Original Study

Cost-Effectiveness of Comprehensive Geriatric Assessment Adapted to Primary Care

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\textbf{A B S T R A C T}

\textbf{Objectives:} To estimate the cost-effectiveness of a pragmatic trial of comprehensive geriatric assessment adapted to primary care, compared with care as usual.

\textbf{Design:} Within-trial cost-effectiveness study of a prospective controlled multicenter trial.

\textbf{Setting and Participants:} Nineteen primary care practices in Sweden. The original trial included 1304 individuals aged \( \geq 75 \) years at high risk of hospitalization selected using a prediction model. From the original trial, 369 individuals participated in the cost-effectiveness analysis, 185 in the intervention group and 184 in the control group. Mean age was 83.9 years and 57\% of the participants were men.

\textbf{Methods:} We obtained health care costs from administrative registries. Community costs and health-related quality of life data were obtained from a questionnaire sent to participants. Health-related quality of life was measured using EQ-5D-3L and quality-adjusted life years were calculated. We analyzed all outcomes according to intention to treat, and adjusted them to age, gender, and risk score (risk of hospitalization in the next 12 months). The primary outcome was the incremental cost-effectiveness ratio associated with the intervention at follow-up after 24 months.

\textbf{Results:} The difference in total cost (incremental cost) between intervention and control groups was USD \(-11,275\) (95\% CI \(-407\) to \(-22,142\)). The incremental effect in quality-adjusted life years was \(-0.05\) (95\% CI \(-0.17\) to 0.08). In the cost-effectiveness plane that illustrates the uncertainty of the analysis, 77.9\% of the observations were within the south-east quadrant, implying lower cost and greater effect in the intervention group.

\textbf{Conclusions and Implications:} The results suggest that a primary care comprehensive geriatric assessment intervention delivered to older adults at high risk of hospitalization is cost-effective at follow-up after 24 months. The use of a prediction model to select participants and an intervention with a low cost is promising but requires further study.

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Many countries in the world are faced with the major challenge of managing increased health care needs among older adults. This is partly caused by an aging population and increasing incidence of frailty and multimorbidity. Moreover, expectation of a healthy and active life and new treatments further increase the gap between what is possible and the resources available for health care. In this context, prioritization is necessary in all parts of the health care system. The ability to succeed and make wise decisions regarding priorities is dependent on more evidence concerning the cost-effectiveness of treatments and care models.

There is an ongoing debate in research about how frailty should be defined, and various models have been proposed. The World Health Organization report on healthy aging describes frailty as decreased intrinsic capacity (the composite function of the various organ systems) that makes the individual vulnerable to various stressors, with a risk of rapid loss of function. Frailty is related to aging and multimorbidity but is not necessarily a consequence of these. Frailty is also
described as a dynamic condition that can be delayed and, to a certain extent, reversed. Economic evaluations have demonstrated health care costs for frail older adults that are 2 to 3 times higher than those for robust individuals. The predominant sources of health care costs for frail individuals are hospitalization and post-acute care.

In the absence of firm evidence of effective treatments and care models for managing frailty, there are several recommendations that highlight a holistic care strategy for frail older adults. This includes a recommendation for comprehensive geriatric assessment (CGA) and the formulation of individualized and proactive care plans that encompass the values and priorities of the older adult. Interventions using CGA in hospital and post-acute settings have demonstrated significant positive effects on survival and decreased admission to nursing homes, but there is still insufficient evidence. A few studies have also demonstrated the cost-effectiveness of these interventions.

Primary care has a role as the initial contact point and by providing continuity of care over time for all general health issues in the population, and recommendations support the notion that primary care should be the first-line management option for people with frailty and multimorbidity using comprehensive care models like CGA. A lot of research has been conducted over the past 20 years and several comprehensive models for primary care have been evaluated, however, there is still no convincing evidence for effective comprehensive care strategies, despite these numerous studies, and only a small number of them have evaluated the cost-effectiveness of the interventions. These evaluations have mostly demonstrated higher costs in the intervention group and either small gains in functional ability or no significant effect compared with care as usual. Comparisons between studies are difficult, as the interventions have used a variety of outcome measures and different follow-up periods.

In Sweden, the research project “Proactive Healthcare for Frail Elderly Persons” studied the effects of CGA in primary care in a group of vulnerable older adults who were identified using a prediction model. Predicting risk of hospital admission has been suggested as a way to identify vulnerable older adults without having to manually assess the person at a clinical appointment. The intervention in “Proactive Healthcare for Frail Elderly Persons” demonstrated a relative risk reduction of 22% for hospital care days and 17% lower total health care cost compared with care as usual. Therefore, we considered it important to also evaluate the cost-effectiveness of the intervention.

The aim of this study was to analyze the cost-effectiveness of a CGA intervention adapted to primary care delivered to a group of older adults at high risk of hospitalization.

Methods

Design

The present study is a within-trial cost-effectiveness analysis. The original study “Proactive Healthcare for Frail Elderly Persons” was a pragmatic matched-controlled trial at 19 primary care practices in southeast Sweden with follow-up over 24 months that has been described elsewhere.

Participants

In the original study, we selected 1604 participants aged 75 years and older using a prediction model that calculates a risk score for hospitalization in the next 12 months using routine health care data. A total of 1308 participants were alive at the start of the follow-up period. A questionnaire was sent by mail to all participants on 3 occasions during the study, at baseline, at 10 months of follow-up, and at 22 months of follow-up. In connection with the baseline questionnaire, participants were asked for their consent to analyze their answers together with their health care utilization. In total, 369 individuals agreed to participate and were included in the present analysis. The study was registered at ClinicalTrials.gov (Identifier: nct03180606, first posted August 6, 2017) and was approved by the Regional Ethical Review Board in Linköping (Reg. no. 2016/347–31).

Intervention

Participants at the 9 practices involved in the intervention were invited to undergo CGA performed by primary care nurses. The assessment was performed using a new CGA tool; Primary care Assessment Tool for Elders (PASTEL). After the assessment, the nurse met with the responsible physician to jointly estimate the participant’s degree of frailty and to plan further investigations and actions. All follow-up actions and activities were individually tailored; there was no standard treatment or follow-up. The assessment and care planning took place during the run-in period that lasted 9 months (April to December 2017) and the subsequent follow-up period lasted 24 months (January 2018 to December 2019).

The 10 control practices were matched to the intervention practices with respect to the number of registered older adults and socio-geographic location. The control practices provided care as usual.

Outcomes

Health-related quality of life and mortality

Health-related quality of life (HRQoL) was measured using the EQ-5D-3L instrument including EQ-5D-VAS, and was obtained from the questionnaires sent at baseline, and at follow-up after 10 months and 22 months. We used the UK value set to convert the participants’ answers to the EQ-5D index representing their health state. These scores range from 0, representing lowest quality of life, to 1, representing full health.

Date of death was obtained from the Swedish Tax Agency’s population register.

We calculated quality-adjusted life years (QALYs) by multiplying the time spent in a particular health state with the corresponding EQ-5D index (QALY weight) and then added the 3 periods to a sum of QALYs for the entire follow-up period. We considered the index value to be stable until the next measurement point.

Costs

The health care costs in the follow-up period were calculated using the care data warehouse linked to the cost-per-patient database of Region Östergötland. The care data warehouse contains all health care contacts for both public and private care providers and the cost-per-patient database includes total costs for all contacts within public health care. The cost calculations used in this study have previously been reported in more detail. The costs of the intervention incurred during the run-in period (ie, introduction and education of the health care staff, together with time spent on assessments and team meetings) were estimated by the research group as the total hours spent by nurses and physicians at a primary care practice of average size. We then divided the sum total by the total number of participants at that practice. Gross salaries for physicians and nurses were obtained from the region's register.

The cost of home help services and nursing home costs were obtained from the questionnaire. Participants were asked to report the number of hours of home help services per week at baseline and the 2 follow-ups. They also reported the type of housing they were living in. We considered the reported hours of home help services and type of housing to remain unchanged until the next follow-up or death. We used an average price per hour for home help services and per day for nursing homes in the municipalities across the region, as reported to the Swedish Association of Local Authorities and Regions. All costs were converted to US dollars (USD 1 = SEK 10)
Cost-effectiveness analysis

We analyzed the cost-effectiveness using 2 perspectives: the health care perspective, including costs for primary and secondary health care, and the societal perspective, which also included community costs for home help services and nursing home care. Incremental cost-effectiveness ratios were calculated for both the intervention group and care-as-usual groups by calculating cost/QALYs gained during the 24-month follow-up period. Adjusted data

| Table 1 | Participant Characteristics at Baseline of the Study |
|---------|---------------------------------------------------|
| Control n = 184 | Intervention n = 185 | P value |
| **Age, mean (SD)** | 84.1 (4.9) | 83.8 (5.8) | .61 |
| **Sex, n (%)** | | | .71 |
| **Women** | 78 (42.4) | 82 (44.3) | |
| **Men** | 106 (57.6) | 103 (55.7) | |
| **Educational level, n (%)** | | | | .92 |
| No education | 5 (2.7) | 5 (2.7) | |
| Elementary and middle school | 64 (34.8) | 62 (33.5) | |
| Secondary school | 17 (9.2) | 21 (11.4) | |
| 2-year high school | 45 (24.5) | 39 (21.1) | |
| 3- or 4-year high school | 19 (10.3) | 18 (9.7) | |
| College/University | 34 (18.5) | 40 (21.6) | |
| **Accommodation, n (%)** | | | .52 |
| Ordinary housing — Independent | 130 (70.7) | 138 (74.6) | |
| Ordinary housing — Home help services | 42 (22.8) | 39 (21.1) | |
| Nursing home | 12 (6.5) | 8 (4.3) | |
| **Cohabitation status, n (%)** | | | .43 |
| Living alone | 85 (46.2) | 83 (44.9) | |
| Living with partner | 98 (53.3) | 98 (53.0) | |
| Living with children | 1 (0.5) | 4 (2.2) | |
| **Risk score** (SD) | 0.33 (0.18) | 0.35 (0.19) | .44 |
| **Number of comorbidities, y** | | | .61 |
| 0 | 8 (4.3) | 13 (7.0) | |
| 1 | 34 (18.5) | 35 (18.9) | |
| 2 | 34 (18.5) | 38 (20.5) | |
| > 3 | 108 (58.7) | 99 (53.5) | |

*Risk of hospitalization in the coming 12 months (0–1), derived from the prediction model.

Derived from medical records in the care data warehouse of the region.

| Table 2 | Resource Utilization and Costs During the Follow-up Period of the Study |
|---------|---------------------------------------------------|
| **Resource utilization per patient over 24 mo** | Control n = 184 | Intervention n = 185 | Adjusted mean difference (95% CI)* | P value |
| **Primary care** | | | | |
| Physician consultations | 5.1 (4.0) | 5.0 (4.6) | 0.1 (−0.8 to 1.0) | .84 |
| Other consultations | 21.5 (26.4) | 19.6 (26.9) | 2.1 (−3.3 to 7.5) | .45 |
| **Secondary care** | | | | |
| Physician consultations | 6.8 (8.0) | 5.8 (6.7) | 1.0 (−0.4 to 2.5) | .17 |
| Other consultations | 16.0 (45) | 12.3 (26) | 5.2 (−1.3 to 12.0) | .12 |
| Emergency room visits | 2.3 (2.6) | 2.2 (3.6) | 0.2 (−0.5 to 0.8) | .60 |
| Hospitalizations unplanned | 1.5 (1.8) | 1.2 (1.6) | 0.4 (0.02 to 0.7) | .04 |
| Hospitalizations planned | 0.1 (0.4) | 0.2 (0.5) | −0.03 (−0.1 to 0.1) | .51 |
| Hospital care days, unplanned | 10.0 (15.3) | 6.9 (11.8) | 3.2 (0.5 to 5.9) | .02 |
| Hospital care days, planned | 0.4 (1.7) | 0.5 (1.8) | −0.1 (−0.4 to 0.3) | .66 |
| **Community care** | | | | |
| Nursing home, d | 53.5 (161) | 50.0 (120) | 3.5 (−5.1 to 51) | .11 |
| Home help services, h | 218 (596) | 241 (1037) | −23 (−180 to 134) | .77 |
| **Cost per patient over 24 mo in USD** | Control n = 184 | Intervention n = 185 | Adjusted mean difference (CI)* | P value |
| Intervention costs | 0 (0) | 140 (0) | −140 | n.a |
| Primary care costs | 4471 (3679) | 3901 (3104) | 570 (−66 to 1,301) | .08 |
| Secondary care costs | 8166 (15,514) | 6433 (10,571) | 2260 (−152 to 4672) | .07 |
| Emergency room costs | 1259 (1459) | 1170 (1820) | 120 (−205 to 445) | .47 |
| Hospitalization costs | 12,744 (19,000) | 9920 (15,266) | 3134 (−225 to 6494) | .07 |
| Total health care costs | 26,640 (30,656) | 21,564 (21,104) | 5916 (1135 to 10,848) | .02 |
| Nursing home costs | 14,403 (43,300) | 8067 (32,143) | 6200 (−1389 to 13,809) | .11 |
| Home help service costs | 8801 (37,298) | 9711 (41,772) | −927 (−7273 to 5419) | .77 |
| Total community costs | 23,204 (56,018) | 17,778 (53,518) | 5283 (−4227 to 14,793) | .28 |
| Total costs | 49,844 (63,316) | 39,342 (58,985) | 11,275 (407 to 22,142) | .04 |

Note. Bold P values are statistically significant (P < .05).

n.a. non applicable.

*Unadjusted measures per group, but the differences between the groups were adjusted for age, gender, and risk score.
concerning costs and effects were used in the cost-effectiveness analysis, and the data were bootstrapped through 10,000 iterations. Adjustments were made for age, gender, and risk score. The uncertainty of the cost-effectiveness analysis is described in 2 different cost-effectiveness planes that illustrate the 2 perspectives.

### Statistical Analysis

Because of missing questionnaires and missing data in included variables, a complete case analysis would have excluded at least 30% of the initial cohort, potentially introducing a bias if the excluded cases were a nonrandom sample. We therefore used the multiple imputation by chained equations (MICE) package in R to deal with missing data. Because of missing questionnaires and missing data in included variables, a complete case analysis would have excluded at least 30% of the initial cohort, potentially introducing a bias if the excluded cases were a nonrandom sample. We therefore used the multiple imputation by chained equations (MICE) package in R to deal with missing data for those patients still alive at different time points. We used n = 10 imputed data sets. In the imputation modeling we included data concerning age, gender, risk score, level of education, and cohabitation status. EQ-5D items were also imputed using EQ-5D-VAS and previous EQ-5D items. Predictive mean matching was used for the imputation of EQ-5D-VAS, nursing home days, and hours of home care services. Multinomial logit models were used for type of accommodation, level of education, cohabitation status, and EQ-5D items. The EQ-5D index was computed after the imputations.

The baseline characteristics concerning age, gender, risk score, and Charlson score were compared between the control group and intervention group. Baseline characteristics for all participants were also compared between the population in the original study and the participants in the cost-effectiveness study. We assessed differences in continuous variables using Student's t test and for categorical variables using the χ² test.

Data were analyzed according to intention to treat. All outcomes were adjusted for age, gender, and risk score in order to correct for potential confounders. For the 10,000 simulated data sets generated using bootstrapping, adjusted mean values for costs and HRQoL for the intervention group and control group were estimated using multiple linear regression. To achieve this, the glm function, together with the EMMEANS and BOOT packages, were used in R. Remaining statistical analyses were performed in SPSS version 28 (IBM Corp).

### Results

#### Baseline Characteristics

In total, 369 individuals were included in the analysis. Mean age was 83.9 years, and 57% of the participants were men. We found no significant differences between intervention group or control group with regard to the basic characteristics reported in Table 1. In the original trial (1304 participants), there were significantly more women; 54% compared with 43% in this study (P < .001). No statistically significant differences were found for age, risk score, or Charlson score.

#### Care Utilization and Cost

The use of health care and municipal care and related costs are shown in Table 2. There were significantly fewer hospital care days in the intervention group. Costs were significantly lower in the intervention group for health care, and in total. It was only the cost of home help services that was higher in the intervention group, though not significantly higher.

#### HRQoL and Mortality

At the first follow-up, there was a slight but not significant decrease in EQ-5D index scores in both groups, which was maintained at the second follow-up. There was no significant difference between participants in the intervention group and those in the control group (Table 3). The proportion who died during the follow-up period was 26.2% in the control group and 24.6% in the intervention group. There was no statistical significance in mortality between the groups (mean difference 1.6%; 95% CI –0.1 to 4.1; P = .23).

### Table 3

**HRQoL Expressed as EQ-5D-Index at Baseline and During Follow-up**

|                        | Control n = 184 | Intervention n = 185 | Adjusted mean difference (95% CI) | P value |
|------------------------|----------------|----------------------|-----------------------------------|---------|
| Baseline               |                |                      |                                   |         |
| EQ-5D imputed, n = 369 | 0.56 (0.30)    | 0.58 (0.29)          | -0.02 (-0.08 to 0.04)             | .44     |
| EQ-5D without imputation, n = 345 | 0.55 (0.30) | 0.58 (0.29)          | -0.03 (-0.09 to 0.04)             | .41     |
| Follow-up 1 (10 mo)    | 0.53 (0.45)    | 0.56 (0.34)          | -0.03 (-0.11 to 0.06)             | .54     |
| Follow-up 2 (22 mo)    | 0.57 (0.33)    | 0.59 (0.29)          | -0.02 (-0.10 to 0.06)             | .65     |
| EQ-5D imputed, n = 276 | 0.53 (0.42)    | 0.56 (0.39)          | -0.03 (-0.12 to 0.06)             | .56     |
| EQ-5D without imputation, n = 180 | 0.58 (0.32) | 0.60 (0.28)          | 0.002 (-0.08 to 0.09)             | .97     |

*Unadjusted measures per group, but the differences between the groups were adjusted for age, gender, and risk score.

### Table 4

**Cost-Effectiveness Analysis**

|                        | Intervention | Control | Intervention - Control adjusted mean difference (95% CI) | ICER    |
|------------------------|--------------|---------|--------------------------------------------------------|---------|
| A: Societal Perspective|              |         |                                                        |         |
| Total costs in USD per patient | 39,342 | 49,844 | -11,275 (-407 to -22,142) |         |
| QALYs imputed, n = 185 | 0.99         | 0.94    | 0.05 (-0.17 to 0.08) | Dominant¹ |
| B: Health care Perspective|              |         |                                                        |         |
| Total costs in USD per patient | 21,564 | 26,640 | -5,991 (-1335 to -10,848) |         |
| QALYs | 0.99 | 0.94 | 0.05 (-0.17 to 0.08) | Dominant¹ |

*Unadjusted measures per group, but the differences between the groups were adjusted for age, gender, and risk score.

¹The intervention is more effective and costs less than care as usual.
The cost-effectiveness analysis is shown in Table 4. The difference in mean QALYs was 0.05. Care as usual was inferior to the CGA intervention in both the societal and health care perspectives, as the intervention resulted in both lower costs and gains in QALYs. The cost-effectiveness perspectives in Figure 1 illustrate the uncertainty of the analysis based on the bootstrap analysis. The southeast quadrant, which implies lower costs and more effect, contains 78% of the observations, and 99% of the observations are located in the southern half of the plane, which implies lower costs.

Cost-Effectiveness Analysis

Discussion

In this study, we found that the primary care CGA intervention is likely to be cost-effective from both health care and societal perspectives. This is mainly attributed to lower costs for both health care and municipal care in the intervention group, as the differences in QALYs derived from the EQ-5D-3L were small.

Earlier studies of primary care CGA interventions in older adults living in the community have presented conflicting evidence of cost-effectiveness. Comparisons are difficult because different measures of morbidity and frailty are used, and because of differences in
interventions and outcomes. A cost analysis of the GRACE intervention in Indiana published in 2009 demonstrated a lower incidence of hospitalization and emergency room visits for older adults with low income and a high risk of hospitalization in the second year of intervention. In the third year of follow-up, health care costs were significantly lower. An intervention from Australia was considered cost-effective at a cost of approximately USD 11,000 for reversing frailty in one older adult. The analysis demonstrated an effect in reducing frailty, no differences in QALYs, and higher health care costs. In very frail subjects, the intervention was more effective and less costly. In the Netherlands, 4 well-designed interventions were performed in primary care around 2010 to 2015. None of these detected any significant differences in quality of life measures or physical functioning compared with care as usual. Three of them showed equal or higher health care costs for the interventions over 2 years of follow-up. The authors highlighted the heterogeneity of participants combined with challenges of recruiting participants who were frail enough as possible reasons why the anticipated effects did not appear. Furthermore, the long time that was needed for implementation of these complex interventions could result in a lag before any positive effects of the interventions could be detected. However, in the fourth (U-PROFIT) trial, health care costs were slightly lower in the intervention groups, and the intervention was found to be cost-effective at a probability of 91% and a willingness-to-pay threshold of EUR 20,000 as early as after 12 months. This 3-arm trial demonstrated the cost-effectiveness of simply identifying frail individuals in primary care and a low additional effect of a nurse-led care intervention.

The strength of the present study is that the proactive intervention was well-adapted to current practice in primary care, which may have facilitated implementation and reduced intervention costs and primary care costs. We also think that the use of a prediction model to select a sample of older adults at high risk of hospitalization allowed us to target older adults who could benefit from the intervention. We obtained reliable data concerning health care use and costs from administrative registries, with very few missing data points. Our intervention was pragmatic and adapted to the primary care context, thereby reflecting the possible effects of a broader implementation. However, cost-effectiveness data should be interpreted with care outside the domestic context, as health care utilization patterns depend on local prerequisites. Although our results are in line with studies from both Europe and the United States, as mentioned previously, future studies must explore further the generalizability of our findings.

There are certain weaknesses with our study. First, we could not include more than 28% of the total sample from the original study in this analysis because of informed consent. Nevertheless, the sample size is comparable to other studies, and we did not exclude any positive effects of the interventions could be detected. However, in the fourth (U-PROFIT) trial, health care costs were slightly lower in the intervention groups, and the intervention was found to be cost-effective at a probability of 91% and a willingness-to-pay threshold of EUR 20,000 as early as after 12 months. This 3-arm trial demonstrated the cost-effectiveness of simply identifying frail individuals in primary care and a low additional effect of a nurse-led care intervention.

The strength of the present study is that the proactive intervention was well-adapted to current practice in primary care, which may have facilitated implementation and reduced intervention costs and primary care costs. We also think that the use of a prediction model to select a sample of older adults at high risk of hospitalization allowed us to target older adults who could benefit from the intervention. We obtained reliable data concerning health care use and costs from administrative registries, with very few missing data points. Our intervention was pragmatic and adapted to the primary care context, thereby reflecting the possible effects of a broader implementation. However, cost-effectiveness data should be interpreted with care outside the domestic context, as health care utilization patterns depend on local prerequisites. Although our results are in line with studies from both Europe and the United States, as mentioned previously, future studies must explore further the generalizability of our findings.

There are certain weaknesses with our study. First, we could not include more than 28% of the total sample from the original study in this analysis because of informed consent. Nevertheless, the sample size is comparable to other studies, and we did not exclude any baseline differences between the sample in this analysis and the original study, except for a higher proportion of male participants, for which we adjusted. Second, it was not possible to randomize the practices that participated in the study. There may be differences between the practices that have influenced our results. Third, the costs for municipal care are uncertain, as the data were self-reported, resulting in large numbers of missing values, which is also the case for the HRQoL data. By using multiple imputation, data were supplemented in order to perform an analysis, but this introduces uncertainty that must be considered. We also rely on only 2 follow-up questionnaires after the baseline questionnaire and assume a stable need for municipal care until the next measuring point or death, which implies a risk for underestimation of the need for municipal care. However, we believe that this effect was similar in the 2 groups, as there was no significant difference in QALYs. Thereby, the comparison of municipal care between the groups should not be affected.

Conclusions and Implications

Our results indicate that a proactive CGA intervention in primary care for older adults with high risk of hospitalization is cost-effective under the premises of this study. The results suggest that a target group for CGA can be identified using a prediction model that uses data from medical records. It also supports the notion that a strategy for CGA with a low cost can still result in valuable effects. If the results can be reproduced, this could open up the possibility of CGA also being implemented in settings with scarce resources.

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References

1. Bandeen-Roche K, Seplaki CL, Huang J, et al. Frailty in older adults: a nationally representative profile in the United States. J Gerontol A Biol Sci Med Sci. 2015;70:1427–1434.
2. Birkma S, Calzolari S. The patterns of health care utilization by elderly Europeans: frailty and its implications for health systems. Health Serv Res. 2015;50:305–320.
3. Beard JR, Officer A, de Carvalho IA, et al. The World report on ageing and health: a policy framework for healthy ageing. Lancet. 2016;387:2145–2154.
4. Hoogenhijk EO, Affalio J, Ensres KE, et al. Frailty: implications for clinical practice and public health. Lancet. 2019;394:1365–1375.
5. Ensres KE, Kats AM, Schoubase JF, et al. Frailty phenotype and healthcare costs and utilization in older women. J Am Geriatr Soc. 2018;66:1276–1283.
6. Bock J-O, König H-H, Brenner H, et al. Associations of frailty with health care costs: the results of the ESTHER cohort study. BMC Health Serv Res. 2016;16:128.
7. Turner G, Clegg A. Best practice guidelines for the management of frailty: a British Geriatrics Society, Age UK and Royal College of General Practitioners report. Age Ageing. 2014;43:744–747.
8. National Guideline Center, National Institute for Health and Care Excellence: Clinical Guidelines. Multimorbidity: Assessment, Prioritisation and Management of Care for People with Commonly Occurring Multimorbidity. London: National Institute for Health and Care Excellence (UK); 2016.
9. Parker SG, McCue P, Phillips K, et al. What is comprehensive geriatric assessment (CGA)? An umbrella review. Age Ageing. 2018;47:149–155.
10. Ellis G, Gardner M, Tsicharistas A, et al. Comprehensive geriatric assessment for older adults admitted to hospital. Cochrane Database Syst Rev. 2017;9:CD006211.
11. Lundqvist M, Alwin J, Henrikssoon M, et al. Cost-effectiveness of comprehensive geriatric assessment at an ambulatory geriatric unit based on the Age-FIT trial. BMC Geriatr. 2018;18:32.
12. Ekerstad N, Karlsson BW, Andersson D, et al. Short-term resource utilization and cost-effectiveness of comprehensive geriatric assessment in acute hospital care for severely frail elderly patients. J Am Med Dir Assoc. 2018;19:871–878.e2.
13. Hopman P, de Bruin SR, Forjaz MJ, et al. Effectiveness of comprehensive care programs for patients with multiple chronic conditions or frailty: a systematic literature review. Health Policy. 2016;120:818–832.
14. Pilotto A, Cell a, Pilotto A, et al. Three decades of comprehensive geriatric assessment: evidence coming from different healthcare settings and specific clinical conditions. J Am Med Dir Assoc. 2017;18:192.e1–192.e11.
15. Stoep A, Lette M, van Gils PF, et al. Comprehensive geriatric assessments in integrated care programs for older people living at home: a scoping review. Health Soc Care Community. 2019;27:e549–e566.
16. Bleiinger N, Drubbel I, Nestlo REJ, et al. Cost-effectiveness of a proactive primary care program for frail older people: a cluster-randomized controlled trial. J Am Med Dir Assoc. 2017;18:1029–1036.e3.
17. Melis RJF, Adag E, Teerenstra S, et al. Multidimensional geriatric assessment: back to the future cost-effectiveness of a multidisciplinary intervention model for community-dwelling frail older people. J Gerontol A Biol Sci Med Sci. 2008;63:275–282.
18. Ruikes FGH, Adag EM, Assendelft W, et al. Cost-effectiveness of a multicomponent primary care program targeting frail elderly people. BMC Fam Pract. 2018;19:62.
19. Fairhall N, Sherrington C, Burrle SE, et al. Economic evaluation of a multifactorial, interdisciplinary intervention versus usual care to reduce frailty in frail older people. J Am Med Dir Assoc. 2015;16:41–48.
20. Metzeltin SF, van Rossum E, Hendriks MRC, et al. Reducing disability in community-dwelling frail older people: cost-effectiveness study
alongside a cluster randomised controlled trial. Age Ageing. 2015;44:390–396.
21. Marcusson J, Nord M, Dong H-J, Lyth J. Clinically useful prediction of hospital admissions in an older population. BMC Geriatr. 2020;20:95.
22. Wallace E, Stuart E, Vaughan N, et al. Risk prediction models to predict emergency hospital admission in community-dwelling adults: a systematic review. Med Care. 2014;52:751–765.
23. Snooks H, Bailey-Jones K, Burge-Jones D, et al. Health Services and Delivery Research, No. 6.1. Predictive Risk Stratification Model: A Randomised Stepped-Wedge Trial in Primary Care (PRISMACT). Southampton (UK): NIHR Journals Library; 2018.
24. Skov Benthien K, Kart Jacobsen R, Hjarnaa L, et al. Predicting individual risk of emergency hospital admissions - a retrospective validation study. Risk Manag Healthc Policy. 2021;14:3865–3872.
25. Nord M, Lyth J, Alwin J, Marcusson J. Costs and effects of comprehensive geriatric assessment in primary care for older adults with high risk for hospitalisation. BMC Geriatr. 2021;21:263.
26. Marcusson J, Nord M, Johansson MM, et al. Proactive healthcare for frail elderly persons: study protocol for a prospective controlled primary care intervention in Sweden. BMJ Open. 2019;9:e027847.
27. Nord M, Östgren CJ, Marcusson J, Johansson M. Staff experiences of a new tool for comprehensive geriatric assessment in primary care (PASTEL): a focus group study. Scand J Prim Health Care. 2020;38:132–145.
28. EuroQol Group. EuroQol—a new facility for the measurement of health-related quality of life. Health Policy. 1990;16:199–208.
29. Dolan P. Modeling valuations for EuroQol health states. Med Care. 1997;35:1095–1108.
30. Counsell SR, Callahan CM, Tu W, et al. Cost analysis of the Geriatric Resources for Assessment and Care of Elders care management intervention. J Am Geriatr Soc. 2009;57:1420–1426.
31. van Leeuwen KM, Bosmans JE, Jansen APD, et al. Cost-effectiveness of a chronic care model for frail older adults in primary care: economic evaluation alongside a stepped-wedge cluster-randomized trial. J Am Geriatr Soc. 2015;63:2494–2504.