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Review

The cost-effectiveness of integrated home care and discharge practice for home care patients

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ABSTRACT

Objectives: To evaluate the effects of integrated home care and discharge practice (IHCaD-practice) on the use of services and cost-effectiveness.
Methods: A cluster randomised trial with Finnish municipalities ($n = 22$) as the units of randomisation. At baseline the sample included 668 home care patients aged 65 years or over. Data consisted of interviews (discharge, 3-week, 6-month) and care registers. The intervention was a generic prototype of care/case management-practice that was tailored to each municipality's needs. The effects were evaluated in terms of the use and cost of health and social care services. Unit costs of services were calculated. Cost-effectiveness was calculated for changes in health-related quality of life using the Nottingham Health Profile (NHP) and the EQ-5D instruments. All analyses were based on intention-to-treat.
Results: At 6-month follow-ups, the patients in the trail group used less home care, doctor and laboratory services than patients in the non-trial group. Similar differences between groups were found regarding costs. According to the NHP instrument, the IHCaD-practice showed higher cost-effectiveness compared to the old practice. No evidence for cost-effectiveness was found with the EQ-5D instrument.
Conclusions: The study suggests that the IHCaD-practice may be a cost-effective alternative to usual care.

Contents

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1. Introduction

The main interest of this study was to evaluate the effects on the use of services and the cost-effectiveness of integrated home care and discharge practices (IHCaD-practices). The most critical period after a hospital stay is the first 2 weeks at home [1]. Some problems in home care and discharging practices are common, such as shortcomings in the flow of information and in the continuity of care. Further, there is a lack of clarity on responsibilities in discharging a patient from hospital to home care and a lack of integration of services based on the patient's needs [2,3].

New discharge and home care practices such as case/care management and co-ordinators [4–7], multidisciplinary team work [8,9], discharge, integrated care and educational programmes [10–13] have been developed to address the above mentioned shortcomings and also to cut or restrain the costs of health and social care [7]. The discharge interventions have decreased the number of days spent in hospital [5,10,14] and re-admission rates as well as improved functional ability [10] and HRQoL [5,10]. Effects on mortality have not been found [5,10,14]. Home care interventions have decreased the use of hospital and institutional care [7] and re-admissions [6], but increased the use of home help services [7]. In addition these interventions have improved clients' functional ability, HRQoL, improved satisfaction among clients and informal caregivers and decreased caregiver burden [6,12]. Although discharge and home care interventions have shown improvements, the results are contradictory and clear beneficial effects have not always been found [6,11,13]. In randomised studies, there are methodological problems, such as a short follow-up time, too small sample sizes, and the lack of adequate power to detect the effects of an intervention [4,10,13,15,16].

In cost-effectiveness studies the evidence of cost-effectiveness also varies. Miller et al. [9] studied cost-effectiveness of an early discharge rehabilitation and found that the intervention was cost-effective. Anttila et al. [14] assessed the cost-effectiveness of a post-discharge programme on the use of hospital care in an elderly population. The results showed that the costs of university hospital care decreased by 52% in the interventions group and by 24% in the control group per patient year. According to Kwok et al. [17] the discharge intervention increased costs. In home care interventions the results of cost-effectiveness have been contradictory. Hughes et al. [6] found higher cost in intervention groups, but in Landi et al. [7] study the intervention decreased the total cost. The heterogeneity of methods and outcome measures used in cost-effectiveness studies make comparisons difficult. Ramos et al. [18] assessed the economic evaluations of home care for the elderly and found a low adherence to the methodological principles in economic evaluations, e.g. incremental costs were not evaluated, indirect costs were not taken into account or sensitivity analyses were not reported. Further, many studies do not include a real cost-effectiveness analysis, only comparisons of costs between intervention and control groups [5,6,14]. In addition, several studies have been conducted outside Europe [1,6,17], where the service structure is different. Service structures vary even in Europe and within countries. The research of care practices is always connected with the context of the local health and social service system, and therefore a working-pattern that has been developed elsewhere cannot be implemented without piloting.

The aim of this study was to evaluate the effects on the use of services and the cost-effectiveness of integrated home care and discharge practice for home care patients, using cluster randomised trial (CRT). The intervention was applied to home care and hospital staff, not to patients. CRT is a suitable design when an intervention influences changes in practice and affects a number of people rather than individuals [15,16].

2. Methods

2.1. Design and settings

The effects on services and the cost-effectiveness of the new practice were evaluated using a CRT in 22 Finnish municipalities. Each municipality formed its own cluster.

2.2. Municipalities' recruitment and randomisation

This study belongs to the series of studies called 'Integrated Services in the Practices of Home Care and Discharge' [19]. The results of earlier studies were used as a basis for formulating criteria for the municipality-pairs for this study [20,21]. Municipalities were chosen from the total number of Finnish municipalities ($N = 448$ as of 2000) with the minimum number of inhabitants set at over 10 000 (capital city was excluded). Municipalities were recruited based on the following recruitment criteria for pairing: (1) the populations in municipalities were alike, (2) the pathways of patient care were similar, (3) the proportion of patients discharged from hospital to home was similar and (4) the administration structures of health and social care were similar. The municipalities were matched by researchers according to the above criteria and were then recruited together.

The municipality-pairs were randomised to a trial (11) or to a non-trial group (11) after the pilot study (Fig. 1). The purpose of the pilot study was to ensure the success of the

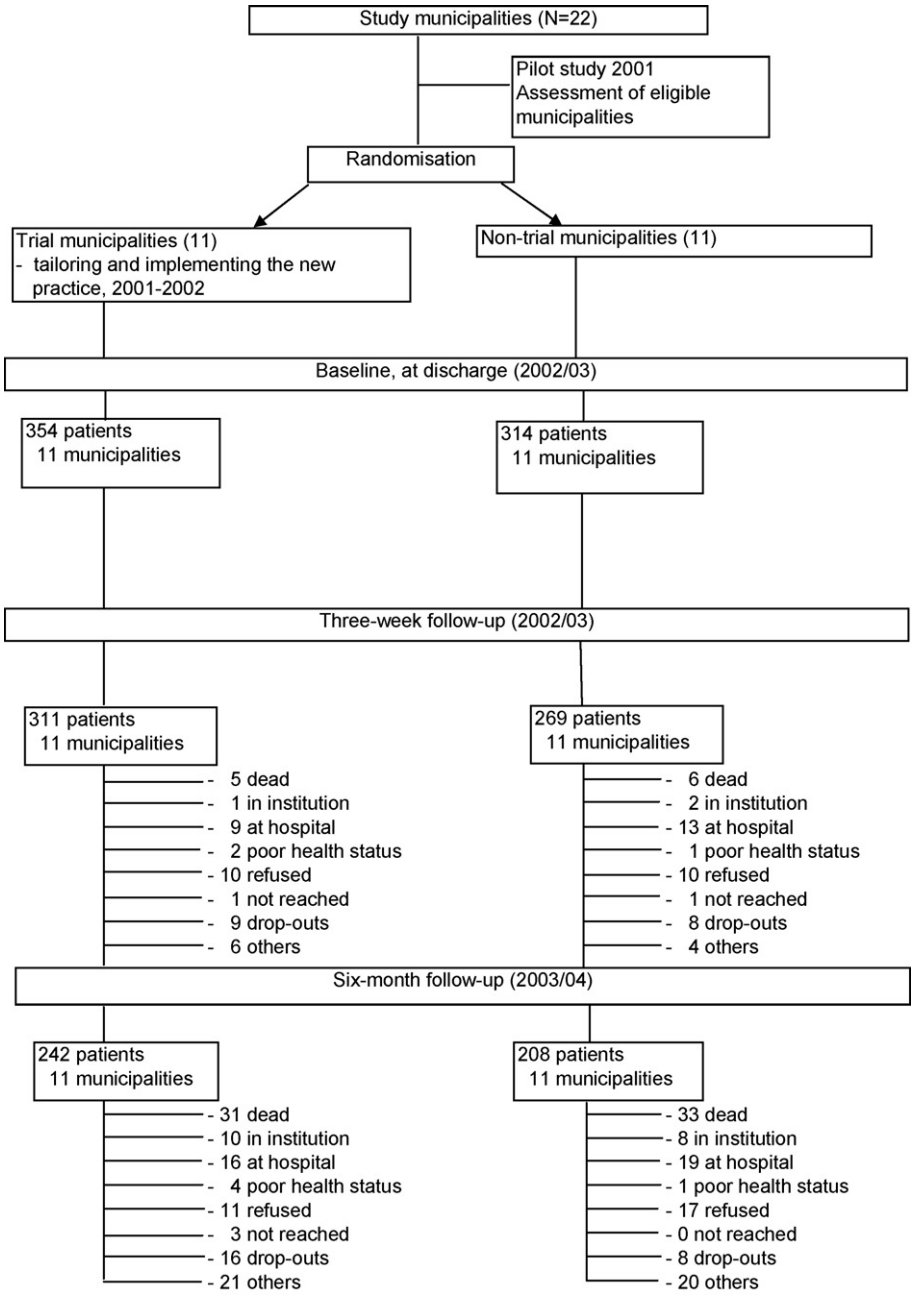

Fig. 1. Study design and flow of participants.

randomisation before the follow-up study had begun. The randomisation was carried out by researchers using lots. After randomisation, hospital and home care staff and the interviewers were aware of which group the municipality belonged to, but the patients were not.

2.3. Sample

Power calculations were performed for the two main outcome variables: HRQoL using a population-based sample of the HRQoL-instrument (the 15D) [22] and success in discharge from hospital to the patient's home (source: Care Register HILMO 1997). The discharge success measures the percentage of patients who are released from hospital back to their homes. An estimate of a 15% increase in the number of patients managing at home is a clinically significant improvement in discharge success. We performed power calculations using data from the 15D HRQoL-instrument, as the required information was not available from the EQ-5D and Nottingham Health Profile (NHP) instruments. This choice was made on the assumption that these instruments, however, measure similar phenomena. The power

calculation took into account that randomisation focused on a patient cluster (municipalities) and not on a single patient [15,16,23]. We assumed an intra-cluster correlation (ICC) of $\rho = 0.05$. According to the calculation, an adequate power ($\alpha = 0.05$, $\beta = 0.20$) to detect significant changes in both outcome variables can be reached by a sample of 22 clusters (11 per group) and 35 patients in each cluster ($N = 770$). The study design and the flow of participants are shown in Fig. 1.

The interviewers recruited patients to the study between October 2002 and July 2003. A two-stage filter was used to include or exclude patients. At the first stage, study candidates were included (in the order of their arrival) if they were aged 65 years or older, lived in the study municipalities, and were admitted to hospital from home. If the primary admission diagnosis was cancer, dementia or some psychiatric diagnosis, the patient was excluded. Final selection was made at discharge based on the following criteria: the preliminarily chosen patient had to be discharged back home with regular home care services. Those patients who were unable to answer the Short Portable Mental Status-test (SPMSQ-test) [24] were excluded.

2.4. Intervention

The IHCaD-practice was implemented in the trial municipalities by means of action research [25]. The intervention was applied to home care and hospital staff, not to the patients. The effect of the intervention was assessed through patient outcomes. The tailoring and implementation of the practice lasted 1–1.5 years. The municipalities in the trial group continued in their 'old practice'.

One aim of the intervention was to standardise practices and make written agreements between hospital and home care and within home care, which defined practices, responsibilities and support tools. At the same time the patient's whole care chain from home to hospital and from hospital to home was described in writing and made available to all those involved in the care chain. Previous to the intervention, only a part of the chain, for example, from hospital discharge to home, has been described, though not in as much detail, while home care responsibilities in particular were hardly ever mapped in the care chain.

The intervention was a generic prototype of care/case management-practice (IHCaD-practice) [19,26] which was tailored to fit the municipalities' administrative structure and practice codes. Multidisciplinary teamwork is further emphasised in the hospital as well as in home care practices. The home care team named a working pair (cf. a care/case manager) inside the team. The care/case manager has previously been used in only a few municipalities, and not before as a pair. This care/case manager pair consisted of a home nurse and a home aid/helper. The care/case manager pair was assigned to all patients who received home care services regularly. The pair planned and integrated home care services, and participated in planning the patient's discharge from hospital to home care in co-operation with hospital staff (proactive discharge planning). More detailed information of the intervention has been reported in Perälä et al. [26].

2.5. Data collection

Three kinds of data were used: patient interviews, medical records, and care register data compiled by means of patients' personal identification number. In each municipality and hospital, a trained interviewer who did not work on the wards or for the home care agency and did not participate in the development of intervention carried out the interviews. The interviewers selected eligible participants and interviewed them during 2002–2003 using a structured questionnaire at discharge, and at a 3-week and 6-month follow-up. Patients' diagnoses and medication use were obtained from medical records.

The register data were gathered from the Care Registers for Social Welfare and Health (Hilmo) and the Cause of Death statistics during 2002–2004. The registry data contained information on patient care episodes and deaths and number of re-admissions. In addition, information from the SOTKA-municipal database for social and health statistics in 2002 was gathered on municipalities' health and social care structure and number of inhabitants.

2.6. Variables

The use of health care services included home nursing and physiotherapist's home visits, visits to a doctor, a nurse, a physiotherapist, laboratory, out-patient clinic and emergency and days of hospital (primary and special care) and institutional care. The use of social services included visits by home help and support services (meals-on-wheels, transfer, bathing, cleaning, security telephone) and visits to a social worker, and were measured as number of visits during 1 week.

Our cost concept only included the cost of health and social care, and not the cost for the patients or productivity costs. We derived data on the costs of care – with the exception of the use of hospital and institutional care – from questionnaire responses. Costs were calculated weekly. Unit costs were defined on the basis of a national standard cost study [27], though the unit costs for transport, bathing and security telephone service were obtained from annual account reports of two municipalities (Annual reports of Kangasala and Kuopio 2001).

Cost causing by hospital care (including the hospital stay before discharge and re-admissions after discharge) and institutional care after hospital discharge was derived from the Care registers for social welfare and health registers. The unit cost for a care episode, using price levels from the year 2001, was estimated based on the diagnostic related groups (DRG) used in Hujanen's et al. study [27]. Costs for hospital care included examinations, medicine and hospital care. In those cases (87) where the DRG-groups were not used, the costs were derived based an average bed-day price depending on the care location (hospital care, nursing homes) based on study of Hujanen [27].

Health-related quality of life (HRQoL) was measured using the NHP and EQ-5D instruments. Both of these instruments have been validated for use in the Finnish general population [28,29]. The NHP is composed of 38 assertions (yes/no) from which six dimensions can be derived. The values in each dimension vary from 0 (best) to 100

(worst). The EQ-5D is a generic HRQoL-instrument consisting of five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. After a weighting procedure, a general index value for HRQoL, varying between 0 (dead) to 1 (best), is derived [29]. Functional ability (FA) was assessed using a Finnish version of the Activities of Daily Living (ADL), which includes both basic (PADL) and instrumental (IADL) dimensions [30].

2.7. Ethical issues

All enrolled patients gave written informed consent. Patients were given a letter explaining the purpose of the study. Patients were assured that their care would be unaffected if they chose not to be involved. Permission for the study was obtained from the Finnish Ministry of Social Affairs and Health, while the Ethics Committee at the National Research and Development Centre for Welfare and Health (STAKES) approved the design and implementation of the study.

2.8. Statistical analyses

All analyses were by intention-to-treat. To compare use and cost of services between groups we analysed differences in means (t-test) and medians (Mann–Whitney U test, Wilcoxon two-sample test). A p value ≤ 0.05 was regarded as statistically significant.

Patients were asked about visits to a doctor, laboratory, social worker, physiotherapist, out-patient polyclinic and emergency department during the previous week before hospital admission, during the 3 weeks post-discharge and also 6 months post-discharge.

The use or home care services (home nursing, home help, meals-on-wheels, transfer, bathing, cleaning, security telephone) were asked about the same points as above. However, because our respondents were rather old and they used a lot of home care services, so they are asked only about use for the previous week, at each time of interview, that is at admission, 3 weeks and 6 months post-discharge. The total use of services for the 3-week period was estimated by multiplying the use of services for the 1 week asked about by three. The total use of services for the 6-month period was estimated as follows. First, the use of services from 3 weeks to 26 weeks was estimated by calculating a coefficient for of the use of services separately for each patient and then multiplying the coefficient by weeks: $y = a_i + (1 + 2 + 3 + \ldots..23 \text{ weeks}) \times x_i$ where

- y = use of service
- a_i = constant
- x_i = coefficient.

Second, the uses of services at 3 weeks and from 3 to 26 weeks were summed together. The total costs were estimated by calculating values of total use.

Deceased people were included in the analysis. The use of services from 3 weeks to the week of death was estimated using the above described calculation method. The use of services in the week of death was imputed using the mean values in the trial or non-trial groups, depending on which group the deceased respondent belonged to. Those respondents who had missing values at 3 weeks or at 6 months follow-ups were excluded from the analysis.

Because we used CRT there was a fear that the values were too small and confidence intervals too narrow [15,16]. To avoid cluster effects, the municipalities were matched in pairs. A summary statistic (mean, median) in outcome variables for each cluster was calculated and then the summary values in the trial and control groups were compared. We used hierarchical regression models (variance component models) [31] to analyse the potential effects of the number of inhabitants and the administrative structure of care in the municipalities on total cost of services, thereby

Table 1
Characteristics of study population, municipalities and hospitals at baseline.

	Intervention group	Control group	p
Study population	$n = 354$	$n = 314$	
Age, mean (SD)	81.7 (6.5)	81.7 (7.1)	ns
Gender, women (%)	73.7	74.1	ns
Marital status, widowed (%)	51.1	48.9	ns
Education, <7 years (%)	85.3	86.4	ns
Living status, alone (%)	75.5	73.0	ns
Children, 'yes' (%)	80.2	83.7	ns
Number of diagnoses, mean (SD)	4.1 (2.25)	3.8 (1.91)	0.046
Perceived health, good (%)	38.2	36.0	ns
Functional ability, good or moderate (%)	35.0	33.1	ns
Study municipalities	$n = 11$	$n = 11$	
Size			
10 000–21 000	2	3	
21 001–35 000	5	5	
35 001–96 000	4	3	
Structure of health and social care			
Combined	3	3	
Study hospitals (26)			
University hospitals (tertiary level)	4	3	
Regional hospitals (secondary level)	5	5	
Health centre hospitals (primary level)	11	11	

discounting any possible correlation of responses among municipalities. The cluster effects in these models were weak and not statistically significant, thus the results are not shown here.

Incremental cost-effectiveness ratios were calculated. Costs were estimated differently way at baseline (weekly cost) and at 6 months (cumulate cost over 6 months) and so we were not able to subtract the weekly cost from the cumulate costs. We did not detect any statistically significant differences between groups at baseline, so in cost-effectiveness analyses we decided to use the cumulate costs only. Cost-effectiveness (c-e) was calculated for changes in HRQoL using the NHP and the EQ-5D instruments. Patients who died during the follow-up period (9.5%) were excluded from the analyses where the NHP was used, but for the EQ-5D, the HRQoL-value was coded as zero. Patients who were admitted to institutional care ($n = 18$) were excluded from the analysis because data contained no values for cost and for HRQoL. Further, those respondents who had missing values at 3-week or at 6-month follow-ups were excluded from the analysis. Because the whole study period was short (follow-up 6 months) we did not perform any discounting of the costs. Some uncertainty will always be encountered when calculating mean costs and when trying to detect improvements in outcome variables. This uncertainty was analysed with a bootstrapping approach to assess the variability of cost-effectiveness estimates [32].

The SPSS for Windows program (V.14) and MLwin program (V1.1) were used for statistical analyses.

3. Results

We interviewed 668 patients at discharge, 580 at the 3-week follow-up and 450 at the 6-month follow-up. Despite the loss during the follow-up and the number of deceased, the structure of the study population (age, gender) remained similar during the follow-up period, with no differences between groups. Further, none of the clusters dropped out (Fig. 1).

At discharge, the patients were rather old and frail, and the majority was women living alone. In terms of background characteristics, the only difference between groups was the number of diagnoses, which was higher in the experimental group (Table 1). Most patients (78%) were discharged from a health centre hospital ward to home. Half of the patients (50%) were readmitted during the follow-up period (mean 1.7) with no differences between groups. In 3-week and 6-month mortality there was no difference between the groups.

3.1. *The use and costs of services*

Over half of the patients had received publicly provided home care services before hospital admissions. Home help services were the most frequently used followed by meals-on-wheels and home nursing (Table 2). Private services were used rarely. Before hospital admission, the only differences between the groups were in the transfer services, which were used more by the non-trail group. At 3-week and 6-month follow-ups, the patients in the

Table 2
Health and social care use among intervention and control groups.

Number of services	Before hospital admission (Weekly use)				p^2	3-week follow-up (Total use)				p^2	6-month follow-up (Total use)				p^2
	Intervention ($n = 281$–310)		Control ($n = 248$–269)			Intervention ($n = 296$–309)		Control ($n = 257$–269)			Intervention ($n = -216$–253)		Control ($n = 207$–217)		
	Mean (SD)	IQ[a] (median)	Mean (SD)	IQ[a] (median)		Mean (SD)	IQ[a] (median)	Mean (SD)	IQ[a] (median)		Mean (SD)	IQ[a] (median)	Mean (SD)	IQ[a] (median)	
Health care visits															
Home nursing	0.7 (1.9)	3 (1)	0.9 (2.1)	4 (1)	ns	2.2 (4.5)	3 (0)	3.1 (5.6)	3 (3)	0.003	14.5 (26.9)	26 (3)	20.5 (34.2)	26 (11)	0.002
Physician	0.2 (0.4)	0 (0)	0.2 (0.5)	0 (0)	ns	0.2 (0.4)	0 (0)	0.2 (0.5)	0 (0)	ns	1.1 (1.6)	1 (1)	1.6 (2.2)	2 (1)	<0.001
Laboratory	0.1 (0.3)	0 (0)	0.2 (0.4)	0 (0)	ns	0.2 (0.5)	0 (0)	0.5 (0.9)	1 (0)	<0.001	1.0 (2.1)	1 (0)	2.1 (3.6)	2 (1)	<0.001
Outpatient clinic	0.03 (0.2)	0 (0)	0.03 (0.2)	0 (0)	ns	0.1 (0.6)	0 (0)	0.1 (0.4)	0 (0)	ns	0.5 (2.8)	0 (0)	0.4 (0.8)	0 (0)	ns
Emergency	0.1 (0.3)	0 (0)	0.03 (0.2)	0 (0)	ns	0.04 (0.2)	0 (0)	0.1 (0.3)	0 (0)	ns	0.4 (0.8)	0 (0)	0.3 (0.7)	0 (0)	ns
Social care visits															
Home help	2.5 (4.5)	3 (1)	3.2 (5.9)	4 (1)	ns	10.0 (14.8)	15 (6)	13.8 (23.3)	15 (3)	ns	81.0 (115.9)	122 (33)	114.0 (189.7)	157 (26)	ns
Meals-on-wheels	1.0 (2.2)	2 (0)	1.7 (2.6)	3 (0)	ns	4.9 (7.1)	9 (0)	6.4 (7.7)	21 (3)	0.010	34.1 (49.9)	61 (0)	48.0 (58.9)	78 (15)	0.007
Transfer	0.1 (0.3)	0 (0)	0.1 (0.4)	0 (0)	0.004	0.5 (1.8)	0 (0)	0.4 (1.2)	0 (0)	ns	4.0 (11.9)	0 (0)	3.6 (10.5)	0 (0)	ns
Bathing	0.2 (0.4)	0 (0)	0.2 (0.4)	0 (0)	ns	0.7 (1.4)	0 (0)	0.9 (1.5)	3 (0)	0.005	5.3 (9.7)	3 (0)	7.7 (10.9)	13 (0)	0.03
Cleaning	0.2 (0.4)	0 (0)	0.3 (0.5)	1 (0)	ns	0.5 (1.3)	0 (0)	0.8 (1.3)	1 (0)	0.014	4.3 (8.4)	3 (0)	6.5 (9.8)	11 (0)	0.006
Security telephone	0.1 (0.3)	0 (0)	0.1 (0.3)	0 (0)	ns	0.1 (0.6)	0 (0)	0.2 (0.9)	0 (0)	0.031	0.4 (3.6)	0 (0)	1.9 (8.8)	0 (0)	0.008
Before hospital discharge															
Days of hospital or institutional care	($n = 314$)		($n = 270$)			($n = 312$)		($n = 268$)		($n = 309$)			($n = 265$)		
	17.1 (21.8)	13 (11)	18.4 (23.6)	14 (10)	ns	2.3 (6.3)	0 (0)	2.8 (8.4)	0 (0)	ns	24.0 (42.5)	28 (9)	23.0 (49.6)	27 (7)	ns

p = Significant between groups using Mann–Whitney U test.

[a] Interquartile range.

Table 3
Health and social care costs among intervention and control groups.

Service visits	Unit cost	Before hospital admission, weekly costs (€)				p^2	3 weeks follow-up, total costs (€)				p^2	6 months follow-up, total costs (€)				p^2
		Intervention (n = 281–310)		Control (n = 248–269)			Intervention (n = 296–309)		Control (n = 257–269)			Intervention (n = 216–217)		Control (n = 168–189)		
		Mean (SD)	IQ[a] (median)	Mean (SD)	IQ[a] (median)		Mean (SD)	IQ[a] (median)	Mean (SD)	IQ[a] (median)		Mean (SD)	IQ[a] (median)	Mean (SD)	IQ[a] (median)	
Health care (€)																
Home nursing	40	28 (74)	40 (0)	36 (83)	40 (0)	ns	88 (181)	121 (0)	124 (225)	121 (121)	0.003	584 (1088)	1048 (121)	827 (1379)	1048 (443)	0.002
Physician	76	11 (28)	0 (0)	12 (37)	0 (0)	ns	13 (31)	0 (0)	18 (36)	20 (0)	ns	80 (120)	76 (51)	119 (167)	132 (78)	<0.001
Laboratory	5	1 (2)	0 (0)	1 (2)	0 (0)	ns	1 (3)	0 (0)	2 (5)	5 (0)	<0.003	5 (11)	5 (0)	11 (18)	10 (5)	<0.001
Outpatient clinic	147	4 (26)	0 (0)	4 (28)	0 (0)	ns	13 (84)	0 (0)	14 (51)	0 (0)	ns	73 (408)	44 (0)	56 (119)	53 (0)	ns
Emergency	243	17 (79)	0 (0)	6 (39)	0 (0)	ns	10 (47)	0 (0)	19 (73)	0 (0)	ns	86 (183)	56 (0)	79 (160)	78 (0)	ns
Social care (€)																
Home help	30	74 (131)	89 (30)	93 (173)	118 (30)	ns	295 (439)	444 (178)	409 (691)	444 (89)	ns	2396 (3429)	3611 (977)	3376 (5614)	4647 (770)	ns
Meals-on-wheels	7	10 (16)	15 (0)	13 (19)	22 (0)	0.037	36 (53)	67 (0)	47 (57)	89 (22)	0.010	253 (369)	451 (0)	354 (436)	577 (111)	0.007
Transfer	17	1 (5)	0 (0)	2 (7)	0 (0)	0.004	8 (31)	0 (0)	7 (21)	0 (0)	ns	68 (201)	0 (0)	61 (178)	0 (0)	ns
Bathing	42	8 (17)	0 (0)	10 (19)	0 (0)	ns	28 (60)	0 (0)	40 (63)	0 (0)	0.005	224 (410)	0 (0)	325 (463)	127 (0)	0.003
Cleaning	27	6 (12)	0 (0)	7 (13)	27 (0)	ns	15 (34)	0 (0)	21 (36)	21 (0)	0.014	115 (224)	80 (0)	173 (261)	294 (0)	0.006
Security telephone	51	1 (7)	0 (0)	2 (8)	0 (0)	ns	1 (14)	0 (0)	4 (20)	0 (0)	0.031	9 (81)	0 (0)	41 (197)	0 (0)	0.005
Hospital /Institutional care		Before hospital discharge (n = 314)		(n = 270)			(n = 312)		(n = 268)			(n = 309)		(n = 265)		
		2569 (2526)	1730 (1590)	2445 (2510)	1434 (1590)	ns	414 (1147)	0 (0)	519 (1193)	0 (0)	ns	3429 (4595)	4414 (1645)	3448 (5678)	4875 (1490)	ns
Total cost		2730 (2556)	1987 (1667)	2631 (2484)	1525 (1665)	ns	922 (1022)	792 (388)	1224 (1243)	1348 (500)	0.008	7320 (5652)	7074 (4983)	8870 (7438)	7923 (5359)	ns

p = Significant between groups using Mann–Whitney U test.

[a] Interquartile range.

Table 4
Total costs of health and social care and HRQoL among intervention and control groups, and values of incremental cost-effectiveness ratio (ICER).

	Baseline			6 months follow-up			
	Intervention (n = 214–259)	Control (n = 193–226)	p^2	Intervention (n = 214–258)	Control (n = 194–226)	p^2	ICER[a]
Before hospital admission	Weekly costs (€)	Weekly costs (€)		Total costs (€)	Total cost (€)		
Total costs							
Mean (SD)	2863.4 (2743)	2692.4 (2741)	ns	6773.5 (5582)	8000.9 (7090)	ns	
With deceased	2830.8 (2655)	2722.2 (2691)	ns	6678.0 (5574)	7773.1 (6884)	ns	
At discharge							
EQ-5D[b]							
Mean (SD)	0.6 (0.1)	0.5 (0.1)	0.001	0.5 (0.2)	0.5 (0.2)	0.024	12274.0
With deceased	0.6 (0.1)	0.5 (0.1)	0.002	0.5 (0.2)	0.4 (0.2)	0.021	10951.0
NHP[c], mean (SD)							
Energy level	60.9 (24.9)	63.7 (23.9)	ns	43.2 (36.8)	50.6 (37.5)	0.039	266.8
Sleep	42.1 (31.7)	38.4 (32.0)	ns	36.9 (29.9)	32.8 (31.3)	ns	−3068.5
Pain	37.3 (23.9)	40.2 (23.2)	ns	30.7 (27.9)	36.3 (28.2)	0.018	454.6
Physical mobility	49.6 (22.9)	50.8 (20.3)	ns	43.7 (23.5)	47.8 (22.3)	ns	423.2
Emotional reactions	21.0 (24.2)	22.0 (24.7)	ns	13.0 (19.7)	18.2 (23.8)	0.022	292.2
Social isolation	15.3 (21.0)	20.1 (23.9)	0.034	12.5 (18.3)	18.4 (22.3)	0.002	1115.8

p = Significance between groups using Mann–Whitney U test.
[a] ICER: total costs/changes in HRQoL at 6 months follow-up.
[b] Ohinmaa & Sintonen 1999. In EQ-5D 0 refers to dead and 1 to best state.
[c] Koivukangas et al. 1995. In NHP 100 refers to worst and 0 to best state.

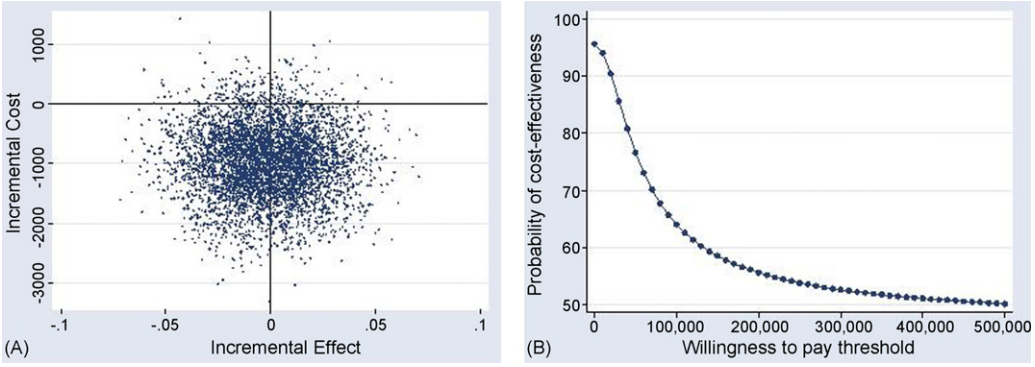

Fig. 2. (A) The incremental cost-effectiveness plane on EQ-5D. (B) Cost-effectiveness acceptability curve on EQ-5D.

trial group used less home nursing, laboratory, meals-on-wheels, bathing, cleaning and security telephone services than patients in the non-trial group. Further, at 6 months the numbers of visits to a physician were lower in the trial group (Table 2). Where less service was used by the trial group, costs also decreased (Table 3). In summary statistics at the municipality level, the only difference between groups was found in the use and cost of laboratory services. At 3 weeks, the patients in non-trial municipalities made more laboratory visits (mean 0.2 vs. 0.5, p = 0.013) thus the costs were also higher (mean 1.2€ vs. 2.3€, p = 0.013).

3.2. Cost-effectiveness

Before hospital admission and at 6-month, the HRQoL measured with the EQ-5D was better in the trail group comparing with the non-trial group. At 6-month follow-up, the NHP values in energy, pain, emotional reactions and social isolation were higher in the trial group (Table 4).

Fig. 2 shows a representation of the c-e plane of variability of cost-effectiveness as regards EQ-5D. The points are predominately below the x-axis and are quite evenly distributed either side of the y-axis i.e. the cost of intervention is lower, but results show no evidence in HRQoL. The acceptability curve indicates that only at a lower willingness to pay for improvements in EQ-5D is the intervention likely to be more cost-effective. Fig. 3 shows a scatter plot on the c-e plane using the bootstrapped sample of cost and NHP data (mobility) and the cost-effectiveness acceptability curve. These findings indicated that the intervention is more cost-effective than the usual way to work.

4. Discussion

The clientele in home care are becoming frailer with multiple service needs. This complexity calls for better integration of services and better collaboration between hospital and home care. The need for integration emphasises particularly the interfaces between services, for

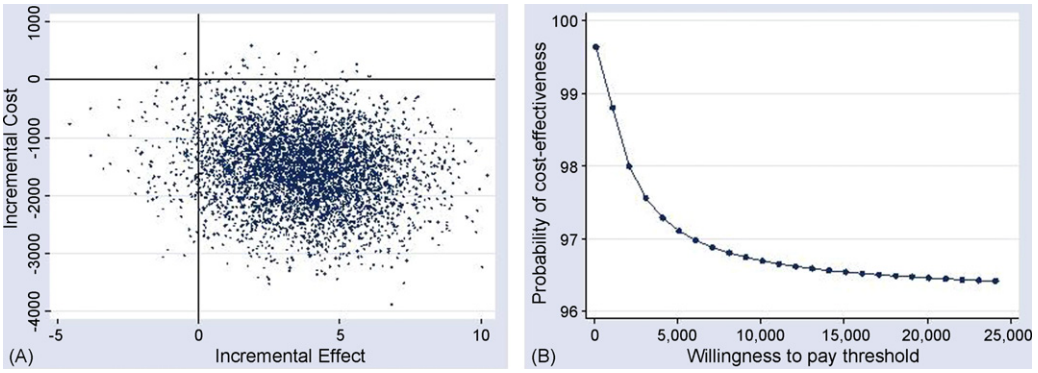

Fig. 3. (A) The incremental cost-effectiveness plane on NHP (mobility dimension). (B) Cost-effectiveness acceptability curve on NHP (mobility dimension).

example when the patient is discharged from hospital to home. In this study, we evaluated the effectiveness and cost-effectiveness of an IHCaD-practice using CRT.

Our results are consistent with previous studies that have reported that old and frail people discharged from hospital to home care are mainly persons living alone [5,9,14]. This group demands special attention when their discharges are planned and put into practice. Different kinds of interventions (case/care manager, discharge planning) have been developed to improve patients' discharge process and their coping at home after hospital care [4,7,12]. Our intervention was applied to home care and hospital staff, but the effects of the intervention were assessed through patient outcomes. Vass et al. [12] have used a similar design in their study. Their intervention improved older people's functional ability, but there was no effect in mortality or nursing home admissions. In our study, the main interest was to study the effects of an IHCaD-practice on the use and cost of services. According to our results, the use and cost of home care services decreased at the 3-week and 6-month follow-ups, while the visits to a laboratory or physician were also lower in the trial group. We found no differences in the use of hospital care between groups. In some previous studies [5,7] the use of services has decreased when a case/care manager type of working or multidisciplinary team work have been used. Furthermore, we found no differences in re-admissions and in mortality between groups. These results are supported by previous studies [5,12,13], but there are also studies that disagree with our findings [10,14].

Evidence of the cost-effectiveness of previous interventions has been inconclusive [5,6,7,18]. According to our results, the evidence of IHCaD-practice's cost-effectiveness varied depending on the HRQoL-instrument. With the NPH the intervention seemed to be a cost-effective alternative, but with EQ-5D the intervention is likely to be more cost-effective only at a lower willingness to pay for improvements in EQ-5D. The intervention, however, at least maintains HRQoL with decreasing total costs, thus making the intervention feasible. Extra resources or new actors (c.f. a liaison nurse) were not allocated to the trial municipalities, since the working pair is appointed from within the existing home care team members. The price of the intervention is mainly caused by the loss of working hours during the training process (meetings, seminars). The cost of home care will continuously increase because of the aging population. The pressure to maximize the cost-effectiveness of home care means that municipalities have to develop their health and social care practices. The following topics need to be discussed: what is the best way to arrange high-quality services with limited resources, and how much the municipalities are willing to pay to improve their citizens' health and HRQoL.

In theory, the cluster randomisation tends to reduce the statistical power and precision of trials because of similarities between individuals within each cluster [15,16]. In spite of this, we did find statistically significant differences between groups although we were not able to interview all 770. The old practice seemed to be as good as the new practice but the new one was also cost saving. The municipalities were matched in pairs and were recruited together to the study. Based on the pilot study, the randomisation seemed successful, with two similar groups obtained. In addition, none of the clusters dropped out during the follow-up period. Many methodological issues, however, must be taken into account when drawing conclusions. The patients were recruited after the municipalities were randomised, thus all selection biases might not been avoided [15,16,23]. The interviewers were aware of which group the patients belong to. It is possible that interviewers in the trial group were more eager to recruit patients and also to keep them in the study. This may explain the slightly higher number of recruited patients in the trial group. Further, we did not know what was an adequate power to detect significant changes in outcome variables, because information on the internal variations in municipalities regarding response variables could not be obtained. In this study, the NHP showed positive changes in effectiveness than the EQ-5D, confirming the finding of Rissanen [33].

For deceased individuals we imputed values using the mean values of the trial or non-trial groups, depending on which they belonged to. The differences, however, in the use and cost of services between groups were similar with and without deceased people. Furthermore, there were no differences between the trial and non-trial groups regarding the number of missing values and deceased people. The use of hospital and institutional care was derived from statistical registers, which are reliable in Finland [34]. The use

of home care service was derived from patient interviews. The weekly use of home care services was asked and then the total use and cost of services during the follow-up time were estimated. This selection was made because information thus gathered was supposed to be more reliable. Older clients find it easier to estimate use for 1 week rather than the use over a 6-month period. Our estimations might be biased upwards or downwards but on the other hand the information received might be more reliable because of the short evaluation time (a week).

We found no differences between groups in the average distances from the patient's home to the hospital or to home care unit. In addition, there were no differences in the number of patients receiving help from informal caregivers between groups. Therefore excluding the travelling costs and the effort of informal caregivers from the cost analysis did not greatly affect the differences between groups. Certainly, more studies are needed where the costs of informal care as well as travelling costs are included in the cost analyses, so as to give a more realistic picture of cost-effectiveness.

The researchers developed a new practice that was then tailored and implemented in the trial municipalities using action research. The staff and the researchers were both involved in this process. The attendance of researchers in the process may weaken the objectivity of the study. However, in this study, each municipality had a project group responsible for tailoring and implementing the practice. The researchers guided and supported the personnel but did not actually develop the practices in the municipalities. Neither did the researchers interview patients.

5. Conclusion

The study reported here suggests that the IHCaD-practice may be a cost-effective alternative to usual care. The IHCaD-practice is generic and goal-orientated, making it suitable for all patient groups in different settings and organisations.

Registers

Care registers for social welfare and health care (Hilmo) years 2001–2004, Finland.

Sotka-municipal database for social and health statistics, year 2000.

Statistics of causes of death during 2001–2004.

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