A telephone-based case-management intervention reduces healthcare utilization for frequent emergency department visitors

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Background **A small group of frequent visitors to emergency departments accounts for a disproportional large number of total emergency department visits. Previous interventions in this population have shown mixed results.**

Objective **To determine whether a nurse-managed telephone-based case-management intervention can reduce healthcare utilization and improve self-assessed health status in frequent emergency department users.**

Methods **We carried out a Zelen-design randomized-controlled trial among patients who were identified as frequent emergency department users (≥ 3 visits during the 6 months before inclusion) at the Karolinska University Hospital in Stockholm (Sweden). Patients included in the study ($n = 268$) were randomized to either the intervention group or the control group and followed for 1 year. Patients who declined to participate or could not be reached were also followed for the study outcome.**

Results **The telephone-based case-management intervention reduced the total number of outpatient visits (relative risk 0.80; 95% confidence interval 0.75–0.84), the number of emergency department visits (relative risk 0.77; 95% confidence interval 0.69–0.86), the number of days patients were admitted to hospitals as well as the total healthcare costs for hospital admissions. There was no difference in mortality or other identified adverse outcomes between the intervention and the control groups. Patient self-assessed health status improved for the patients who received the case-management intervention.**

Conclusion **Our results indicate that the nurse-managed telephone-based case-management intervention represents a possible strategy to improve care for frequent emergency department users as well as decrease outpatient visits, admission days and healthcare costs.** ***European Journal of Emergency Medicine*** **00:000–000 © 2012 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

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Introduction

In many countries and healthcare systems, a small subgroup of patients represents a disproportionately large share of all emergency department visits [1–4]. In addition to generating high healthcare costs and contributing towards problems with overcrowding, it is likely that these diagnostically heterogeneous, socially disadvantaged and often demanding patients are not receiving optimal long-term care in the emergency department setting [1–6]. It is thus not surprising that these patients have a higher mortality compared with nonfrequent users of emergency department services [4,7,8]. Challenges often include both somatic and psychiatric disease, drug and alcohol dependence, and/or homelessness.

Various case and disease management programmes have been implemented in attempts to improve care for frequent emergency department users, primarily through (a) systematic and early identification of high-risk patients; (b) development and implementation of plans of care; (c) proactive and close contact between patients and providers through telephone calls or visits; and (d) continuous monitoring of patient progress and tracking of patients' medical status, healthcare-seeking patterns and quality of life [9]. Although results have varied, many programmes have achieved both reductions in healthcare expenditure and improvements in patients' quality of life, without compromising patient safety [10–12]. Some case-management strategies have based services almost entirely on telephone support, thus improving cost-efficiency [9,13]. This approach has shown promise both for patients with multiple and/or complex diseases and for the management of patients with specific diseases [13].

Here, we present the results of a Zelen-design randomized-controlled trial with 1 year of follow-up that was

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designed to study the effects of a nurse-managed telephone-based case-management intervention on healthcare utilization and self-assessed health status in patients who were identified as frequent emergency department users. The mortality rate in the study group, the specific interventions performed by the case manager and the satisfaction of patients with the intervention were also examined.

Methods

Study setting and population

Stockholm County is the most populous region in Sweden, with a population of ~2 million individuals (2011). The healthcare system is almost exclusively publicly financed, with a limited number of private healthcare providers. The study was carried out at the Karolinska University Hospital (Huddinge), which is one of the largest hospitals in the area, and has an emergency department with ~90 000 visits/year.

Study design and oversight

The aim of the study was to develop, implement and evaluate a telephone-based case-management programme for patients with a sustained high frequency of emergency room visits. We hypothesized that patients who were provided access to the programme would have a decreased frequency of healthcare visits and improved quality of life compared with patients who did not participate in the programme. On the basis of a pilot study, we decided to include patients with three or more emergency room visits at Karolinska University Hospital (Huddinge) during the 6-month period before the start of the study. No patients from the pilot study were included in this analysis. A list of all patients currently fulfilling this criterion was compiled on a regular basis and, for each patient, we then carried out a qualitative assessment on the basis of a number of additional criteria. Patients aged under 18 years, patients with dementia or psychotic diseases, patients with terminal illness or patients living in other counties were excluded from the study. A manual chart review was carried out by two physicians using an anonymized extraction of all electronically available hospital records for these patients from the year before the inclusion. The purpose of the secondary screening was to identify patients who were expected to have a sustained high healthcare demand and who would be receptive to and might benefit from the programme. The chart reviewers were instructed to exclude patients with life expectancy shorter than 12 months, patients who had recently undergone major surgery or were planning to undergo major surgery the following 6 months, patients with psychotic disease and patients with severe hearing impairment. A qualitative review was also carried out to assess whether the patients had the ability to participate in the study on the basis of previous and present diseases, the number of medications used and social factors. All patients who fulfilled the qualitative criteria were included in the study.

Among patients selected for possible inclusion, we randomly selected 80% for inclusion in the case-management programme according to Zelen's study design [14]. This group is henceforth referred to as the intervention group, and the remaining 20% of the patients as the control group. The randomization process was carried out in regular batches by first generating a list of random numbers for the identified patients and then sorting them according to this random number. In compliance with the ethics committee, the control patients were not contacted or informed of participation. Patients who died between the generation of the primary patient list and randomization were excluded.

The study was approved by the regional research ethics committee in Stockholm (No. 2010/976-31/4).

Study intervention

After randomization, the patients in the intervention group were sent a letter informing them about the study and asking for possible participation. The letter stated that the patients would be contacted by telephone and offered an appointment with a case-management nurse. Information was also provided on how the patient could cancel the call if they did not want to be contacted. The patients who agreed to participate were invited to an information meeting with one of the study nurses, during which informed consent was obtained. During the first meeting, the patients also underwent a comprehensive structured interview to assess the patients' current social and medical situation. Patients also completed a quality-of-life assessment using the Short-Form Health Survey (SF-36) [15]. Patients who declined participation were not contacted further, but were followed for health outcomes as one of the control groups.

The intervention was developed on the basis of previous case-management concepts [9]. In brief, the licensed nurses used the data collected during the initial structured interview to characterize the patients' current situation, with an emphasis on understanding each patient's individual medical and social problems. On the basis of this analysis, a personalized programme for each patient was then designed and transferred to a standardized protocol. Telephone contacts were made between nurses and their patients on a weekly or a biweekly basis. At each patient contact, the individualized protocol was reassessed and adapted if deemed necessary. Scheduling of the next supportive call was on the basis of a qualitative assessment of the patients' current risk of being admitted to hospital. Throughout the study, we also carried out regular monitoring of the outcomes for all patients managed by each nurse. These analyses were integral in facilitating exchange of knowledge between nurses and for providing feedback to individual nurses.

Importantly, the nurses did not provide medical advice, but were rather instructed to facilitate contacts with the standard healthcare providers and to support interactions with social services. All nurses were employed by a private company, contracted by Stockholm county council.

Statistical analyses

Patients were followed from the date of inclusion until the end of follow-up (30 September 2011) or death. To ensure that all patients included would have sufficient follow-up for the relevant assessment of efficacy, only patients who entered the programme before 30 August 2010 were included in the analyses. *A priori*, we focused on two primary endpoints: the number of hospitalizations and the number of doctors' appointments. Outcome data were determined by linking the patient database with the regional patient register (GVR), with records of all patient contacts with the publicly financed healthcare system in the Stockholm area including visits to primary care facilities. Record linkages were carried out both for the study participants and the controls using individually unique national registration numbers assigned to all Swedish residents. The record linkages provided dates of doctors' appointments or hospital admissions. For hospitalized patients, it also provided information about the date of discharge, length of stay, discharge diagnosis(es), whether the visit/admission was planned, as well as the total costs for the healthcare contact. All costs were converted into Euros, on the basis of an approximate exchange rate of 8.8 SEK (Swedish krona) per Euro. In addition to the primary endpoints, we also carried out a reassessment of a subset of the participating patients' quality of life (using SF-36) at 6–8 weeks after inclusion in the study. On the basis of the study design, the assessment of quality of life was carried out only among the participating patients and not the controls, nor among patients who declined participation.

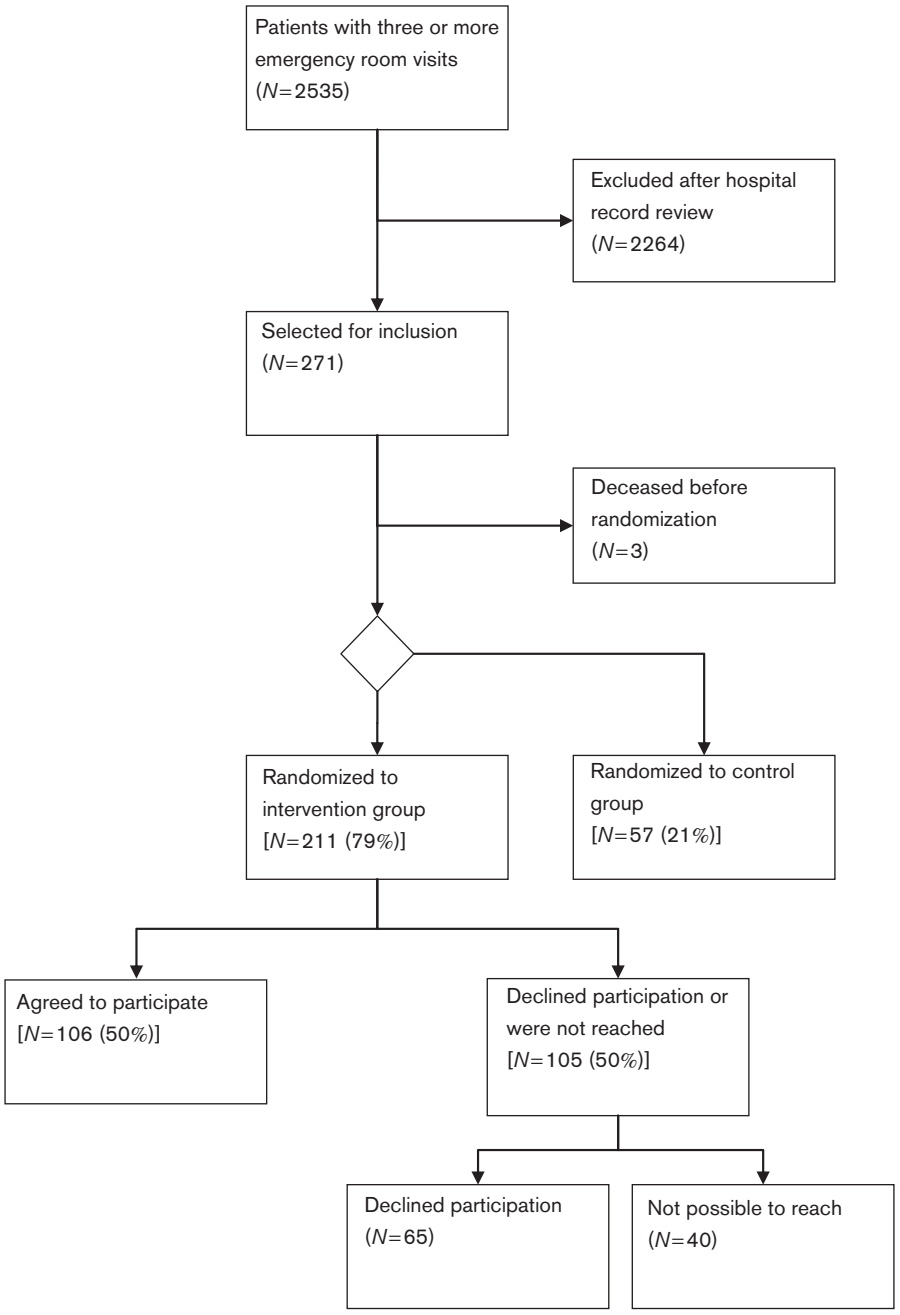
Age differences between groups were assessed using Student's *t*-test. Differences in the distribution of sex and previous disease diagnoses were assessed using Fisher's exact test. The number of prior emergency department visits and hospitalizations was compared using the Wilcoxon two-sample test. Differences in the dimensions of the SF-36 assessments were evaluated using the Wilcoxon signed-rank test, a nonparametric alternative to paired *t*-tests. Healthcare consumption among participants and controls was assessed using unadjusted Poisson regression analyses, providing relative risks (RRs) expressed as incidence rate ratios. Analyses were carried out separately for inpatient and outpatient care, as well as for emergency and planned care, accounting for time in the study as an offset term. Because cost and hospitalization time data were heavily skewed, differences in the total cost and the total number of days in hospital were assessed using negative binomial regression to effectively deal with overdispersion [16]. In both Poisson and negative binomial regression analyses, time at risk was incorporated by including the logarithm of follow-up time as an offset term. The analyses were carried out according to the intention-to-treat principle, but we also carried out analyses per protocol, that is, with those who choose to participate and those who chose to decline separated. Finally, we also carried out analyses stratified by sex, age at inclusion and follow-up time. 95% confidence intervals (CIs) and *P*-values were computed using likelihood ratio tests. All *P*-values were two-sided. *P*-values less than 0.05 were considered statistically significant.

Results

The identification and enrolment of participants for the study are presented in Fig. 1. Between 30 June and 31 August 2010, a total of 2535 patients fulfilled the criteria of having had three or more visits to the emergency department of Karolinska University Hospital (Huddinge) during the previous 6 months. After manual chart review by two physicians, 2264 patients were excluded on the basis of the exclusion criteria defined in the study protocol. Three patients died before randomization and these patients were also excluded. In all, 268 patients remained for inclusion in the study. Of these patients, 211 (79%) were randomly selected to receive the intervention (intervention group) and the remaining 57 (21%) were used as a control group (controls). One hundred and six patients in the intervention group agreed to actively participate in the study (participants) and to maintain contact with the case-management nurse and 105 patients in the intervention group declined to participate or could not be reached by letter or telephone (nonparticipants). Table 1 presents the baseline characteristics of the included patients. There was no difference in the mean age (62.7 vs. 60.2 years, $P = 0.40$) or sex distribution (60 vs. 56% women, $P = 0.62$) on comparing the intervention group with controls. We also found no differences in healthcare utilization in the 6 months before inclusion for emergency department visits ($P = 0.76$), hospital admissions ($P = 0.66$) or other outpatient care ($P = 0.86$).

There was also no statistically significant difference in the age (64.4 vs. 61.0 years, $P = 0.19$) and sex (58 vs. 56% women, $P = 0.72$) distribution between the participants and the nonparticipants in the intervention group. The most common medical diagnoses in the 268 patients included in the study were hypertension (26%), ischaemic heart disease (19%), chronic obstructive pulmonary disorders (9%), heart failure (15%), anxiety disorders (9%), generalized or unspecified pain (41%) and atrial fibrillation (18%). There were no significant differences in the distribution of these diagnoses between the intervention and the control groups (Table 1).

Fig. 1



Identification, enrolment and randomization of the study patients.

The participants in the intervention group met with the case-management nurse and a personalized programme was developed for each patient. The nurses and patients had telephone contact on average every 11 days. On average, nurses were able to manage 50–75 active patients in parallel, with some variation depending on patient needs, spending ~50% of their time in direct contact with patients and the remaining time facilitating contacts with healthcare providers and social services, as well as with administrative tasks. A subset of 146 telephone calls were analysed and the interventions provided by the nurses mainly consisted of motivational conversations (13%); support for patient self-care (17%); education on basic medical issues (18%); providing contact with counsellors (3%) or social services (5%); providing contacts with primary care physicians (14%) and primary care nurses (5%); or help to establish contacts or appointments at other healthcare facilities (15%).

Table 1 Characteristics of the study population

	Intervention group	Controls	*P* (difference)
Number of patients (% of total)	211 (78.7)	57 (21.3)	0.63
Females (% of group)	126 (59.7)	32 (56.1)	
Age at inclusion (years) [*N* (%)]			
<45	46 (21.8)	14 (24.6)	0.37
45–64	53 (25.1)	14 (24.6)	
65–79	61 (28.9)	21 (36.8)	
≥ 80	51 (24.2)	8 (14.0)	
Mean age (SD)	62.6 (19.3)	60.2 (18.6)	0.40
Median follow-up time [years (IQR)]	1.16 (1.13–1.18)	1.16 (1.13–1.17)	0.97
Median number of healthcare episodes in the previous 6 months (IQR)			
Emergency department visits	5 (3–8)	5 (3–7)	0.76
Hospital admissions	1 (0–3)	1 (0–3)	0.66
All outpatient care	7 (3–11)	7 (3–14)	0.86
Prior diagnoses [*N* (%)]			
Hypertension	55 (26.1)	14 (24.6)	0.87
Ischemic heart disease	40 (19.0)	11 (19.3)	1.00
Chronic obstructive pulmonary disease	22 (10.4)	3 (5.3)	0.31
Heart failure	31 (14.7)	10 (17.5)	0.68
Anxiety disorder	18 (8.5)	6 (10.5)	0.61
Generalized or unspecific pain diagnosis	85 (40.3)	25 (43.9)	0.65
Atrial fibrillation	35 (16.6)	14 (24.6)	0.18

IQR, interquartile range.

Data on the number of hospital admissions and outpatient visits to a physician are presented both according to intention to treat and per protocol in Table 2. In the intention-to-treat analyses, we found no differences in the number of hospitalizations between the patients in the intervention and the control groups when hospitalizations were considered overall and when data were restricted to emergency hospitalizations, with RRs of 0.90 (95% CI 0.74–1.09) and 0.90 (95% CI 0.73–1.12), respectively. Similar patterns were found for hospitalizations in the per protocol analyses. However, for outpatient visits, we observed an overall 20% decrease in the frequency of outpatient visits, with RRs of 0.80 (95% CI 0.75–0.84) and 0.77 (95% CI 0.69–0.86) overall and for emergency visits, respectively. Per protocol analyses showed similar effects in participants and nonparticipants (Table 2).

We also carried out subgroup analysis on patients stratified by sex, age (< 65 or ≥ 65 years) and follow-up time (0–120, 121–240 or >240 days) (Table 3). This analysis did not identify any subgroup that was more or less receptive to the intervention *vis-à-vis* hospitalization frequency. The decrease in the number of outpatient visits that was observed for the intervention group was consistent in most subgroups and did not differ systematically in relation to sex, age or follow-up time.

Table 4 presents data on the average number of hospital days and costs. For inpatient care overall, patients in the intervention group had a nonsignificant 36% lower number of days in hospital than the control group ($P = 0.11$). For the total costs per patient, which also included outpatient care, however, this translated into a 45% decreased cost ($P = 0.004$). The per protocol analyses indicated that the tendency for a decreased number of days in hospital and the decreased costs were largely driven by the patients in the participant group (Table 4). Similar effects were found when analyses were restricted to emergency care only. Altogether, we noted two deaths among controls and nine in the intervention group, resulting in a nonsignificant RR of death of 1.22 (95% CI 0.31–7.98), comparing intervention patients with the controls.

At the start of the study, the participants were asked to carry out a standardized self-assessment of their health and this assessment was repeated 8 weeks after inclusion in the study for the participants (Table 5). The health assessment showed significant increases ($P < 0.05$) in six out of the eight parameters studied including general health perception, emotional role functioning, physical role functioning, bodily pain, social role functioning and vitality. In addition, the patients were also asked to rate whether they perceived that their participation in the study programme and the contact with the case-management nurse had helped them to better healthcare and quality of life as well as whether they were satisfied with the help provided by the case-management nurse. In all, 84% of the participants reported that the contact with the case-management nurse had helped them receive better healthcare and 82% of the participants reported that the programme had led to improvements in their quality of life. Finally, 71% of the patients stated that they were 'satisfied' or 'very satisfied' with the help that they had received and 25% reported that they were somewhat satisfied (data not shown).

Discussion

Our study shows that the investigated telephone-based case-management intervention for frequent visitors to an emergency department reduced both the number of outpatient visits as well as the total number of days these patients were admitted to hospitals. The decrease in

Table 2 Number of hospitalizations and doctor's visits with the resulting relative risks comparing participants and controls, presented according to intention to treat as well as per protocol

	Intention to treat		Per protocol		
	Events/person years	Relative risk (95% CI)		Events/person years	Relative risk (95% CI)
All inpatient care					
Intervention group	444/238	0.90 (0.74–1.09)	Participants	213/122	0.84 (0.67–1.04)
			Nonparticipants	231/116	0.96 (0.78–1.19)
Controls	134/64	1.00 (reference)	Controls	134/64	1.00 (reference)
Emergency inpatient care					
Intervention group	374/238	0.90 (0.73–1.12)	Participants	178/122	0.84 (0.66–1.06)
			Nonparticipants	196/116	0.97 (0.77–1.23)
Controls	112/64	1.00 (reference)	Controls	112/64	1.00 (reference)
All outpatient care					
Intervention group	4794/238	0.80 (0.75–0.84)	Participants	2617/122	0.85 (0.79–0.90)
			Nonparticipants	2177/116	0.74 (0.70–0.79)
Controls	1629/64	1.00 (reference)	Controls	1629/64	1.00 (reference)
Emergency outpatient care					
Intervention group	1175/238	0.77 (0.69–0.86)	Participants	603/122	0.77 (0.68–0.87)
			Nonparticipants	572/116	0.78 (0.68–0.88)
Controls	413/64	1.00 (reference)	Controls	413/64	1.00 (reference)

CI, confidence interval.

Table 3 Relative risks comparing participants and controls, presented according to intention to treat as well as per protocol and stratified by sex, age at inclusion and follow-up time

	Incidence rate ratio (95% confidence interval)				
	Intention to treat		Per protocol		
	Intervention group	Controls	Participants	Nonparticipants	Controls
All inpatient care					
Sex					
Males	0.98 (0.73–1.34)	1.00 (reference)	1.17 (0.85–1.63)	0.76 (0.53–1.09)	1.00 (reference)
Females	0.84 (0.66–1.09)	1.00 (reference)	0.63 (0.47–0.84)	1.06 (0.82–1.39)	1.00 (reference)
Age at inclusion					
<65 years	0.97 (0.71–1.33)	1.00 (reference)	1.01 (0.72–1.43)	0.93 (0.66–1.31)	1.00 (reference)
≥ 65 years	0.84 (0.66–1.09)	1.00 (reference)	0.72 (0.54–0.95)	0.99 (0.76–1.30)	1.00 (reference)
Follow-up time (days)					
0–120	0.99 (0.71–1.41)	1.00 (reference)	0.84 (0.57–1.25)	1.14 (0.79–1.68)	1.00 (reference)
121–240	0.94 (0.64–1.41)	1.00 (reference)	1.01 (0.66–1.56)	0.86 (0.56–1.35)	1.00 (reference)
241	0.81 (0.61–1.10)	1.00 (reference)	0.75 (0.54–1.04)	0.89 (0.65–1.23)	1.00 (reference)
All outpatient care					
Sex					
Males	0.71 (0.65–0.77)	1.00 (reference)	0.80 (0.73–0.87)	0.60 (0.54–0.66)	1.00 (reference)
Females	0.87 (0.81–0.94)	1.00 (reference)	0.89 (0.82–0.96)	0.85 (0.78–0.93)	1.00 (reference)
Age at inclusion (years)					
<65	0.91 (0.84–1.00)	1.00 (reference)	1.08 (0.99–1.19)	0.75 (0.68–0.83)	1.00 (reference)
≥ 65	0.71 (0.66–0.76)	1.00 (reference)	0.68 (0.63–0.74)	0.74 (0.68–0.81)	1.00 (reference)
Follow-up time (days)					
0–120	0.85 (0.77–0.94)	1.00 (reference)	0.90 (0.81–1.01)	0.79 (0.70–0.88)	1.00 (reference)
121–240	0.76 (0.69–0.84)	1.00 (reference)	0.82 (0.74–0.92)	0.69 (0.62–0.78)	1.00 (reference)
241	0.78 (0.72–0.86)	1.00 (reference)	0.82 (0.74–0.90)	0.75 (0.67–0.83)	1.00 (reference)

outpatient care utilization was consistent for both outpatient care that included visits to primary care facilities and visits to other nonemergency care providers as well as for emergency department visits. These findings strongly indicate that there was a decrease in all outpatient visits and not only a transfer of healthcare visits from emergency departments to other healthcare providers. We did not observe any significant decrease in the total number of hospital admissions nor did we find a decrease in the number of admissions from emergency departments. However, the number of days patients were admitted to hospitals showed a marked decrease for the patients who received the case-management intervention. Accordingly, although these patients are admitted to the hospital at the same rate as controls, they were seemingly discharged sooner. Together with the fewer number of outpatient visits, this translated into a lower average cost per patient in the intervention group. Although this finding was stronger than expected, the shorter hospital stays can perhaps be explained if the case-management intervention was successful in establishing an improved care network for these patients, which would then have permitted an earlier discharge. Importantly, although the study was not designed specifically for assessing this aspect, the shorter hospital stays were not associated with any detectable increase in

Table 4 Days in hospital and healthcare costs comparing participants and controls, presented according to intention to treat as well as per protocol

Intention to treat							Per protocol					
	Number of hospital days per patient per year	% difference	*P*-value	Cost per patient per year (EUR)*	% difference	*P*-value		Number of hospital days per patient per year	*P*-value	Cost per patient per year (EUR)*	% difference	*P*-value
Planned and emergency care												
Intervention group	10.8	−36	0.11	14 612	−45	0.004	Participants	7.0	0.005	11 417	−57	<0.0001
							Nonparticipants	14.8	0.6	17 994	−32	0.09
Controls	16.9			26 490			Controls	16.9		26 490		
Emergency care												
Intervention group	8.6	−36	0.39	9766	−49	0.09	Participants	5.2	0.022	6355	−67	0.003
							Nonparticipants	12.2	0.9	13 376	−30	0.57
Controls	13.5			19 044			Controls	13.5		19 044		

*Costs including also outpatient care.

Table 5 Quality of life according to the various dimensions of SF-36 at baseline and at the 8-week follow-up

	Time	*N*	Mean (SD)	*P*-value*
General health perceptions	Baseline	71	33.9 (17.1)	0.01
	8 weeks	71	37.7 (18.9)	
Emotional role functioning	Baseline	71	28.2 (39.7)	<0.01
	8 weeks	70	41.4 (43.0)	
Physical functioning	Baseline	70	45.4 (23.8)	0.24
	8 weeks	69	48.3 (24.7)	
Physical role functioning	Baseline	70	15.4 (31.1)	0.02
	8 weeks	69	24.3 (39.3)	
Mental health	Baseline	71	54.7 (22.1)	0.06
	8 weeks	67	58.0 (24.7)	
Bodily pain	Baseline	71	36.4 (27.8)	0.001
	8 weeks	67	46.1 (26.7)	
Social role functioning	Baseline	71	47.0 (29.7)	<0.01
	8 weeks	70	57.9 (29.7)	
Vitality	Baseline	71	33.9 (23.7)	0.01
	8 weeks	67	40.1 (25.2)	

SF-36, Short-Form Health Survey.
*Calculated using the Wilcoxon Signed-rank test.

mortality or other identified adverse outcomes for the patients.

The study was carried out according to Zelen's design, where only those randomized to participate in the study were asked for consent, and the control group was not informed about their participation, which was only passive [14]. This design was chosen primarily to avoid possible negative effects associated with being randomized to not receiving any supportive care. We viewed the latter as an important advantage for this particular patient population, where such effects could otherwise be very strong in light of the fact that a placebo procedure could not be carried out. The obvious limitation of this study design, however, is problems with nonparticipation. Unfortunately, in this instance, of the patients who were randomized to the intervention group, no fewer than 50% declined participation, which considerably undermined the power of the investigation. However, if analyses are based on the intention-to-treat principle, nonparticipation is largely an issue of underestimating the efficacy and should have less of an effect on the validity of the study. Although this issue could otherwise have been addressed in per protocol analyses, this was largely unsuccessful as the common reasons for nonparticipation were related to health issues and as such, such analyses would likely have been confounded. An additional limitation of Zelen's design is also the inability to ascertain information such as quality of life from the nonparticipants. This means that we were unable to account for the regression to the mean phenomenon, with spontaneous improvements, that is likely to occur when a patient group is included on the basis of a transient extreme situation, such as in this case. However, considering the participants' high degree of satisfaction, according to their generally excellent qualitative feedback, we believe that the consistent improvements in quality of life can largely be attributed to the programme.

Previous reports on case-management interventions for frequent emergency department visitors have shown mixed results, with some studies finding reductions in outpatient or inpatient care as well as in healthcare costs [10–12,17], whereas others have not observed such effects [18–20]. It is difficult to compare these studies directly because of heterogeneity in study designs, follow-up and case-management interventions. Also, we systematically excluded patients with severe psychiatric disease and drug dependence, which may further limit the comparability. There are also several external factors that may influence the result of a specific case-management intervention such as the characteristics of the patient population targeted by the intervention, the healthcare system, access to different kinds of healthcare facilities and socioeconomic factors. Although our results indicate that the case-management intervention is successful in reducing outpatient visits, days of hospital stay, as well as healthcare costs, there are possible limitations to applying the results to a larger group of patients. The number of patients included in the current study represented ~10% of all the patients with frequent visits to the emergency department identified in the

initial screening process. The fact that we had to manually process a large number of patient charts to find patients who were deemed to benefit from the intervention had two negative effects. First, it was a tedious and time-consuming process that limited the rate of patient inclusion and, in turn, decreased the number of patients available for analysis. Second, it also casts some doubt on the generalizability of our findings. However, we believe that these limitations can be overcome with the use of a revised inclusion process where patients are not selected on the basis of extensive manual chart screening, but rather after an automatic process involving a prediction model. Such approaches have been used previously successfully [13] and should be especially applicable in this setting, where all patient data are electronically available, and will be used for future studies.

Conclusion

In this study, we provide evidence suggesting that a nurse-managed telephone-base case-management intervention is a possible strategy to improve care for frequent emergency department users as well as decrease outpatient visits, admission days and healthcare costs.

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Conflicts of interest

Dr Edgren has received consulting fees from Health Navigator AB for providing assistance with study design and research methodology. Joachim Werr is a co-owner and a managing director of Health Navigator AB. For the remaining authors there are no conflicts of interest.

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