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Cost-effectiveness of the ‘Walcheren Integrated Care Model’ intervention for community-dwelling frail elderly

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Abstract

Background. An important aim of integrated care for frail elderly is to generate more cost-effective health care. However, empirical research on the cost-effectiveness of integrated care for community-dwelling frail elderly is limited.

Objective. This study reports on the cost-effectiveness of the Walcheren Integrated Care Model (WICM) after 12 months from a societal perspective.

Methods. The design of this study was quasi-experimental. In total, 184 frail elderly patients from 3 GP practices that implemented the WICM were compared with 193 frail elderly patients of 5 GP practices that provided care as usual. Effects were determined by health-related quality of life (EQ-5D questionnaire). Costs were assessed based on questionnaires, GP files, time registrations and reports from multidisciplinary meetings. Average costs and effects were compared using *t*-tests. The incremental cost-effectiveness ratio (ICER) was calculated, and bootstrap methods were used to determine its reliability.

Results. Neither the WICM nor care as usual resulted in a change in health-related quality of life. The average total costs of the WICM were higher than care as usual (17 089 euros versus 15 189 euros). The incremental effects were 0.00, whereas the incremental costs were 1970 euros, indicating an ICER of 412 450 euros.

Conclusions. The WICM is not cost-effective, and the costs per quality-adjusted life year are high. The costs of the integrated care intervention do not outweigh the limited effects on health-related quality of life after 12 months. More analyses of the cost-effectiveness of integrated care for community-dwelling frail elderly are recommended as well as consideration of the specific costs and effects.

Key words: Cost-effectiveness, economic evaluation, frail elderly, general practice, integrated health care systems, prevention.

Introduction

Due to population ageing, primary care systems throughout the world are encountering great challenges urging innovation in the organization of elderly care. Elderly individuals will gradually experience complex age-related problems in the physical, psychological, cognitive and social domains of daily functioning. This condition is

known as frailty and is found to increase the risk of negative health and social outcomes. Frailty is related to poor quality of life and becoming more care dependent, with an increased likelihood of hospitalization and institutionalization (1). While budget cuts reduce health and social care expenditures, there is, thus, a strong need for providing high-quality care in order to maintain elderly's quality of

life. It is frequently questioned whether the current approach to care delivery provides good value for money, given its fragmentation and its lack of responsiveness to the needs of frail elderly (2). Therefore, it is essential to consider alternatives.

Integrated care has been increasingly advocated as a means to deliver value for money. Integrated care is defined as 'a well-planned and well-organised set of services and care processes, targeted at multi-dimensional needs/problems of an individual client, or a category of persons with similar needs/problems' (3). The two main features of integrated care are client centredness and continuity. First, integrated care is demand-oriented, addressing client's needs by professionals from different disciplines and sectors (2). Second, integrated care aims to promote continuity: the set of services is delivered coherently, seamlessly and in accordance with clients' changing needs over time (3). Common elements of integrated care models proven to be effective for community-dwelling frail elderly are a single entry point, geriatric assessments, case management, multidisciplinary teams (4), multidisciplinary protocols and discussions, web-based patient files and a network structure (5).

Even though integrated care largely aims at cost-effectiveness, research comparing the associated costs and effects of interventions is scarce, limiting conclusions on the cost-effectiveness of integrated care interventions (6). Thus far, studies on cost-effectiveness have also shown mixed results. Some interventions for community-dwelling frail elderly have shown to be cost-effective compared with care as usual (6–9), whereas other studies have shown that integrated care is not cost-effective (10,11). The wide variation in the interventions, costs and effects considered in these studies, limits the possibility to draw conclusions regarding what promotes cost-effectiveness in integrated care for community-dwelling frail elderly.

This study adds knowledge by exploring the cost-effectiveness of a specific integrated care intervention: the Walcheren Integrated Care Model (WICM). Our study is relevant for two reasons. In contrast to earlier studies that used a narrow health care perspective (6,7,9), we adopted a societal perspective, which is strongly recommended given its policy relevance at the macro level (12). Second, our intervention comprises all integrated care elements that have been identified as effective in prior research rather than a selection of elements. Therefore, we provide valuable insights regarding the cost-effectiveness of a comprehensive integrated care model for community-dwelling frail elderly. This study aimed to answer the following research question: Is the WICM cost-effective from a societal perspective after 12 months?

Methods

Design

The design of this study was quasi-experimental and included before and after measurements with a control group providing care as usual [for a more detailed description of the methods, see ref. (13)]. The cost-effectiveness analysis was conducted from a societal perspective and thus considered all costs related to the intervention, irrespective of who pays for these expenses (12).

Intervention

In the WICM, the GP functions as care coordinator and as a partner in prevention. The GP practice is a single entry point for the elderly, their informal caregivers and health professionals. GPs detect frailty in their patient population using the Groningen Frailty Indicator, a validated 15-item instrument that measures decreases in physical, cognitive, social and psychological functioning. Elderly patients with a score of 4 or higher are visited by a nurse practitioner who assesses their functional, cognitive, mental and psychological functioning

using EASYcare, an evidence-based instrument used to assess care needs. A multidisciplinary treatment plan is then formulated in consultation with the elderly and their informal caregiver(s). Case management is provided by the nurse practitioner. Multidisciplinary meetings are attended by the GP, the nurse practitioner and other professionals, depending on the care required by the frail elderly. The entire process is supported by web-based patient files and multidisciplinary protocols. The WICM requires task reassignment and delegation between nurses and doctors, and among GPs, nursing home doctors and geriatricians. Consultations occur among primary, secondary and tertiary care providers. At the organizational level, a steering group serves as an umbrella organization under which the WICM is developed and disseminated. The steering group, which consists of representatives from all involved organizations, forms a Joint Governing Board that provides the necessary provider network. All patient representatives support the project, and the health insurer CZ provides financial support for the project.

Compared with the WICM, care as usual in the Netherlands is fragmented and reactive. In the Dutch health care systems, patients need a referral from their GP to obtain care from the primary, secondary and tertiary echelons. GPs thus play the role of gatekeepers. Care as usual is fragmented, as professionals merely communicate bilaterally through referral letters and sporadic telephone calls. Moreover, care as usual is reactive; patients solely receive care for specific (health) problems on their own initiative. The GPs in the control group were unable to implement elements of the integrated model during the study period because they did not receive financial support from the health insurer to implement the integrated care activities of the WICM. Accordingly, participants in the control group were not systematically screened for frailty, their care needs were not assessed, multidisciplinary treatment plan were not formulated and case management was not provided. The GPs in the control group had a monodisciplinary focus; they did not organize multidisciplinary meetings or implement multidisciplinary protocols and web-based files. Furthermore, the GPs in the control group could not treat the frail elderly patients differently, as these GPs were not given information on who participated in the study. Therefore, the probability of bias was minimized.

Participants

The study population consisted of the entire elderly patient population of the GPs in both the experimental and control groups (see Fig. 1). At baseline, 254 frail elderly from three GP practices were included in the experimental group, and 249 frail elderly from six GP practices in the control group. The frail elderly were asked whether they received informal care, including care from non-professionals and unpaid care provided by partners, family, close friends or neighbours. At baseline, 144 frail elderly in the experimental group reported receiving informal care compared with 118 frail elderly in the control group. After 12 months, the final study population included 184 frail elderly and 83 informal caregivers in the experimental group and 193 frail elderly and 76 informal caregivers in the control group.

Measures

Effects

The primary outcome of the intervention was quality of life, which was operationalized with health-related quality of life measured with the EQ-5D instrument. The EQ-5D has five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has three answering categories: (i) no problems; (ii) some problems and (iii) extreme problems. The answer to each of

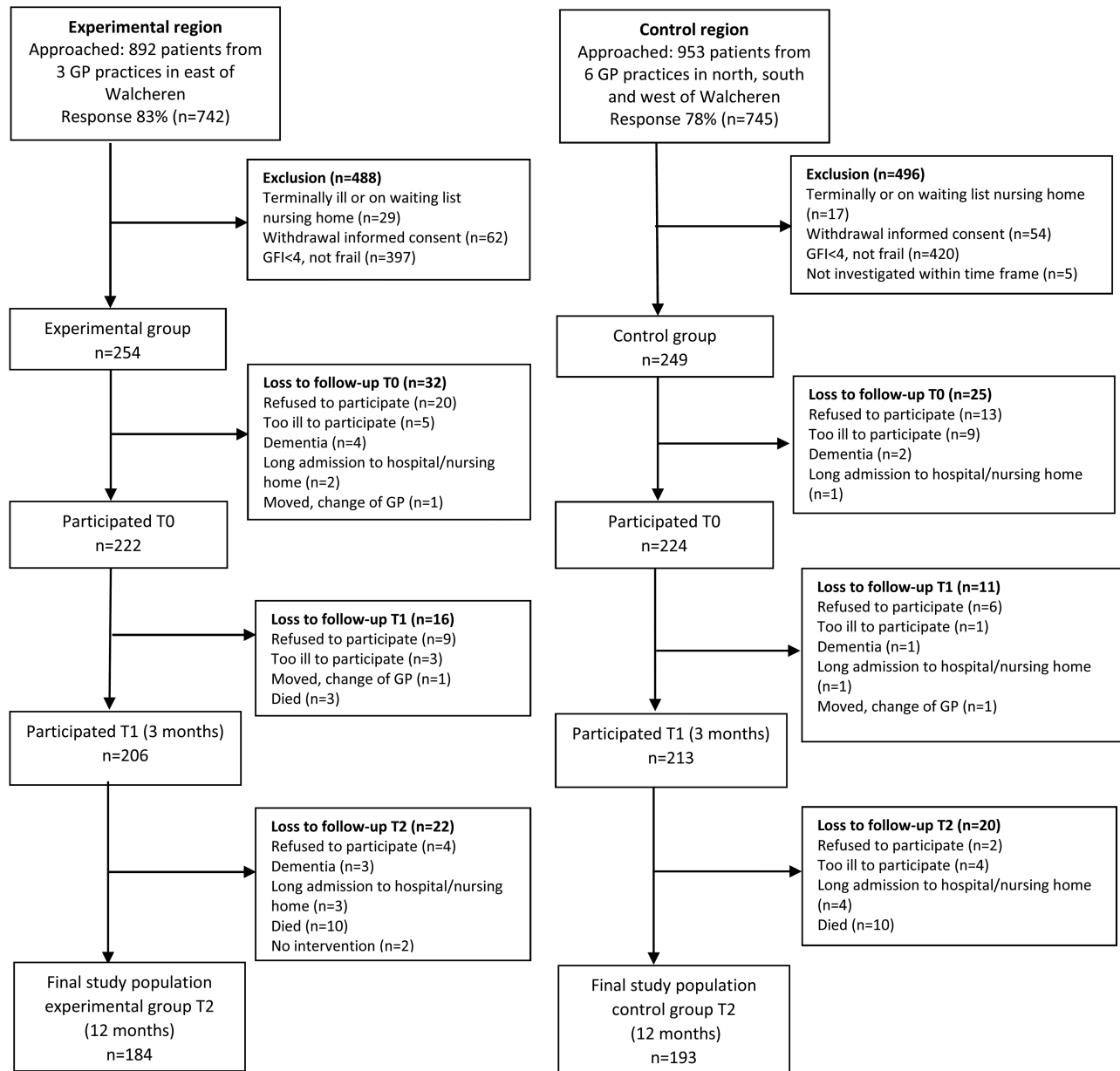


Figure 1. Flow chart of selection and loss to follow-up of study participants in experimental and control groups

these 5 dimensions leads to a combination of 5 numbers and 243 possible health states (e.g. health state 21232 means: having some problems in walking about, having no problems with self-care; having some problems with performing usual activities; having extreme pain or discomfort; being moderately anxious or depressed). The health states unconscious and dead were added, which makes a total of 245 health states that were valued by the Dutch audience on their desirability. In previous research a general sample of the Dutch audience was asked to indicate what period of time in perfect health (11111) was equal to 10 years in a specific health state (e.g. 21232) (14). The weights obtained in this research were used to calculate the utility scores of the frail elderly of our study population. Measurements of these utility scores were obtained at baseline, 3 and 12 months and were used to calculate quality-adjusted life years (QALYs) for each respondent. QALYs combine both quantity and quality of life in one single measure; 1 QALY means 1 year in perfect health (14).

Costs

Health care costs, intervention costs and informal care costs were calculated by multiplying the volume of care by its corresponding cost price.

Health care volumes were collected through questionnaires and GP file research (see Table 1). In the questionnaires, the frail elderly were asked to indicate the volume of care in assisted living facilities and nursing homes, in day care centres and in home care. Information on the volume of care in assisted living facilities and nursing homes was sought retrospectively after 3 and 12 months. The volumes of day care and home care were measured in the questionnaire at baseline, 3 and 12 months. These volumes were extrapolated with a calculation rule to obtain the volume of care over 12 months. The volume at baseline was considered to be the volume for the first month, the volume at 3 months was considered the volume for the second and third months and the volume at

Table 1. Costs of care and data collection

Type of care		Data collection				Cost price €
		Questionnaire	GP file	Time registrations	Notes from multidisciplinary meeting	
Health care costs						
GP practice						
GP	Telephone consultation		Number			14.51
	Consultation		Number			29.02
	Consultation long		Number			58.04
	Visit at home		Number			44.57
Practice assistant	Visit at home long		Number			89.13
	Telephone consultation		Number			5.48
	Consultation		Number			10.97
	Consultation long		Number			21.93
Emergency GP	Visit at home		Number			16.84
	Visit at home long		Number			33.68
	Telephone consultation		Number			21.29
	Consultation		Number			42.58
Hospital	Visit at home		Number			63.88
	Admission—general		Days			450.85
	Admission—academic		Days			595.95
	Outpatient clinic—general		Number			66.33
	Outpatient clinic—academic		Number			133.70
	Day surgery		Number			260.15
	Emergency ward		Number			156.50
Assisted living facility	Ambulance		Number			271.55
	Temporary stay assisted living facility	Days				93.28
Nursing home	Temporary stay nursing home	Days				246.67
	Permanent stay nursing home	Days				246.67
	Day treatment in nursing home	Days				146.66
Home care	Home care—household activities	Hours				24.87
	Home care—personal care	Hours				45.60
	Home care—nursing care	Hours				67.37
Day care centre	Day care	Days				26.00
Paramedical	Physiotherapy		Sessions			37.31
	Occupational therapy		Hours			22.80
	Dietitian		Hours			27.98
Psychosocial	Psychological care		Sessions			89.83
	Social care		Sessions			67.37
Intervention costs						
	Preparation multidisciplinary meeting			Minutes	Minutes	Variable ^a
	Multidisciplinary meeting			Minutes	Minutes	Variable ^a
	Time spent per patient by case manager			Minutes		Variable ^a
Informal care costs						
	Household activities	Hours				24.87
	Personal care	Hours				45.60
	Instrumental tasks	Hours				13.00

^aThe cost price differs per group health care professionals and is calculated for each group separately.

12 months was considered to be the volume for the last 9 months. The GP file research led to data regarding the volume of care within GP practices, hospitals and paramedical and psychological care. Data were not extrapolated, as the files provided the exact date of care consumption.

Information on intervention costs was obtained from time registrations of the case managers and notes from the multidisciplinary meetings. The exact intervention time and therefore intervention costs could be calculated for each individual frail elderly person. The education costs of the GPs and case managers were not considered.

Informal care volumes were assessed by questionnaires completed by informal caregivers of the frail elderly at baseline, 3 and 12 months. The volume of informal care was measured using the Objective Burden of Informal Care Instrument (15) that distinguishes time spent on household, personal care and instrumental tasks. The same calculation rule was applied as for the health care costs assessed in the questionnaire of the frail elderly.

Cost prices were determined using the Dutch guidelines of costing studies (16). Cost prices were determined in euros for the year 2011 and were corrected for inflation.

Statistical analysis

The costs and the effects were compared by conducting a cost-effectiveness analysis. First, the background characteristics of the experimental and control participants at baseline were compared by chi-square tests for the categorical variables and *t*-tests for the continuous variables. Second, the average volume of care and corresponding costs during the 12-month period were compared between the experimental and control groups with *t*-tests (17). The cost-effectiveness of the WICM was determined by calculating the incremental cost-effectiveness ratio (ICER). The ICER is calculated by dividing the difference between costs of the experimental group and control group (incremental costs) by the difference in effects between the experimental and control groups (incremental effects). Missing values were imputed with the fully conditional specification method. We determined the reliability of the ICER with the bootstrap method, which is a statistical method with repetitive computation to determine the confidence interval (CI) of the ICER. By sampling from both the distribution of costs and effects concurrently, multiple estimates from ICER were obtained ($n = 10\,000$) (10).

Results

The study population consisted of frail elderly patients with an average age of 82 years and an average score of 6 on the Groningen

Frailty Indicator (Table 2). Women were over-represented in both groups and the majority of the frail elderly lived alone and independently. Nearly half of the frail elderly patients had an informal caregiver. At baseline, the health-related quality of life was equal in both groups. Compared with the control group, the experimental group consisted of significantly more women and frail elderly who lived in assisted living facilities.

Frail elderly patients most commonly used care from the GP, hospital and home care (Table 3). All experimental participants used GP care, as it was the single entry point of care for the intervention. In the control group, 4% of the frail elderly did not use any GP care over the 1-year period. Three-quarters of the frail elderly visited the hospital within 1 year. The highest expenses in both groups were for home care and informal care. Only limited differences were observed in the health care utilization of the experimental and control group. For two types of care, the cost differences were significant. The first type was GP care: the costs were significantly higher in the experimental group than in the control group. Furthermore, because the intervention costs were 0 in the control group, these costs were significantly higher in the experimental group.

The average total costs in the experimental group were 17,089 euros for each frail elderly person over a 1-year period (Table 4). The costs were lower in the control group, with an average of 15,189 euros for each frail elderly person. The dispersion of costs was high:

Table 2. Characteristics of the study participants in experimental and control groups at baseline

	Experimental group ($n = 184$)	Control group ($n = 193$)	<i>T</i> -statistic or chi square
Groningen Frailty Indicator (0–15)	6.0 (2.0)	5.8 (1.8)	–1.3
Age	81.8 (4.7)	82.3 (5.3)	0.8
Sex—women	70%	60%	4.1*
Marital status			0.9
Married and living together	37%	42%	
Single and widowed	63%	58%	
Living situation			6.1*
Independently	72%	82%	
Assisted living facility	28%	18%	
Informal caregiver	45%	39%	1.5
Health-related quality of life (0–1)	0.65 (0.2)	0.67 (0.3)	0.5

* $P < 0.05$.

Table 3. Costs of care in experimental and control groups 0–12 months

Costs of care	Experimental group ($n = 184$)			Control group ($n = 193$)				
	% frail elderly using care	Mean (€)	SD (€)	% frail elderly using care	Mean (€)	SD (€)	95% CI	<i>P</i> -value
Health care costs								
GP	100	315	229	96.4	245	191	–133, –27	0.001***
Emergency GP	25.5	20	50	16.6	12	37	–16, 1	0.104
Hospital care	76.6	1096	3304	77.7	709	1628	–918, 146	0.154
Nursing home and assisted living	5.4	1244	8389	3.1	820	6987	–1985, 1136	0.593
Home care	69.0	7084	9573	71.0	6410	10902	–2756, 1408	0.525
Day care	5.4	205	1157	8.3	239	1216	–207, 274	0.786
Paramedical care	42.4	166	361	35.8	136	295	–96, 37	0.380
Psychosocial care	8.2	10	56	4.1	78	535	–8, 144	0.087
Intervention costs	100	340	188	0	0	0	–368, –313	0.000***
Informal care costs	41.8	6608	15269	35.2	6469	14778	–3182, 2904	0.929

SD, standard deviation.

*** $P < 0.001$.

~21 000 euros in both groups. The total costs did not significantly differ between the two groups. The effects were explored in terms of health-related quality of life. The average effect in the experimental group was 0.00 compared with -0.01 in the control group; this difference was not significant.

The WICM was not found to be cost-effective after 12 months. The intervention does not achieve incremental effects, meaning that no additional effects were gained. The incremental costs of the intervention are 1970 euros so the WICM is more expensive than care as usual. The costs do not outweigh the effects of the intervention after 1 year. The results indicate an ICER of 412 450 euros, implying that on average 412 450 should be spent to gain 1 additional QALY (1 year in perfect health). The 95% CI of the ICER is -4 131 743 to 4 210 593. The results of the bootstrap analysis are presented in the cost-effectiveness plane (Fig. 2). Very few of the bootstrap results, 0.21%, appear in the southeast quadrant, meaning that the intervention is more effective and generates lower costs than care as usual.

Conclusions

In this study, we performed an economic evaluation of the WICM, a comprehensive integrated care intervention for community-dwelling frail elderly including several effective integrated care elements and differing considerably from standard care (in the Netherlands). The main conclusion is that the WICM is not cost-effective from a societal perspective over a 12-month period, as the costs do not outweigh the effects and the costs per QALY are high.

Because studies of the cost-effectiveness of integrated care show mixed results, our study both confirms and contradicts current evidence. With regard to the effects, our study corroborates the limited effects of integrated care interventions (8–10). These limited effects do not depend on the effect measures, as studies have adopted

different effect measures, e.g. functional performance, mental health (6), frailty state (9) and health-related quality of life (8–11). In our cost-effectiveness analysis, we also chose to explore effects on quality of life because this refers to the subjective appraisal of the frail elderly themselves (1). Moreover, we focused on health-related quality of life because this measure is primarily used for interventions that expect effects on patient health (12). However, comparability between the studies is limited; it is uncertain what results would have been observed if all studies had chosen the same effect measures.

The main difference between our study and earlier research concerns the costs included (i.e. health care costs, intervention costs and informal care costs). With regard to the health care costs, the types of care that were considered clearly differed among studies. Our study included a wide range of costs because the intervention focused on physical, psychological and social functioning of the elderly. Accordingly, we included costs of both paramedical and psychological care, which were not or partially considered in other studies from a societal perspective (8,11). Furthermore, intervention costs were calculated differently in our study than in other studies. In these studies, the total intervention costs were calculated and divided by the number of intervention participants (8–11). The WICM involved specific investments, such as case management and time spent on multidisciplinary meetings by all professionals. These costs were studied in detail and calculated for each frail elderly person individually. This approach enhanced the validity of our study. Finally, informal care costs were considered only in studies adopting a societal perspective (8,11). Three of the interventions that were considered to be cost-effective (6,7,9) adopted a health care perspective that did not include the assessment of informal care costs.

This study has several limitations. Our quasi-experimental design was chosen to ensure that the frail elderly patients could stay with their own GP. As randomization of the frail elderly made this impossible, a quasi-experimental design was the second best choice. However, quasi-experimental designs may risk baseline differences between the experimental and control groups. In our study, the experimental group consisted of more women and more elderly living in assisted living facilities compared with the control group. However, these differences did not influence our results, as previous research has shown no clear association between sex and quality of life (18) or between living in an assisted living facility and quality of life (19). This also applies to the costs of care, which were not found to be higher for women (20) or for elderly in assisted living (21). Additionally, with

Table 4. Effects and total costs of care in experimental and control groups 0–12 months

	Experimental group	Control group	95% CI	P-value
Effects—EQ-5D	0.00 (0.19)	-0.01 (0.17)	-0.04, 0.03	0.80
Total costs	17 089 (21 468)	15 189 (21 709)	-6344, 2405	0.38

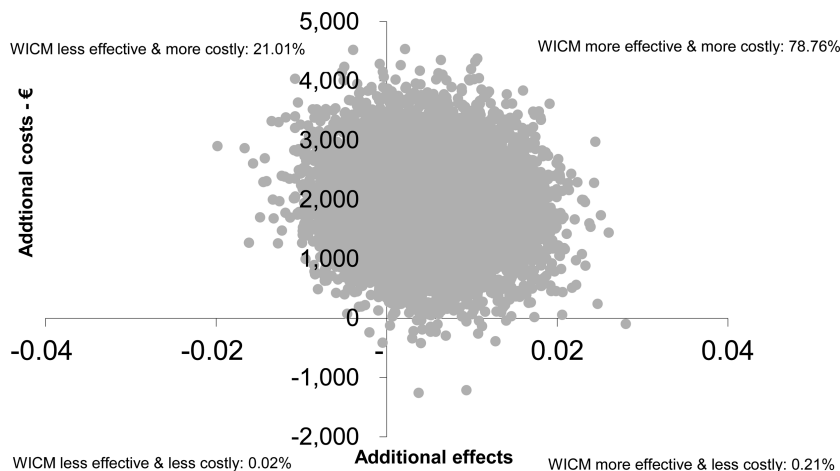


Figure 2. Cost-effectiveness plane—costs (euros) versus effects (QALY) of WICM versus care as usual

the quasi-experimental design, we might have selectively included GPs in the experimental group who initially already had a more proactive attitude toward the delivery of care to frail elderly patients. Because a proactive attitude has an effect on elderly's quality of life (1), the choice not to randomize the GPs might have led to a smaller effect on the change in quality of life for the experimental group. Although the quality of life at baseline did not significantly differ in the two groups, we have no information regarding changes in the quality of life prior to the beginning of the intervention. The selection of intervention GPs could also mean that these GPs are more likely to participate in care activities for the frail elderly, leading to higher care costs irrespective of the costs associated with the WICM.

The second limitation is related to the calculation of care costs. In this study, precise data on the volume of some types of formal and informal care were lacking because the elderly patients did not keep records of the care they received, a method which is a commonly used in cost-effectiveness analyses. Instead, we extrapolated the volume based on their health care use at three explicit moments in time (at baseline, after 3 and after 12 months). This method could have led to an underestimation or overestimation of health care use and informal care and, consequently, of the costs of care. Additional analyses also showed that the volume of care used at the three moments in time rarely differed.

Third, we did not account for all costs in the cost-effectiveness analysis, e.g. costs regarding medication and assistive devices. We selected the seemingly most important types of care because it remains unknown what specific types of health and social care should be considered in cost-effectiveness analyses of integrated care interventions for the frail elderly. Furthermore, the costs of schooling and training were not accounted for because consideration of such costs would lead to unrealistically high costs for the experimental group, as the return on investment for these costs requires >12 months.

It remains unclear whether integrated care for the frail elderly can achieve one of its major aims of being cost-effective and thereby providing value for money. In current health care systems, this knowledge is essential in determining whether integrated care can achieve its high expectations. This implies that further research of evaluation studies on integrated care should include a cost-effectiveness analysis from a societal perspective with similar types of care considered. Adopting a societal perspective, i.e. considering the costs of informal care, is strongly recommended (12). This is necessary because informal caregivers have become increasingly important in the care of frail elderly patients. It is crucial to consider similar costs and effects in cost-effectiveness analyses to ensure comparability among studies. More comparable cost-effectiveness analyses may help researchers to draw conclusions regarding what combinations of integrated care elements are cost-effective. However, performing such research requires determination of the types of care and health issues can be influenced by integrated care interventions for the frail elderly and should thus be considered relevant costs and effects in future cost-effectiveness analyses.

Second, future research may explore whether other goals of the WICM are achieved, such as improvements in the quality of care and consumer satisfaction. Because of a possible trade-off between the various goals of integrated care, focusing solely on cost-effectiveness might impede the implementation of a potentially successful integrated care arrangement for frail elderly patients.

Declaration

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Ethics approval: the study (design) was reviewed by the medical ethics committee of the Erasmus Medical Center, Rotterdam, the Netherlands, under protocol number MEC-2013-058. This committee waived further examination because the rules established in the Medical Research Involving Human Subjects Act did not apply. Conflicts of interest: none.

References

- Gobbens RJ, van Assen MA. The prediction of quality of life by physical, psychological and social components of frailty in community-dwelling older people. *Qual Life Res* 2014; 23: 2289–300.
- Gröne O, Garcia-Barbero M. Integrated care: a positioning paper of the WHO European office for integrated health care services. *Int J Integrated Care* 2001; 1: 1.
- Nies H. Integrating care: concepts and background. In: Nies H, Berman PC (eds). *Integrating Services for Older People: A Resource Book for Managers*. Dublin, OH: Ehma, 2004.
- Johri M, Beland F, Bergman H. International experiments in integrated care for the elderly: a synthesis of evidence. *Int J Geriatr Psychiatry* 2003; 18: 222–35.
- Kodner DL, Kyriacou CK. Fully integrated care for frail elderly: two American models. *Int J Integr Care* 2000; 1: e08.
- Melis RJ, Adang E, Teerenstra S *et al*. Cost-effectiveness of a multidisciplinary intervention model for community-dwelling frail older people. *J Gerontol A Biol Sci Med Sci* 2008; 63: 275–82.
- Stuck AE, Aronow HU, Steiner A *et al*. A trial of annual in-home comprehensive geriatric assessments for elderly people living in the community. *N Engl J Med* 1995; 333: 1184–9.
- Drubbel I. Frailty screening in older patients in primary care using routine care data. Zuthpen, The Netherlands: CPI Koninklijke Wöhrman BV, 2014.
- Fairhall N, Sherrington C, Kuurle SE *et al*. Economic evaluation of a multifactorial, interdisciplinary intervention versus usual care to reduce frailty in frail older people. *JAMDA* 2015; 16: 41–8.
- Kehusmaa S, Autti-Rämö I, Valaste M, Hinkka K, Rissanen P. Economic evaluation of a geriatric rehabilitation programme: a randomized controlled trial. *J Rehabil Med* 2010; 42: 949–55.
- Metzelthin SF, van Rossum E, Hendriks MR *et al*. Reducing disability in community-dwelling frail older people: cost-effectiveness study alongside a cluster randomised controlled trial. *Age Ageing* 2015; 44: 390–6.
- Drummond MF, Sculpher MJ, Torrance GW *et al*. *Methods for the Economic Evaluation of Health Care Programmes*, 3rd edn. Oxford, UK: Oxford University Press Oxford, 2005.
- Fabbriotti IN, Janse B, Looman WM *et al*. Integrated care for frail elderly compared to usual care: a study protocol of a quasi-experiment on the effects on the frail elderly, their caregivers, health professionals and health care costs. *BMC Geriatr* 2013; 13: 31.
- Lamers LM, McDonnell J, Stalmeier PF, Krabbe PF, Busschbach JJ. The Dutch tariff: results and arguments for an effective design for national EQ-5D valuation studies. *Health Econ* 2006; 15: 1121–32.
- van den Berg B, Spauwen P. Measurement of informal care: an empirical study into the valid measurement of time spent on informal caregiving. *Health Econ* 2006; 15: 447–60.
- Hakkaart-van Roijen L, Tan SS, Bouwmans CAM. *Handleiding Voor Kostenonderzoek, Methoden En Standaard Kostprijzen Voor Economische Evaluaties in De Gezondheidszorg [Dutch Manual for Costing: Methods and Standard Costs for Economic Evaluations in Healthcare]*. Diemen, The Netherlands: College voor Zorgverzekeringen, 2011.
- Thompson SG, Barber JA. How should cost data in pragmatic randomized controlled trials be analysed? *BMJ* 2000; 320: 1197–2000.
- Bowling A. *Measuring Health. A Review of Quality of Life Measurement Scales*. Berkshire, UK: Open University Press, 2005.
- Grayson P, Lubin B, Van Whitlock R. Comparison of depression in the community-dwelling and assisted-living elderly. *J Clin Psychol* 1995; 51: 18–21.
- Kehusmaa S, Autti-Rämö I, Helenius H *et al*. Factor associated with the utilization and costs of health and social services in frail elderly patients. *BMC Health Serv Res* 2012; 12: 204.
- McGrail KM, Lilly MB, McGregor MJ *et al*. Health care services use in assisted living: a time series analysis. *Can J Aging* 2013; 32: 173–83.