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Reducing disability in community-dwelling frail older people: cost-effectiveness study alongside a cluster randomised controlled trial

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Abstract

Background: although proactive primary care, including early detection and treatment of community-dwelling frail older people, is a part of the national healthcare policy in several countries, little is known about its cost-effectiveness.
Objective: to evaluate the cost-effectiveness of a proactive primary care approach in community-dwelling frail older people.

Design and setting: embedded in a cluster randomised trial among 12 Dutch general practitioner practices, an economic evaluation was performed from a societal perspective with a time horizon of 24 months.
Method: frail older people in the intervention group received an in-home assessment and interdisciplinary care based on a tailor-made treatment plan and regular evaluation and follow-up. Practices in the control group delivered usual care. The primary outcome for the cost-effectiveness and cost-utility analysis was disability and health-related quality of life, respectively.
Results: multilevel analyses among 346 frail older people showed no significant differences between the groups regarding disability and health-related quality of life at 24 months. People in the intervention group used, as expected, more primary care services, but there was no decline in more expensive hospital and long-term care. Total costs over 24 months tended to be higher in the intervention group than in the control group (€26,503 versus €20,550, P = 0.08).
Conclusions: the intervention under study led to an increase in healthcare utilisation and related costs without providing any beneficial effects. This study adds to the scarce amount of evidence of the cost-effectiveness of proactive primary care in community-dwelling frail older people.
Trial registration: Current Controlled Trials, ISRCTN 31954692.

Introduction

Frail older people have an increased risk for adverse outcomes such as disability [1]. It is assumed that interventions that aim to reduce disability have the potential to prevent hospitalisation and institutionalisation resulting in lower costs for government and society [2]. Therefore, proactive primary care, including early detection and treatment of community-dwelling frail older people, is a part of the national healthcare policy in several countries, such as UK, Denmark and Australia. However, results regarding the effectiveness of these approaches are inconsistent and little is known about their cost-effectiveness, as this aspect is often neglected in research [3–6].

A review by Markle-Reid and colleagues [6] identified merely six studies between 1966 and 2003 that included an economic evaluation; three studies provided some evidence that healthcare costs can be reduced. However, the usefulness of this evidence is limited as only one study [7] conducted a cost-effectiveness analysis (CEA), meaning that relative costs and outcomes (effects) were compared. During the last decade, a few more economic evaluations were conducted [8–11], but only one study [11] showed some beneficial effects regarding functional decline at 6 months, while costs were comparable between both groups. Long-term effects are not known [11].

Between 2008 and 2010, Daniëls and colleagues [12] developed a proactive primary care approach for frail older people: the Prevention of Care (PoC) approach. The approach was based on most recent evidence from two literature reviews [13, 14]. Furthermore, a pilot study was conducted that showed promising results [15]. It was expected that the approach leads to reduced disability and improved health-related quality of life in frail older people. Furthermore, we assumed an increase in the use of primary care services and a decline in the use of more expensive hospital and long-term care, leading to a reduction in overall healthcare costs, and consequently a cost-effective intervention. Although professionals and frail older people were very positive about the approach [16], no effects on disability and several secondary clinical outcomes were found [17].

However, it was not yet known whether the approach has an impact on health-related quality of life and results in cost savings by reorganising healthcare delivery. Therefore, an economic evaluation was conducted. This article reports about shifts in healthcare utilisation and the cost-effectiveness of the PoC approach compared with usual care.

Method

Design

Alongside a cluster randomised controlled trial, a cost-effectiveness analysis (CEA) and cost-utility analysis (CUA) were performed from a societal perspective with a time horizon of 24 months. The design, methods, feasibility and clinical outcomes of this trial have been described in detail elsewhere [16–18].

Setting and participants

The trial was conducted between 2010 and 2012 among 12 Dutch general practitioner (GP) practices. Community-dwelling frail older people (≥70 years) were recruited from these practices by means of postal screening, including the Groningen Frailty Indicator (GFI) [19]. People with a GFI score of 5 or higher (range: 0–15) were eligible for the study.

Intervention

Older people in the intervention group received the PoC approach [12], which was delivered by an interdisciplinary team. After a frailty screening (Step 1), people receive an in-home assessment by the practice nurse (Step 2). In a bilateral (i.e. GP and practice nurse) or extended team meeting (e.g. GP, practice nurse, occupational therapist and physiotherapist), a preliminary treatment plan is formulated (Step 3). During a second home visit, a final treatment plan is made together with the frail older person (Step 4). A specific toolbox offers recommendations and guidelines for the execution of the treatment plan (Step 5). The

achievement of goals and implementation of strategies in daily life are regularly evaluated and the need for follow-up is determined (Step 6). Older people in the control group received usual care [12, 18].

Healthcare utilisation and costs

We assessed intervention costs, other healthcare costs and patient and family costs. Intervention costs (i.e. screening, training activities and intervention delivery) were not assessed individually, but mean volumes were estimated based on the process evaluation that was conducted alongside this trial [16]. For details of intervention costs, see Supplementary data, Appendix S1 available in *Age and Ageing* online. Other healthcare costs related to (i) primary care, including services from GP, practice nurse, allied professionals (i.e. occupational therapist, physiotherapist, speech therapist and dietician); (ii) hospital care (i.e. admission days, outpatient medical services and day care); (iii) long-term care (i.e. home for the elderly/nursing home admission, professional home care) and (iv) prescribed medication. In addition, patient and family costs (i.e. informal care and helping aids/in-home modifications) were assessed. During 24 months, volumes of healthcare utilisation as well as medication costs were collected from registries of the three largest health insurance agencies in the region (CZ, Achmea and VGZ), covering data from 91% of the study participants. In the Netherlands, nearly all people are covered by healthcare insurance and the data have high reliability, because of their background of financial reimbursement [20]. Volumes that could not be obtained from these registries were assessed from the local hospital or directly from the participants by means of telephone interviews and postal questionnaires at baseline, 6, 12 and 24 months follow-up. Cost valuation was conducted according to Dutch guidelines for costing research [21]. Costs were calculated by multiplying the volumes with cost prices of that unit. Where no standardised cost prices were available (i.e. helping aids and assistive devices), costs were estimated based on 15 different Internet sources (list available on request). For details of measurement and cost calculation, see Supplementary data, Appendix S2 available in *Age and Ageing* online. Costs are presented in Euros (€) for the year 2010, and if needed, prices were indexed to the reference year using a consumer price index [21].

Cost-effectiveness analysis

The primary outcome of our CEA is disability, which was assessed by the Groningen Activity Restriction Scale (GARS) [22]. For the CUA, outcomes are expressed in terms of generic quality adjusted life years (QALYs), measured by means of the EuroQol-5D (EQ-5D) [23]. A direct value for every state of health was generated using the UK Dolan tariff [24], which provides an algorithm to elicit societal utility values from patient EQ-5D scores [23]. Data for CEA and CUA were collected at baseline, 6, 12, and 24 months.

Statistical analysis

Clinical outcomes were analysed according to the intention-to-treat principle using mixed-model multilevel analyses. Volumes of healthcare utilisation and related costs are presented as arithmetic means and were tested for their significance by using t-tests, which is considered the most appropriate method to analyse cost data [25]. Incremental cost-effectiveness ratios (ICERs) were calculated, representing the differences in mean costs between the intervention and control group in the numerator and the difference in mean clinical effects in the denominator [23]. Sampling uncertainty around the ICER was assessed by means of (1,000 times) non-parametric bootstrapping (percentile method) [23]. To assess the robustness of the assumptions made, we performed one-way sensitivity analyses. First, the intervention costs were not assessed individually, but mean volumes were estimated based on the process evaluation that was conducted alongside this trial [16]. If intervention aspects are reimbursed as usual care, this may have resulted in double counting of intervention costs. Therefore, we compared the base-case with the analyses without intervention costs. Second, as the study was performed in a Dutch setting, the base-case (UK tariff) [24] was compared with the Dutch tariff [26]. Statistical analyses were conducted with SPSS for Windows version 20.0; bootstrapping was done in Excel 2010.

Results

Participants

Out of 3,498 screened people, 393 were eligible and 346 were included in the study with 193 (56%) receiving the PoC approach. Details of the progress of participants through the trial are reported elsewhere [17]. The mean age of participants was 77.2 years. At baseline, participants in the intervention group were on average significantly more frail (GFI: 7.13 versus 6.72, $P = 0.03$) and more disabled (GARS: 33.09 versus 30.58, $P = 0.03$). Other characteristics, including the amount of healthcare utilisation, were comparable between both groups. For details of baseline characteristics, see Supplementary data, Appendix S3 available in *Age and Ageing* online.

Healthcare utilisation and costs

Volumes of hospital care (including outpatient medical services), long-term care, informal care and helping aids/in-home modifications were comparable between the groups over a period of 24 months. However, people in the intervention group had more primary care use compared with the control group (Table 1). Additional analyses of annual volumes showed that this group difference was stronger in the first 12 months: the intervention group showed significantly more contacts with the occupational therapist (4.6–0.4, $P < 0.001$), practice nurse (5.2–1.0, $P < 0.001$) and GP (15.0–12.4, $P = 0.05$). From month 12–24, only the amount of occupational therapy sessions was significantly higher for

Table 1. Mean (SD) volumes of healthcare utilisation 0–24 months

Variable	Intervention			Control			Mean difference (95% CI)	P
	Older people[e]	Mean	SD	Older people[e]	Mean	SD		
Primary care[b]								
GP (contacts)	131/132	31.4	23.4	115/115	27.2	20.7	4.2 (−1.35 to 9.79)	0.14
Practice nurse (contacts)	128/132	5.2	3.4	33/115	1.1	2.7	4.1 (3.29 to 4.82)	0.00[a]
Occupational therapist (contacts)	41/132	7.1	13.4	8/115	1.2	4.7	5.9 (3.44 to 8.35)	0.00[a]
Physiotherapist (contacts)	85/132	33.5	53.0	68/115	32.8	50.9	0.7 (−12.39 to 13.74)	0.92
Hospital care[c]								
Admission (days)	39/148	5.3	17.6	33/131	3.1	9.8	2.2 (−1.07 to 5.57)	0.18
Outpatient medical services (contacts)	138/148	11.5	11.4	113/131	10.0	8.7	1.5 (−0.85 to 3.88)	0.21
Long-term care[d]								
Admission (days)	5/134	2.1	12.0	6/119	2.1	10.8	0.1 (−2.74 to 2.94)	0.95
Professional home care (hours)	77/134	228.2	288.5	67/119	220.2	319.9	8.0 (−67.30 to 83.36)	0.83
Others[d]								
Informal care (hours)	44/154	479.0	1,238.4	38/135	503.2	1,152.4	−24.1 (302.37 to 254.12)	0.87
Aids/in-home modifications (number)	85/137	1.5	1.8	74/122	1.2	1.4	0.3 (−0.11 to 0.67)	0.16

Data are mean (SD) by group allocation.
[a]Statistically significant.
Data were collected by:
[b]Health insurance registries,
[c]Registry of the local hospital or
[d]Gathered via self-reported measures.
[e]Proportion of elderly who received services.

the intervention group (2.6–0.7, $P = 0.01$). Annual volumes are not tabulated, but available on request.

Table 2 shows the mean costs for participants with a complete data set over a period of 2 years ($n = 194$, 56%). The mean total costs for 24 months were €26,503 per participant in the intervention group compared with €20,550 in the control group. The costs for the PoC approach were €728. Mean healthcare costs were significantly higher in the intervention group than in the control group (€17,664 versus €12,963, $P = 0.03$). Participants in the intervention group showed significantly higher mean costs for GP care (€1,072 versus €729, $P < 0.001$), hospital care (€2,905 versus €1,488, $P = 0.05$) and helping aids/in-home modifications (€552 versus €278, $P = 0.03$) than participants in the control group. The remaining categories of healthcare utilisation were comparable between the groups.

Clinical outcomes

No significant effects were found for disability (GARS) [17] and health-related quality of life (EuroQol-5D). For the scores, see Supplementary data, Appendix S4 available in *Age and Ageing* online. In addition, 2-year QALYs are presented [27].

Base-Case CEA and sensitivity analyses

Since we did not detect differences in clinical effects, it is not useful to present ICERs. The cost-effectiveness plane of the CUA base-case bootstrap analysis for QALYs (Figure 1) shows that 2% of the ICERs lies in the dominant ('south east') quadrant (representing the probability of

the PoC approach having more effect and lower costs compared with usual care). Sensitivity analyses did not reveal other results. For details of the sensitivity analyses, see Supplementary data, Appendix S5 available in *Age and Ageing* online.

Discussion

As expected, frail older people in the intervention group used more primary care services compared with the control group, especially in the first 12 months, but against our hypothesis we found no effects on disability or health-related quality of life and no decline in more expensive hospital and long-term care. Subsequently, total healthcare costs over 24 months tended to be higher in the intervention group than in the control group (€26,503 versus €20,550, $P = 0.08$). The probability of the PoC approach being cost-effective compared with usual care is negligible (2%).

Possible explanations of findings

The findings of this economic evaluation are in line with the effect evaluation that is published earlier [17]. There are some possible explanations why the PoC approach has shown no beneficial effects. First, there is still a lively debate about the conceptualisation and measurement of frailty [28]. Possibly the wrong target group was recruited for the intervention. Second, according to the process evaluation, some steps of the intervention protocol were not sufficiently implemented [16]. Third, frail older people in countries with advanced health care consume a substantial amount of

Table 2. Mean (SD) costs of healthcare utilisation complete cases (*n* = 194) after 24 months

Variable	Intervention (*n* = 103)		Control (*n* = 91)		Mean difference (95% CI)	*P*	Bootstrap 95% uncertainty interval	
	Mean	SD	Mean	SD			2.5th percentile	97.5 percentile
Healthcare costs	17,664	18,277	12,963	10,439	4,701 (540 to 8,861)	0.03[a]	767	8,928
Intervention costs[b]	728	0	0	0	788			
Other healthcare costs	16,936	18,277	12,963	10,439	3,973 (−188 to 8,134)	0.06	−7	8,069
GP care	1,072	732	729	545	343 (158 to 528)	0.00[a]	166	524
Allied professionals	1,189	1,918	1,322	1,937	−134 (−681 to 413)	0.63	−680	416
Hospital care	2,905	6,882	1,488	2,235	1,417 (−3 to 2,837)	0.05[a]	172	2,862
Long-term admission	531	2,787	221	1,554	310 (−341 to 961)	0.35	−283	947
Professional home care	8,031	10,462	7,020	7,473	1,011 (−1,595 to 3,617)	0.45	−1,514	3,957
Medication	3,208	6,306	2,182	2,211	1,026 (−286 to 2,338)	0.12	−101	2,632
Patient and family costs	8,839	18,459	7,587	14,521	1,252 (−3,496 to 5,999)	0.60	−2,758	6,158
Informal care	8,287	18,352	7,309	14,490	978 (−3,747 to 5,704)	0.68	−3,303	6,205
Aids/in-home modifications	552	1,067	278	643	273 (27 to 520)	0.03[a]	34	541
Total costs	26,503	27,273	20,550	18,891	5,953 (−633 to 12,538)	0.08	−785	12,741

Data are mean (SD) by group allocation.
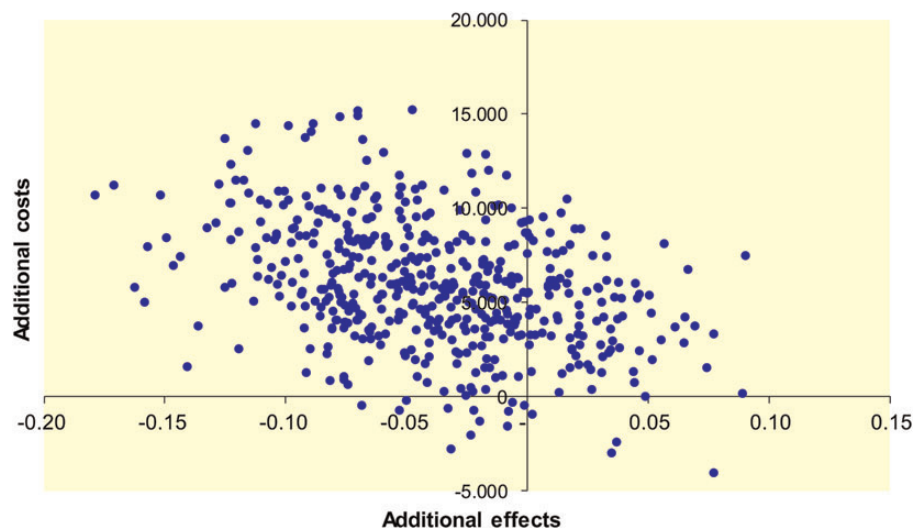[a]Statistically significant.
[b]Intervention.

Figure 1. Cost-effectiveness plane for costs (Euros) versus adjusted life years (QALYs) based on UK tariff.

services. This is supported by the volumes of healthcare utilisation in our control group. Over a period of 24 months, people in this latter group had, on average, 27 contacts with their GP, 33 physiotherapy sessions and 10 contacts with outpatient medical services. The contrast between the PoC approach and usual care was possibly too small to demonstrate convincing effects. This is in line with other studies assuming that the increasing awareness of the needs and problems of older people might have reduced the benefit of recent interventions compared with studies in earlier decades [29]. Fourth, potential benefits of the intervention are assessed by changes in disability and health-related quality of life, respectively, QALYs. These rather restricted outcomes do not consider broader aspects of well-being that go beyond health. Thus, probably the benefits of the

intervention have been underestimated. However, there is no consensus yet on how to incorporate non-health outcomes like well-being or capability indices in economic evaluations [20].

Comparison with other studies

During the past decades, much research targeting community-dwelling (frail) older people has been conducted, with many studies in the field of preventive home-visiting programmes. The studies evaluated a range of interventions carried out by various professionals. In each case, the aim is to proactively detect modifiable risk factors and to prevent adverse outcomes [17]. However, most studies, including our effect study [17], reported no or only modest

effectiveness. Comparing the results of economic evaluations is more challenging due to several reasons. First, measurement, data analysis and outcomes vary across studies. Second, results of economic evaluations have to be interpreted in the light of national contexts [23]. Finally, economic evaluations in this field are scarce.

Strengths and limitations

To our knowledge, this study is the first CEA in this field, which was conducted from a societal perspective with a time horizon of 24 months. However, this study knows some limitations that may have influenced our results. First, although healthcare registries were used as primary data sources, some data were collected via self-reports, which may have led to recall bias. However, there is no reason to assume that possible recall bias is unevenly distributed between the groups. Second, the intervention costs were not assessed individually, but mean costs were based on the process evaluation [16]. When intervention aspects are reimbursed as usual care, this may have resulted in double counting. However, sensitivity analyses without intervention costs did not reveal other results.

Implications for practice and research

Against our hypothesis, the PoC approach in its current form is not cost-effective. Consequently, its implementation is not recommended, at least not in countries with advanced health care. Based on the current evidence, it is not justified to implement proactive care nationally. According to the literature, the 'screening condition' has to be fully understood and suitable screening tools and accepted interventions are needed [30]. Furthermore, the costs of screening, including subsequent assessment and treatment, should be economically balanced in relation to potential healthcare costs [30]. With regard to frailty, there is still a lively debate about its conceptualisation and measurement [28]. In addition, available interventions have produced inconsistent and conflicting results regarding their effectiveness and little is known about cost-effectiveness [3–6]. Consequently, more research into the conceptualisation and measurement of frailty is needed and more studies, including economic evaluations, have to be conducted to optimise services for this target group and to prevent a waste of shrinking healthcare resources.

Conclusion

The intervention under study led to an increase in healthcare utilisation and related costs without providing any beneficial effects. This study adds to the scarce amount of evidence regarding cost-effectiveness of proactive primary care in community-dwelling frail older people.

Key points

- Little is known about the cost-effectiveness of proactive primary care.
- The intervention group used more primary care services compared with the control group, especially in the first 12 months.
- No effects on disability or health-related quality of life and no decline in more expensive hospital and long-term care were found.
- Total healthcare costs over 24 months tended to be higher in the intervention group than in the control group.
- This study adds to the scarce evidence of the cost-effectiveness of proactive primary care in frail older people.

Conflicts of interest

None declared.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

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