna-Carita Kanninen, Hannu Kautiainen & Anu Holm

To cite this article: Jonna-Carita Kanninen, Hannu Kautiainen & Anu Holm (07 Nov 2024): Health screening and its association with emergency department visits and related costs among home-dwelling older adults, Scandinavian Journal of Primary Health Care, DOI: 10.1080/02813432.2024.2423233

To link to this article: https://doi.org/10.1080/02813432.2024.2423233

Published online: 07 Nov 2024.

SCANDINAVIAN JOURNAL OF PRIMARY HEALTH CARE
https://doi.org/10.1080/02813432.2024.2423233

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

OPEN ACCESS Check for updates

Health screening and its association with emergency department visits and related costs among home-dwelling older adults

Jonna-Carita Kanninen[a], Hannu Kautiainen[b,c] and Anu Holm[d]

[a]Wellbeing Services County of North Savo, Finland; [b]Primary Health Care Unit, Kuopio University Hospital, Kuopio, Finland; [c]Folkhälsan Research Center, Helsinki, Finland; [d]Faculty of Medicine, University of Turku, Turku, Finland

ABSTRACT

Background: The aim of this study was to evaluate the effectiveness of the health screening procedure for home-dwelling older adults in reducing emergency department visits and associated costs.

Methods: Data were derived from health screenings from 2020 to 2021 for 75-year-old home-dwelling residents of Western Finland. The study compared emergency department visits and associated costs between older adults who participated in the health screening (intervention group) and those who did not (non-intervention group). For each older adult, three non-intervention controls were matched according to age, sex, health screening year and wellbeing service county. Emergency department visits and International Classification of Diseases (ICD)-10 codes from one year before to two years after health screening were analyzed.

Results: In the non-intervention group, a 19% increase in emergency visit rates was seen (457–564 per 1000 person-years), while the intervention group showed a 67% decrease (165–23). Annual costs for the non-intervention group increased from 148 euros (€) to €183, a mean ratio increase of 1.24 per person-year (range 1.08–1.40). In contrast, the intervention group's costs decreased from €53 to €8, a mean reduction ratio of 0.15 per person-year (range 0.10–0.71). The intervention group had lower frequency of visits for respiratory and circulatory diseases but higher for digestive and metabolic diseases, unlike the non-intervention group.

Conclusions: The implementation of the health screening is an effective strategy for reducing both the frequency of emergency department visits and associated costs in home-dwelling older adults in good condition.

ARTICLE HISTORY
Received 7 June 2024
Accepted 23 October 2024

KEYWORDS
Effectiveness; health screening; older adults; secondary use of data; primary healthcare

Introduction

Healthcare systems worldwide are facing the challenge of aging populations. This phenomenon is particularly noticeable in developed countries like Finland, where almost one-quarter of the population will have reached >75 years of age in 2030 [1]. This has prompted major reforms in the Finnish healthcare and social services system, with an increased emphasis on preventive health initiatives for older adults [1]. The goal of these initiatives is to support individuals in continuing living in their own homes for as long as possible and reduce the need for expensive institutional care [1–3]. One such initiative is a preventive health screening procedure, which was developed in Western Finland [4]. This procedure was established for home-dwelling 75-year-olds, with the aim of identifying potential health risks and functional impairments among older adults to provide them the opportunity to continue living independently [4].

The existing literature lacks a clear definition of health screening, and the landscape and context of screenings are both complex and changing [5]. This complexity presents considerable challenges to any investigation into the effectiveness of health screenings.

Screening programs are designed for a variety of conditions. The aim of each program should be clearly defined and understood. This will influence the program's design and the measures used to evaluate its effectiveness [6]. While the advantages of various disease- and symptom-specific screenings [7–15] and the cost-effectiveness of screenings [7, 14, 15] for adults

CONTACT Jonna-Carita Kanninen jonna-carita.kanninen@pshyvinvointialue.fi Wellbeing Services County of North Savo, Finland

have been evidenced, recent research on the effectiveness of health screenings, particularly for older adults, is limited. Furthermore, evaluating the benefits of health screening in older adults is challenging due to several factors [16], including multiple risk factors associated with geriatric syndromes, reduced physiological reserve, increased comorbidity, and polypharmacy [17, 18]. In addition, important outcomes may not be measured and reported in ways that are useful for evaluating the effectiveness of health screenings in this population [17, 18]. This study aims to evaluate the effectiveness of the health screening procedure in reducing emergency department visits and associated costs.

Materials and methods

The health screening procedure

Finnish aging and health policies focus on enhancing support for older people to live in their own homes, achieved by identifying risk factors and developing preventive measures to maintain functional ability [1–3]. In Pori's social security center, located in Western Finland and transferred to the wellbeing service county of Satakunta at the beginning of 2023 [19, 20], institutional care for older residents of this region has been more common than in other parts of Finland [21]. In response, the center strategized in 2019 to substantially reduce the need for expensive institutional care for residents over 75 [21]. To support this goal, the preventive health screening procedure was established in 2019, targeting home-dwelling 75-year-olds. Health screenings are a publicly funded part of primary care services in Finland [22].

The health screening procedure was conducted at Pori's social security center. All 75-year-old residents were identified from the Population Register Centre, and those living at home were invited to participate in the health screening by a trained nurse through a postal letter. The health screening consisted of 30 validated health measures, which were categorized into three groups: (1) patient-reported outcome measures (PROMs) (nine measures), (2) nurse-conducted screenings (14 measures) and (3) laboratory tests (seven measures) [4]. The measures were divided into three sections, and two of these sections were provided through distinct questionnaires.

The first questionnaire focused on PROMs that could be conducted at home. These screenings included evaluations of quality of life, functional ability, mood and depressive symptoms, sleep disorders, alcohol use, urination difficulties and potential medication-related problems and risks in medication use.

The second questionnaire consisted of screenings to be performed by a health care professional. The healthcare professionals involved in conducting the screenings were practical nurses (PNs), who received training on how to perform all the included screenings during an education day. The screenings of the second questionnaire included frailty assessment, nutritional status, cognition (memory and reasoning), sleep apnea, fall risk, lower-body strength, orthostatism (difficulty in achieving stable blood pressure) and additional tests for identifying impaired vision and hearing. During the PN appointment (2 h), the nurse conducted screenings, ensured the accuracy of the self-reported medication list, reconciled this list with electronic medication records, and recorded the outcomes of both PROMs and nurse-conducted screenings in the electronic health records. Prior to the PN appointment, participants were asked to complete the PROMs at home and bring them to the appointment. In addition, they were asked to visit the laboratory as part of the health screening procedure [4].

The third section comprised laboratory tests, including basic blood count, long-term blood glucose, vitamin D, serum creatine, glomerulus filtration rate, serum sodium and potassium levels, and albumin-corrected calcium.

PNs referred participants identified as having potential health risks to various healthcare professionals based on the cut-off points of health measures. The health screening procedure included a total of 12 referral options for further health actions when necessary. These options were a nurse, nurses specialized in memory diseases, diabetes or mood disorders, a respiratory therapist, a physician, a pharmacist, a dental physician, a physiotherapist, a dietician, a service coordinator and an additional option of other health services or professionals. A detailed description of the procedure's development, the fundamentals of its selected measures, and their respective optimal cut-off points have been published elsewhere [4].

The intervention and non-intervention group

All home-dwelling older adults who turned 75 between 2020 and 2021 and participated in the health screening were categorized as part of the intervention group in this study. A total of 1094 participants took part in the health screening, yielding a participation rate of 41%. Data were obtained for 953 participants, of whom 59% were women.

The home-dwelling older adults who were invited but declined to participate in the health screening were included as a non-intervention group. For each participant in the intervention group, three eligible non-intervention controls were individually matched by age, sex, the year of their health screening visit and

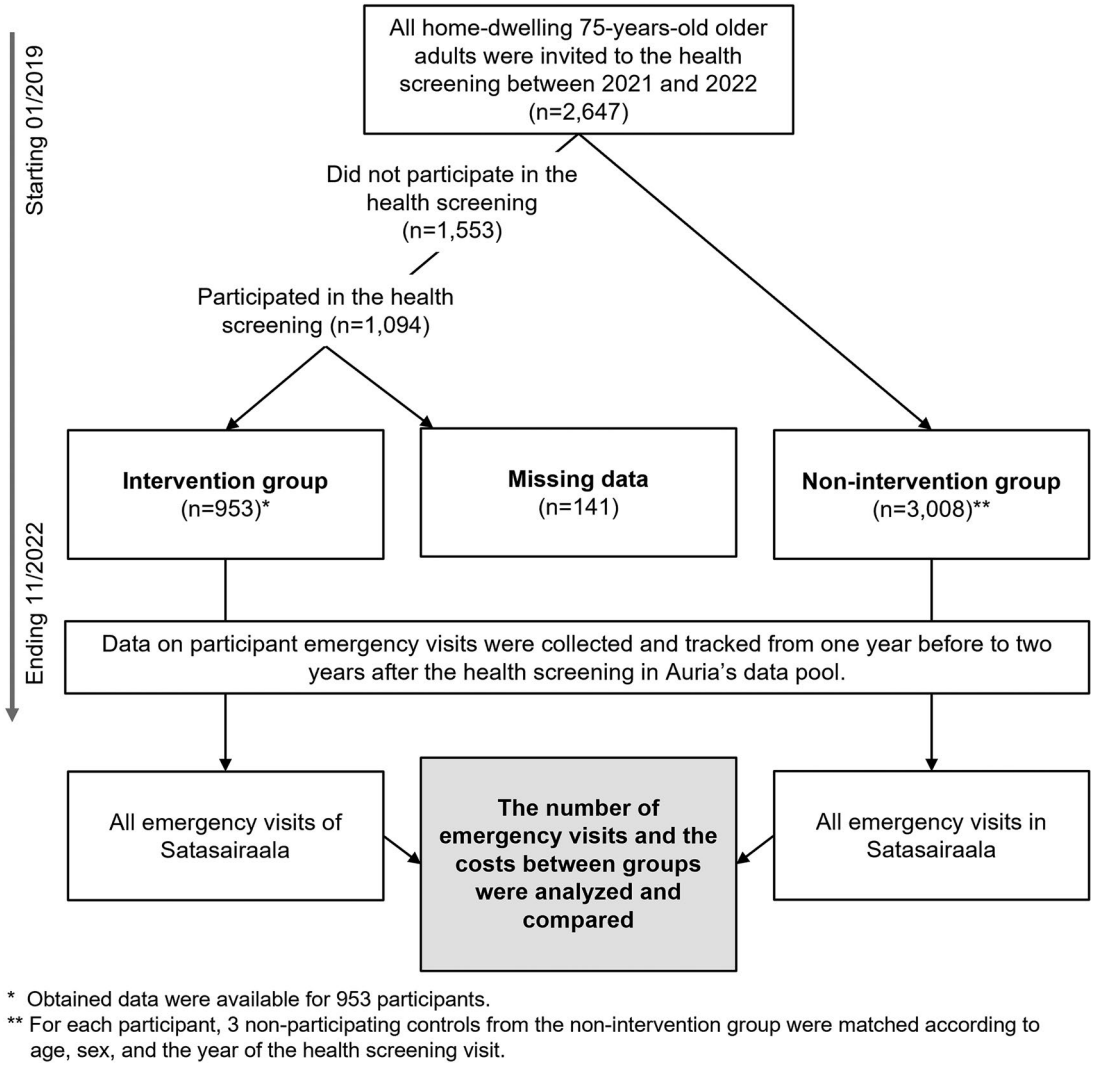

Figure 1. The flowchart of the study for home-dwelling older adults aged 75 years, showing invitations for health screening, participation and group allocation, along with data tracking and analysis of emergency visits and costs over a three-year period around the screening.

wellbeing service county. This register-based study was conducted with the permission of the wellbeing service county of Satakunta. The Auria Data Lake register was used based on the Act on the Secondary Use of Health and Social Data [23]. Older adults aged 75 years in institutional care were excluded from this study. These register-based data did not include clinical data from the non-intervention group, only the number of emergency department visits and the main reasons for these visits. The flowchart of the study, showing the group allocation to the intervention and non-intervention groups, is presented in Figure 1.

Assessments of health risks

Various health risk factors were assessed using several validated measures to describe the intervention group. The educational level was divided into two categories: under or over 10 educational years. Smoking status was categorized as either current smoker or non-smoking (having never smoked or having stopped smoking). Alcohol consumption was determined using the Alcohol Use Disorders Identification Test (AUDIT-C) [24], in which scores range 0–12 (a score of 0 reflects no alcohol use). In addition, a score of 4 or higher is considered positive for men, while a score of 3 or higher is considered positive for women. The use of different supports and services was also separated into two categories: not using any support or services and using some support or service (including care allowance at the basic, middle or highest rates, family care allowance, transport service, security phone, and other services or allowances). Health-related quality of life (HRQoL) was determined using 15D, which is a generic, comprehensive, 15-dimensional and standardized measure [25]. The

maximum score of 15D [25] is 1 and the minimum score is 0 (being dead). Alanne et al. have determined that 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 [26]. A Mini-Mental State Examination (MMSE) was used to check for cognition impairment (memory and reasoning) [27]. The scale of MMSE is from 0 to 30, and higher scores indicate better function [27]. The depression screening was performed using the abbreviated version of the 15-item Geriatric Depression Scale (GDS15) [28, 29]. The maximum sum score of GDS15 is 15; scores of 0–5 indicate none or low depression risk status, scores 6–10 are mild or mildly to moderately depressed, and scores 11–15 represent severely depressed [29]. The Fatigue, Resistance, Ambulation, Illness and Loss of weight (FRAIL) scale was used to screen for frailty [13]. Scores on the FRAIL scale range from 0 to 5, in which score 0 represents robust health status, scores 1–2 are pre-frail, and scores 3–5 equal frail [13]. Falls risk was identified using Falls Risk for Older People in the Community (FROP-Com) [30], which provides an overall score of falls risk within a range of 0–9, with higher scores indicating a higher risk [30].

Performance in the basic activities of daily living (ADL) was assessed using the six-item Katz Index [31] and in instrumental activities (IADL) by the eight-item Lawton and Brody scale [32]. The scoring for the ADL index ranges from 0 to 6 and for the IADL scale from 0 to 8, with higher scores indicating better functioning. Urinary incontinence was determined using the Urinary Distress Inventory (UDI-6) [33, 34]. Total score of UDI-6 is from 0 to 18, in which higher scores indicate more symptom distress.

Furthermore, average blood glucose levels (B-HbA1c) were measured. The total number of regularly used drugs (including both prescription and over-the-counter drugs) were totaled per drug user, excluding food supplements and medicinal products from this study.

The characteristics of intervention group

The sociodemographic and clinical characteristics of the intervention group are presented in Table 1. Demographic characteristics showed that, of the total 953 older adults in the intervention group, 32% had received less than 10 years of education. Only a small number of them were smokers (7%), and alcohol consumption was low, with an average AUDIT-C score of 1.8. A minority (11%) required support or services. Clinical characteristics indicated that the older adults in the intervention group reported a good HRQoL. Their average HRQoL score of 0.902 is higher than the average Finnish population aged 75 or older (0.84). The prevalence of depressive symptoms was low, as indicated by an average GDS15 score of 5.6. The majority of older adults were classified as robust (76%), 21% as pre-frail, and only 3% as frail. Polypharmacy was common, with an average of seven medications per old adult.

Table 1. Demographic and clinical characteristics of the intervention group by gender between 2020 and 2021.

Variable	All *n* = 953	Female *n* = 563	Male *n* = 390
Demographics characteristics			
Education under 10 years, *n* (%)	299 (32)	178 (32)	121 (32)
Smoking, *n* (%)	66 (7)	23 (4)	43 (11)
Alcohol (AUDIT-C), mean (SD)	1.9 (1.8)	1.3 (1.3)	2.7 (2.1)
Supports or services in use[a], *n* (%)	99 (11)	73 (13)	26 (7)
Clinical characteristics			
HRQoL (15D), mean (SD)	0.902	0.901 (0.083)	0.905 (0.093)
Reference[b] value	[0.84]	[0.84]	[0.83]
MMSE, mean (SD)	27.8 (2.3)	27.9 (2.1)	27.6 (2.5)
GDS15, mean (SD)	5.6 (1.3)	5.7 (1.3)	5.4 (1.3)
Frailty, *n* (%)			
Robust	724 (76)	426 (76)	298 (76)
Pre-frail	200 (21)	120 (21)	80 (21)
Frail	25 (3)	13 (2)	12 (3)
FROP-Com, mean (SD)	0.6 (1.1)	0.6 (1.0)	0.7 (1.3)
ADL, mean (SD)	0.4 (1.4)	0.4 (1.3)	0.4 (1.5)
IADL, mean (SD)	1.0 (2.5)	0.5 (1.9)	1.6 (3.1)
UDI6, mean (SD)	2.4 (2.3)	2.6 (2.5)	2.1 (2.1)
B-HbA1c, mean (SD) (mmol/mol)	38.5 (6.7)	37.6 (4.8)	39.8 (8.6)
Number of drugs in use, mean (SD)	7.0 (4.1)	7.5 (4.0)	6.3 (4.1)

ADL: activities of daily living; AUDIT-C: the Alcohol Use Disorders Identification Test consumption; FROP-Com: Falls Risk for Older People in the Community assessment; HbA1c: average blood sugar level; HRQoL: health-related quality of life; IADL: instrumental activities of daily living; GDS15: Geriatric Depression Scale; MMSE: mini-mental state exam; SD: standard deviation; UDI6: Urinary Distress Inventory.

[a]Care allowance at the basic, the middle and the highest rate, family care allowance, transport service, security phone or some other service or allowance.

[b]Reference score of age- and sex-matched general Finnish population (age 75 or older) [35].

The older adults identified with potential health risks and referred by PNs to various healthcare professionals based on the cut-off points [4] of health measures are presented in Figure 2. In total, 62% of health screening participants were identified with some potential health risk and referred to further actions.

Emergency department visits and related costs

We explored the number of emergency department visits, related costs and changes in International Classification of Diseases (ICD) codes during the two-year follow-up period after the intervention. Data on emergency department visits and the main reason of ICD-10 codes for visits for older adults from both the intervention and non-intervention groups at Central Hospital in the wellbeing service county

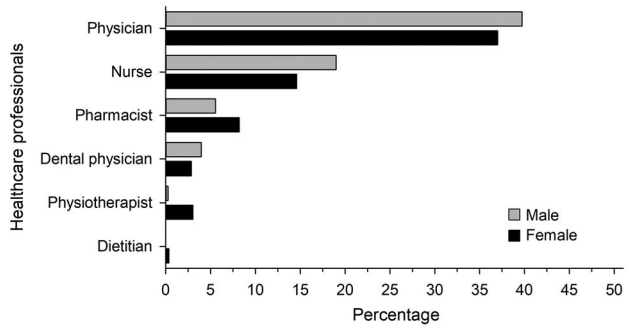

Figure 2. The distribution of male/female persons to various healthcare professionals to whom the 75-year-old participants (n = 953) with potential health risks were referred by practical nurses (PNs) based on the cut-off points [4] of health measures.

of Satakunta were extracted from the hospital's data pool [36]. The data on visits were followed from one year before the intervention to two years after the health screening, which ended in November 2022 for this study. Emergency department costs were determined using mean-unit costs for Finland for the year 2017, as reported by the Finnish National Institute for Health and Welfare [37], with an appropriate correction added for the inflation rate based on the official cost-of-living index [38]. Total costs were calculated by multiplying the number of visits to the emergency department by the cost of a single visit. Costs are presented in Euros (€). The calculation used a cost of €324.55 per emergency visit, based on 2022 values, from one year before the intervention to 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

Demographic and clinical characteristics of the intervention group were expressed as means with standard deviations (SDs), or as counts with percentages (%). The incidence and cost analysis were taken at different time points, including one year before (–1 to 0) to the health screening year (0–1) and two years afterward (1–2). The incidence rate, incidence rate ratio (IRR) and relative change were calculated using population-averaged Poisson regression models with robust standard error. Poisson's regression is a generalized linear model used to model count data with Poisson's distribution and a log link function. Cost analyses were performed using a generalized linear regression model with log-link and gamma-variance functions. The variance function was selected on the basis of Park's test and Akaike's information criterion. In connection with cost analyses, the bootstrapping (bias-corrected) technique (10,000 repetitions) was used to estimate confidence intervals. Crude cumulative rate of death was estimated using Kaplan–Meier's method and compared between groups with the permutation type Log-rank test. The Stata 17.1 (StataCorp LP, College Station, TX) statistical package was used for the analysis.

Table 2. Incidence (per 1000 pyrs) and incidence rate ratios (IRRs), and costs of emergency visits among 75-year-old adults between the intervention and non-intervention groups at three different time points.

	Time (years)		
Variable	Before −1 to 0	After 0 to 1	After 1 to 2
Rate			
Non-intervention[a] (95% CI)	457 (433–482)	530 (502–558)	564 (522–609)
Intervention[a] (95% CI)	165 (140–193)	164 (139–194)	23 (12–41)
IRR[b] (95% CI)	2.77 (2.35–3.27)	3.22 (2.71–3.83)	24.33 (13.41–44.15)
Euros (€)			
Non-intervention[c] (95% CI)	148 (135–161)	172 (157–187)	183 (162–204)
Intervention[c] (95% CI)	53 (42–65)	53 (42–65)	8 (2–14)
Mean cost ratio (95% CI)	2.77 (2.19–3.51)	3.22 (2.55–4.07)	24.33 (3.21–17.61)

[a]Visit per 1000 person-years.
[b]Incidence rate ratio.
[c]Euros (€) per one person-years.

Results

Emergency visit rates and mortality

Over a three-year period, the number of emergency visits in the non-intervention group increased from 457 to 564 per 1000 person-years (IRR 1.19 (95% CI: 1.08–1.31)) (Table 2). In contrast, the number of emergency visits in the intervention groups did not increase between the year prior to the health screening and the year following it, remaining at 160 per 1000 person-years. In addition, a surprising result was observed one to two years after the health screening: the number of emergency visits decreased from 165 to 23 per 1000 person-years, which represents a 67% reduction (IRR 0.33 (95% CI: 0.17–0.63)). The changes differed significantly between the groups (p < .001). Figure 3 represents the number of emergency visits per 1000 person-years among 75-year-old adults, comparing the intervention group and the non-intervention group.

The IRRs for the intervention group compared to the non-intervention group was 2.77 in the first period, 3.22 in the second and surged to 24.33 in the final period, indicating the intervention's significant impact on reducing emergency visits.

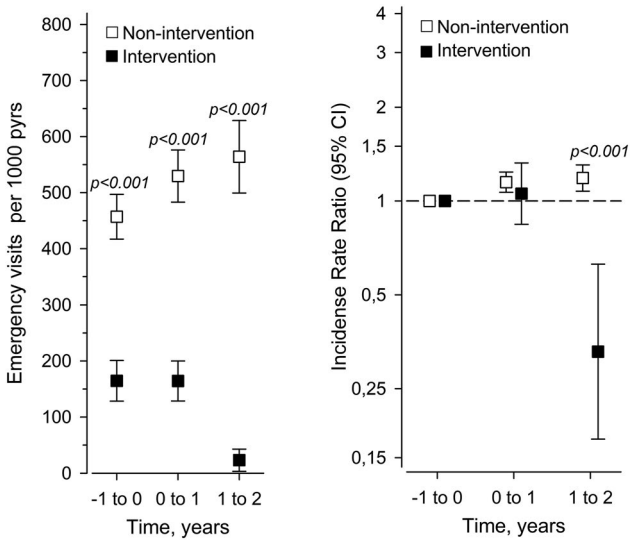

Figure 3. Incidence of the emergency department visits and incidence rate ratios (IRRs) from one year before the intervention to one and two years after the health screening (ended in November 2022) among 75-year-old adults. The left panel presents the number of emergency visits per 1000 person-years for both the intervention and non-intervention groups. The right panel shows the IRRs with 95% confidence intervals.

The 24-month mortality rate for the intervention group was 0.2% (95% CI: 0.1–0.8) with two events, while the non-intervention group experienced a slightly higher mortality rate of 0.6% (95% CI: 0.3–1.1) with 14 events (p = .23). The hazard ratio (HR) between the intervention and non-intervention groups was 0.41 (95% CI: 0.10–1.83).

Costs of emergency visits

A difference in event rates and associated costs of emergency visits between the intervention and non-intervention groups is presented in Table 2. The mean ratio of costs also followed this trend, with the intervention group showing a mean ratio of 2.77 before the health screening, 3.22 the year of the health screening, and a remarkable increase to 24.33 one year after the health screening, highlighting the financial benefits of health screening. In terms of costs, measured in Euros (€) per person-year, the non-intervention group's expenses increased from €148 to €183 (35€ (95% CI: 14–57)), while the intervention group experienced a decrease from €53 to €8 (€45 (95% CI: −84 to −8)). For the non-intervention group, there was a notable increase in costs with a mean ratio of 1.24 per person-year, with a range from 1.08 to 1.40. Accordingly, the intervention group experienced a significant cost reduction, with a mean ratio of 0.15 per person-year, with the range extending from 0.10 to 0.71.

Changes in ICD-10 code blocks

The distribution of the main reason ICD-10 code blocks for emergency department visits among 75-year-old adults is presented in Figure 4. There is a distinct pattern of change in the occurrence of certain conditions when comparing the period one year before with one year after the health screening. Specifically, frequencies of codes pertaining to respiratory diseases (e.g. J00–J99), musculoskeletal and connective tissue diseases (e.g. M00–M99) and circulatory system diseases (e.g. I00–I99) showed a marked decrease in the intervention group one year after the health screening. In contrast, the non-intervention group did not exhibit a similar trend. The codes for digestive system diseases, infectious and parasitic diseases, and endocrine, nutritional, and symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (e.g. K00–K93, A00–B99 and R00–R99) were the main reason for the emergency department visits in the intervention group after a one-year period.

Discussion

This study focused on evaluating the effectiveness of the health screening procedure in reducing emergency department visits and associated costs for home-dwelling 75-year-old adults. We found a significant reduction in both areas.

Numerous countries have recognized the high cost-effectiveness of health screening programs and have thus implemented them for specific diseases, such as cardiovascular diseases and diabetes [39, 40], or as a part of occupational health screening [41]. The findings of this study suggest that health screening procedure is an effective strategy for reducing emergency department visits among 75-year-old adults. An important finding of the study was a remarkable 67% reduction in emergency visits, particularly one to two years after the screening, demonstrating the effectiveness of health screening and preventive actions in reducing health risks for home-dwelling older adults. This outcome aligns with similar results reported in other studies, where preventive health screenings have been successful in reducing the burden of disease [39, 40], mortality [42, 43] or treatment costs [7, 14, 44, 45]. In addition, the cost associated with emergency department visits for older adults in the intervention group showed a significant reduction, underlining the cost of the health screening for older adults aged 75. When compared to non-participants, this considerable cost reduction suggests that implementing such screening programs could lead to significant healthcare savings.

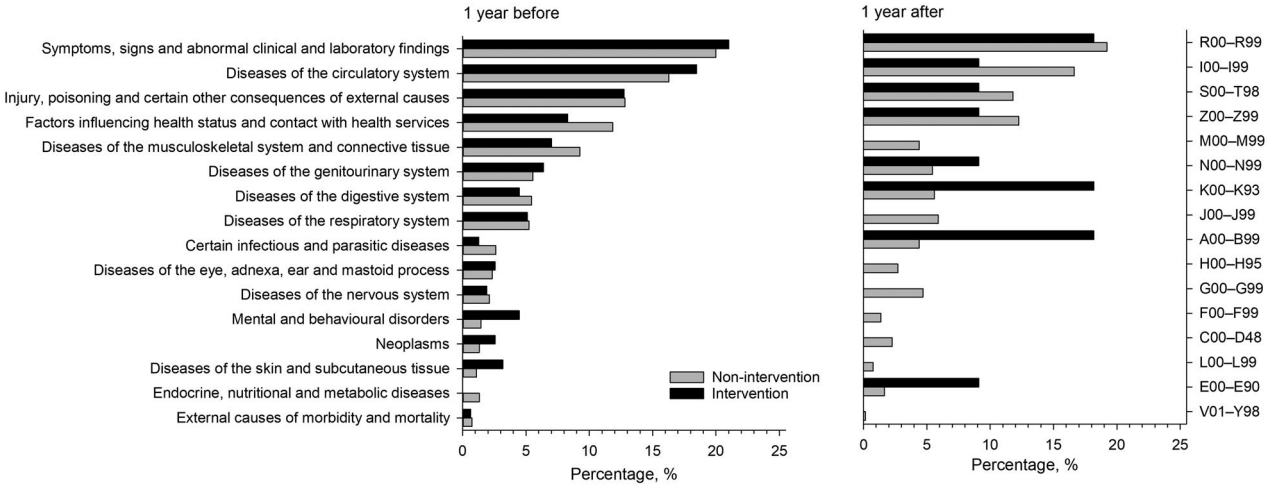

Figure 4. Distribution of the main reasons for emergency department visits, as classified by International Classification of Diseases (ICD)-10 codes, among 75-year-old adults between the intervention and non-intervention groups at two different time points, one year before and one year after health screening.

In addition, the study found that the reduced emergency department visits among the older adults, following the health screening procedure, were particularly associated with diseases of the respiratory system, musculoskeletal and connective tissue, and circulatory system. These results highlight the screening's efficacy in the early detection and management of these specific health conditions. In contrast, the non-intervention group did not show similar reductions. This emphasizes the importance of targeted health screenings for older adults but also necessitates further research to understand the reasons behind these decreases and to assess the long-term validity of such screenings.

An important component of the health screening for older adults aged 75 was its referral system, which effectively guided nearly two-thirds of older adults to appropriate healthcare professionals, mainly physicians and nurses, based on their potential health issues. This emphasizes the critical role of these professionals in managing the health risks of older adults. However, there is a shortage of healthcare, both globally and in Finland, especially of nurses, making it essential to implement strategic changes [46, 47]. Action is required to ensure the availability of competent personnel in the social and healthcare sectors, including the restructuring the distribution of work and organizing work within medical facilities [48]. Notably, the health screening procedure for 75-year-old adults also supported this restructuring, as a significant portion of older adults in the intervention group (over 10%) were referred to other healthcare professionals, such as pharmacists, highlighting their role in managing potential medication-related risks.

The study highlights several strengths. First, it benefits from a long follow-up period, starting a year before the intervention and extending to two years after the health screening. This timeline enables for more comprehensive observation of outcomes and potential changes over time. The study also features a relatively large sample size in the intervention group (n = 953), which enhances the reliability and generalizability of the findings among older adults. The inclusion of matched controls is another remarkable strength, helping to reduce biases and ensuring that the comparisons between the intervention and non-intervention groups are as fair and accurate as possible. Furthermore, an extensive set of baseline data was available for the intervention group, enabling a detailed description of the group.

A limitation of this study was that we did not have access to the diagnoses of the intervention and non-intervention groups during the health screening. In addition, clinical measurements were not taken from the non-intervention group. Based on our results, it would be justified to conduct a randomized controlled trial (RCT) in the future, with a better understanding of the baseline characteristics of the non-intervention population. Furthermore, it is important to acknowledge that while the reduction in emergency department visits is promising, it does not in itself prove the effectiveness of the health screening procedure for older adults aged 75. The effectiveness of health screening could be measured from other perspectives, such as the provision of health counseling [49], but in this study, health counseling was not analyzed separately. However, the health counseling provided by PNs during health screenings for home-dwelling

older adults aged 75 may also impact the effectiveness of the health screening procedure in reducing the frequency of emergency department visits. Therefore, further studies are needed to assess the long-term adherence to the recommendations given during follow-up and to evaluate the potential impact on reducing socioeconomic disparities in health.

The participation rate for the health screening was 41%, and it is important to note that this rate was not particularly high. The COVID-19 pandemic during 2020–2021 may have negatively affected participation rates. This study used data from the health record system, without access to social care records, thus all importance socioeconomic factors were not included. The intervention group consisted of older adults who participated in health screening, and their average HRQoL score of 0.902 is higher than the average for the Finnish population aged 75 or older (0.84) [35]. This may indicate that they are healthier and more interested in their health compared to the non-participants [16]. This is also reflected in the number of emergency visits, showing that those who participated in health screenings had fewer emergency visits even before the screening occurred. Nonetheless, it is crucial to also focus on reducing the frequency of emergency department visits among home-dwelling 75-year-olds in good condition, as this is one important way to decrease the costs associated with emergency department visits.

The results derived from this study could help to guide future decision-making regarding preventive health initiatives for older adults in Finland and optimize the utilization of healthcare resources. In addition, it could also inform similar initiatives in other regions and countries facing the challenges of an ageing population. The findings suggest that the health screening procedure could potentially contribute to the reduction of emergency department visits among home-dwelling 75-year-old older adults. However, further research is needed to optimize the use of health screenings within preventive healthcare strategies for older adults to address future challenges and to explore the long-term impact of preventive initiatives on overall healthcare systems.

Conclusions

The implementation of the health screening procedure is an effective strategy for reducing both the frequency of emergency department visits and associated costs in home-dwelling older adults aged 75 years in good condition. Further studies are needed to research whether this reduction is a direct result of the health screening procedure, referrals to healthcare professionals, and the health counseling provided by PNs, or if other factors might be involved.

Acknowledgements

We are grateful to Susanna Kunvik and Juho Salli from Satakunta University of Applied Sciences for their valuable contribution to this study.

Author contributions

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

Ethical approval

The study was approved by the wellbeing service county of Satakunta (SATSHP/1829/13.01/2019).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Päivikki and Sakari Sohlberg Foundation.

ORCID

Jonna-Carita Kanninen http://orcid.org/0000-0002-7978-5677
Hannu Kautiainen http://orcid.org/0000-0003-0786-0858
Anu Holm http://orcid.org/0000-0003-4282-6479

Data availability statement

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 the current study and so are not publicly available.

References

[1] Ministry of Social Affairs and Health and Association of Finnish Local and Regional Authorities. Quality recommendation to guarantee a good quality of life and improved services for older persons 2020–2023: the aim is an age-friendly Finland. Ministry of Social Affairs and Health; 2020 [cited 2021 Mar 18]. Available from: https://

julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162455/STM_2020_29_J.pdf?sequence=1&isAllowed=y
[2] World Health Organization. Home care across Europe 2012, current structure and future challenges; 2012 [cited 2021 Aug 25]. Available from: http://www.euro.who.int/__data/assets/pdf_file/0008/181799/e96757.pdf
[3] Teperi J, Porter ME, Vuorenkoski L, et al. The Finnish health care system: a value-based perspective. Sitra Reports. 82; 2009 [cited 2021 Aug 25]. Available from: http://www.hbs.edu/faculty/Publication%20Files/Finnish_Health_Care_System_SITRA2009_78584c8b-10c4-4206-9f9a-441bf8be1a2c.pdf
[4] Kanninen JC, Holm A, Koivisto AL, et al. Development of a preventive health screening procedure enabling supportive service planning for home-dwelling older adults (PORI75): protocol for an action research study. JMIR Res Protoc. 2023;12:e48753. doi: 10.2196/48753.
[5] World Health Organization (WHO). WHO European technical consultation on screening; 2021 [cited 2021 Apr 28]. Available from: https://www.euro.who.int/__data/assets/pdf_file/0017/408005/WHO-European-Technical-Consultation-on-Screening.pdf
[6] World Health Organization. Regional officer for Europe. Screening programmes: a short guide. Increase effectiveness, maximize benefits and minimize harm; 2024 [cited 2024 Sep 13]. Available from: https://iris.who.int/bitstream/handle/10665/330829/9789289054782-eng.pdf
[7] Hsu AK, Bassett SM, O'Dwyer LC, et al. Cost-effectiveness of hearing screening in older adults: a scoping review. Res Aging. 2022;44(2):186–204. doi: 10.1177/01640275211008583.
[8] Nicholas JA, Hall WJ. Screening and preventive services for older adults. Mt Sinai J Med. 2011;78(4):498–508. doi: 10.1002/msj.20275.
[9] Creavin ST, Wisniewski S, Noel-Storr AH, et al. Mini-Mental State Examination (MMSE) for the detection of dementia in clinically unevaluated people aged 65 and over in community and primary care populations. Cochrane Database Syst Rev. 2016;2016(1):CD011145. doi: 10.1002/14651858.CD011145.pub2.
[10] Benedetti A, Wu Y, Levis B, et al. Diagnostic accuracy of the Geriatric Depression Scale-30, Geriatric Depression Scale-15, Geriatric Depression Scale-5 and Geriatric Depression Scale-4 for detecting major depression: protocol for a systematic review and individual participant data meta-analysis. BMJ Open. 2018;8(12):e026598. doi: 10.1136/bmjopen-2018-026598.
[11] Guigoz Y, Lauque S, Vellas BJ. Identifying the elderly at risk for malnutrition. The Mini Nutritional Assessment. Clin Geriatr Med. 2002;18(4):737–757. doi: 10.1016/s0749-0690(02)00059-9.
[12] Malmstrom TK, Morley JE. SARC-F: a simple questionnaire to rapidly diagnose sarcopenia. J Am Med Dir Assoc. 2013;14(8):531–532. doi: 10.1016/j.jamda.2013.05.018.
[13] Morley JE, Malmstrom TK, Miller DK. A Simple Frailty Questionnaire (FRAIL) predicts outcomes in middle aged African Americans. J Nutr Health Aging. 2012;16(7):601–608. doi: 10.1007/s12603-012-0084-2.
[14] Cusick MM, Tisdale RL, Chertow GM, et al. Population-wide screening for chronic kidney disease: a cost-effectiveness analysis. Ann Intern Med. 2023;176(6):788–797. doi: 10.7326/m22-3228.
[15] Toumazis I, Cao P, de Nijs K, et al. Risk model-based lung cancer screening: a cost-effectiveness analysis. Ann Intern Med. 2023;176(3):320–332. doi: 10.7326/m22-2216.
[16] Wilson R, Kuh D, Stafford M. Variations of health check attendance in later life: results from a British Birth Cohort Study. BMC Public Health. 2019;19(1):1518. doi: 10.1186/s12889-019-7875-x.
[17] Clarfield AM. Screening in frail older people: an ounce of prevention or a pound of trouble? J Am Geriatr Soc. 2010;58(10):2016–2021. doi: 10.1111/j.1532-5415.2010.03070.x.
[18] Leipzig RM, Whitlock EP, Wolff TA, et al. Reconsidering the approach to prevention recommendations for older adults. Ann Intern Med. 2010;153(12):809–814. doi: 10.7326/0003-4819-153-12-201012210-00007.
[19] Ministry of Social Affairs and Health. Social and health services (online); 2021 [cited 24 Aug 2021]. Available from: http://stm.fi/en/social-and-health-services
[20] Ministry of Social Affairs and Health. Health, social services and regional government reform in Finland (online); 2021 [cited 24 Aug 2021]. Available from: http://alueuudistus.fi/frontpage
[21] The Social Security Center of Pori. Summary of the final report of the productivity program; 2019 [cited 2023 Mar 6]. Available from: https://cms.pori.fi/uploads/sites/2/2022/10/2019_11_22_porin_perustuvan_loppuraportin_tiivistelma.pdf
[22] The Act on The Social and Health Care Customer Fees (734/1992). Finlex Data Bank, Finnish Ministry of Justice [cited 2022 May 13]. Available from: https://www.finlex.fi/fi/laki/smur/1992/19920734
[23] The Act on the Secondary Use of Health and Social Data (552/2019). Finlex Data Bank, Finnish Ministry of Justice [cited 2022 May 13]. Available from: https://www.finlex.fi/fi/laki/alkup/2019/20190552
[24] Bradley KA, DeBenedetti AF, Volk RJ, et al. AUDIT-C as a brief screen for alcohol misuse in primary care. Alcohol Clin Exp Res. 2007;31(7):1208–1217. doi: 10.1111/j.1530-0277.2007.00403.x.
[25] Sintonen H, Pekurinen M. A generic 15 dimensional measure of health-related quality of life (15D). J Soc Med. 1989;26(1):85–96.
[26] Alanne S, Roine RP, Räsänen P, et al. Estimating the minimum important change in the 15D scores. Qual Life Res. 2015;24(3):599–606. doi: 10.1007/s11136-014-0787-4.
[27] Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–198. doi: 10.1016/0022-3956(75)90026-6.
[28] Arthur A, Jagger C, Lindesay J, et al. Using an annual over-75 health check to screen for depression: validation of the short Geriatric Depression Scale (GDS15) within general practice. Int J Geriatr Psychiatry. 1999;14(6):431–439. doi: 10.1002/(SICI)1099-1166(199906)14:6<431::AID-GPS937>3.0.CO;2-I.
[29] Friedman B, Heisel MJ, Delavan RL. Psychometric properties of the 15-item Geriatric Depression Scale in functionally impaired, cognitively intact, community-dwelling elderly primary care patients. J Am Geriatr Soc. 2005;53(9):1570–1576. doi: 10.1111/j.1532-5415.2005.53461.x.

[30] Russell MA, Hill KD, Blackberry I, et al. The reliability and predictive accuracy of the Falls Risk for Older People in the Community assessment (FROP-Com) tool. Age Ageing. 2008;37(6):634–639. doi: 10.1093/ageing/afn129.
[31] Katz S. Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. J Am Geriatr Soc. 1983;31(12):721–727. doi: 10.1111/j.1532-5415.1983.tb03391.x.
[32] Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist. 1969;9(3 Part 1):179–186. doi: 10.1093/geront/9.3_Part_1.179.
[33] Uebersax JS, Wyman JF, Shumaker SA, et al. Short forms to assess life quality and symptom distress for urinary incontinence in women: the Incontinence Impact Questionnaire and the Urogenital Distress Inventory. Continence Program for Women Research Group. Neurourol Urodyn. 1995;14(2):131–139. doi: 10.1002/nau.1930140206.
[34] Utomo E, Korfage IJ, Wildhagen MF, et al. Validation of the Urogenital Distress Inventory (UDI-6) and Incontinence Impact Questionnaire (IIQ-7) in a Dutch population. Neurourol Urodyn. 2015;34(1):24–31. doi: 10.1002/nau.22496.
[35] Koskinen S, Lundqvist A, Ristiluoma N. Health, functional capacity, and wellbeing in Finland 2011. Tampere: National Institute for Health and Welfare – Finnish University Press Ltd; 2012.
[36] Auria Clinical Informatics. The first European Union Digital Innovation Hub in the health sector in Finland; 2023 [cited 2023 Jun 26]. Available from: https://www.auria.fi/tietopalvelu/en/
[37] Mäklin S, Kokko P. Health and social care unit costs in Finland in 2017. Finnish Institute for Health and Welfare, 21/2020; 2023 [cited 2023 Nov 21]. Available from: https://www.julkari.fi/bitstream/handle/10024/142882/URN_ISBN_978-952-343-493-6.pdf?sequence=1&isAllowed=y
[38] Official Statistics of Finland (OSF). Consumer price index [online publication]. Helsinki: Statistics Finland; 2024 [cited 2024 May 23]. Available from: https://stat.fi/en/statistics/khi
[39] Schaufler TM, Wolff M. Cost effectiveness of preventive screening programmes for type 2 diabetes mellitus in Germany. Appl Health Econ Health Policy. 2010;8(3):191–202. doi: 10.2165/11532880-000000000-00000.
[40] Artac M, Dalton AR, Majeed A, et al. Effectiveness of a National Cardiovascular Disease Risk Assessment Program (NHS Health Check): results after one year. Prev Med. 2013;57(2):129–134. doi: 10.1016/j.ypmed.2013.05.002.
[41] Millar JD. Medical screening and biological monitoring for the effects of exposure in the workplace. Screening and monitoring: tools for prevention. J Occup Med. 1986;28(8):544–546.
[42] Kuneinen SM, Eriksson JG, Kautiainen H, et al. The feasibility and outcome of a community-based primary prevention program for cardiovascular disease in the 21st century. Scand J Prim Health Care. 2021;39(2):157–165. doi: 10.1080/02813432.2021.1913893.
[43] Fujino Y, Tanabe N, Honjo K, et al. Interest in health screening as a predictor of long-term overall mortality: multilevel analysis of a Japanese National Cohort Study. Prev Med. 2011;52(1):78–83. doi: 10.1016/j.ypmed.2010.10.012.
[44] Sabbath EL, Sparer EH, Boden LI, et al. Preventive care utilization: association with individual- and workgroup-level policy and practice perceptions. Prev Med. 2018;111:235–240. doi: 10.1016/j.ypmed.2018.03.013.
[45] Wu X, Wu Y, Tu Z, et al. Cost-effectiveness and cost–utility of a digital technology-driven hierarchical healthcare screening pattern in China. Nat Commun. 2024;15(1):3650. doi: 10.1038/s41467-024-47211-w.
[46] Nursing and midwifery. World Health Organization; 2022 [cited 2023 Jun 30]. Available from: https://www.who.int/news-room/fact-sheets/detail/nursing-and-midwifery
[47] Ensuring the sufficiency and accessibility of personnel in the social and healthcare sectors. Vol. 8. Publications of the Ministry of Social Affairs and Health; 2023 [cited 2023 Jun 30]. Available from: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/164634/STM_2023_8.pdf?sequence=1&isAllowed=y
[48] Sufficiency and availability of healthcare and social welfare personnel. Ministry of Social Affairs and Health; 2021 [cited 2023 Jun 30]. Available from: https://stm.fi/en/sufficiency-and-availability-of-healthcare-and-social-welfare-personnel
[49] Holland W. Periodic health examination—a brief history and critical assessment. Eurohealth. 2009;15:16–20.