



**Acute admissions to a
community hospital:
a descriptive cost study**

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Abstract

Introduction: In several countries, health-care providers are searching for alternatives to hospitalization. In recent years, a practice has been established in Hallingdal, a rural region in Norway, in which patients with certain acute somatic illnesses are admitted to Hallingdal Sjukestugu (HSS), a community hospital 150 km from the nearest general hospital, Ringerike Sykehus (RS). A randomized, controlled study was carried out to compare health consequences, patient-perceived quality and health-care costs between patients acutely admitted to HSS and to RS. This paper discusses the topic of health-care costs.

Methods: Patients intended for acute admission to HSS, as an alternative to hospitalization, were included in the study. Eligible patients were randomized to two groups; admitted to HSS (n = 33), and admitted to RS (n = 27). Costs were compared between the two groups at discharge and for the 12-month follow-up.

Results: The cost of the inpatient stay at HSS was significantly lower than the cost at RS, which is explained by lower transport costs ($p < 0.001$) and lower costs for physicians-related work ($p = 0.006$). The health-care cost during the follow-up year did not differ significantly between the two groups.

Conclusions: Compared with general hospital admissions, patient admissions to a community hospital gave cost savings for a similar group of patients. In the follow-up year, there were no significant cost differences between the two groups. Generalizations of the findings should be made with caution, as the study was performed at a single institution and the number of included patients was low.

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Keywords: health economy, rural health care systems, patient admission, emergency health-care services, general practitioners, community hospitals.

JEL: H42, I18

Introduction

To curb costs, health services in many countries are searching for alternatives to acute hospital admissions[1]. In Norway, the health-care system is divided into two levels. The state is responsible for specialist health-care services, including hospitals, outpatient specialist clinics and the ambulance service. The municipalities are responsible for primary health care, including general practice, home nursing services and nursing homes. By 2016, all municipalities in Norway are required by law to establish local facilities for acute admissions that can provide equally good or better health care than the general hospitals to selected groups of patients[2]. In Hallingdal, a rural region in southern Norway, acute admissions to a local institution, Hallingdal Sjukestugu (HSS), have been an established local practice for several years.

HSS can be compared to community hospitals (CHs) in the UK, which provide a level of health-care service that has received increased attention during recent years[3]. HSS is legally organized as part of the nearest general hospital, Ringerike Sykehus (RS), which is situated 150 km from HSS. RS is one of four general hospitals in the Vestre Viken Hospital Trust (VVHF). One of the services offered by HSS is a 14-bed somatic inpatient unit. This unit is staffed by two GPs. They are located at HSS, but employed by RS and under the medical direction of the Chief Medical Officer at the Internal Medical Department at RS. The inpatient unit at HSS can be categorized as an intermediate department at the intersection between the two levels of Norwegian health care.

There are approximately 600 somatic admissions annually at HSS. These can be divided into three approximately equal groups: acute admissions, rehabilitation and follow-up treatment after discharge from the general hospital. The acute admissions at HSS constitutes a selected group of patients who have been assessed by GPs as needing admission with close follow-up by nurses and physicians, but not the hospital's specialized expertise and equipment. The medical treatment offered by HSS is described in a previous paper[4].

The research question of this article is how the cost of acute admissions to a community hospital (HSS) compares to similar acute admissions at a general hospital (RS). The health care cost they generated during their follow-up year was also analysed.

The two patient groups have previously been compared on their perceptions of the quality of the hospitalization and the health outcome of their admission[5,6]. This paper presents a health economic analysis, and is the third part of a study of acute admissions to HSS.

Methods

A randomized, controlled trial (RCT) was carried out in the period from 1 May 2010 to 30 April 2013, with an inclusion period of two years and a follow-up period of one year after discharge. The target population was patients for whom GPs in the region had decided that an acute admission to HSS was an alternative to admission to the general hospital. Included patients met the formalized admission criteria regarding HSS and had their admission approved by the specialist on duty at RS. The inclusion and exclusion criteria are stated in Table 1. Patients who met the inclusion criteria were invited to participate in a draw in which half were admitted to HSS as planned, while the other half were admitted to RS instead.

Originally, the research project was planned with readmissions as the primary outcome variable. Power calculations indicated that 70 patients were required in each group. However, early in the project period it became apparent that this number was unobtainable because of a low inclusion rate. Other primary outcomes were assessed and calculated, but none was found to meet the limitations of the low inclusion rate. The assessment was then made that the study goals could be achieved through a triangulation of the results regarding patients' health outcome, patients' perceived quality and health economics. With focus on these outcome variables, it was decided to continue the study with the original design.

The one-year follow-up period included data on the use of health care from both the specialist health-care and the municipal health-care services for each patient. Specialist health-care services

data was extracted from the medical records. Municipal health-care services data was obtained from GPs and from the municipal care services via letter, email and telephone.

For each of the health-care services, a unit cost was obtained or calculated from official sources (Table 2). The units that formed the basis for calculating the cost varied between the services, and included days in hospital, hours in home-care nursing and number of consultations with GPs. The cost of a day's stay at HSS and RS was calculated on the basis of the combined total running cost of the two institutions divided by the number of bed days at each site separately.

Statistical analysis of the difference between the two groups was calculated with IBM SPSS Statistics for Windows (version 21). Categorical variables were tested using chi-square test differences and Fisher's exact test. Continuous variables were tested with t-tests or with the Mann-Whitney test for data that was not normally distributed. For the same reason, the confidence intervals were calculated by bootstrapping (10,000 draws). The significance level was set at 5% for all tests.

The cost analyses differentiated between the cost of the index stay (i.e., the first stay at HSS or RS) and the cost of health services during the follow-up year (defined as one year from the discharge date).

Index stay

The cost of the index stay at HSS and RS includes transportation, administrative and technical management, care and physicians' work. Capital costs are not included. Overhead costs like administrative and technical costs related to the two patient groups were assumed to be similar because RS operates these functions for both HSS and RS. Costs related to nursing and care were also assumed to be equivalent for the two groups, based on the assumption that the randomized patient groups generated the same needs for nursing and care, and on the fact that the wards at RS and HSS cooperate with each other and follow the same quality systems.

The doctors' on-call rosters at RS and HSS differ. RS organizes on-call doctors in three levels: primary on-call, house-officer and specialist back-up. At HSS, the employed GPs work regular hours

and can be contacted by telephone in the afternoon and evening. If in need of a doctor beyond this, the ward personnel can contact the GP on call at the municipal emergency service, located in the same building. The yearly costs of physicians' work at RS, and at HSS, were used to calculate the average physician cost per day and per patient in the two groups.

Because of different geographic distances between their home municipality and the treatment facilities, the transportation costs will differ between the two groups. The registration of ambulance, health-express bus and taxi was done by predefined allocation keys (Table 2).

Follow-up year

Patient data related to specialist health care were collected as the total number of days hospitalized, number of outpatient consultations and number of kilometres of transportation with ambulance, health-express bus or taxi, during the follow-up year.

In the municipal health-care services, the data included number of overnight stays at nursing homes, number of hours with nursing home care or practical home assistance, and the number of consultations with GPs and their staff during the year.

For each patient, the consumption of the various registered health services during the follow-up year were multiplied by the respective unit costs to reveal the annual cost generated by the patient. Patients' annual costs for each of the registered health-care services are summarized for the two groups and the average costs per patient compared.

Ethics approval

The study was approved by the Regional Committee for Medical and Health Research Ethics in Norway (ref. 2009/1300).

Results

Of 315 acute admissions to HSS in the project period, 60 patients (19%) were included in the study. One hundred and eight patients (34%) did not meet the inclusion criteria, mainly because they were visitors rather than residents of the six municipalities of Hallingdal, or were assessed as not

competent to give consent. Eighty-six patients (27%) did not want to participate in the study because they preferred an admission to HSS. The remaining patients were either not asked (27) or not included for other practical reasons (34). The uneven number of patients in the groups (HSS, n = 33; RS, n = 27) was mainly because more patients in the RS group withdrew after randomization.

The two patient groups have been previously compared and, for all practical purposes, found to be equal[6]. There were no statistically significant differences in the length of stay or underlying morbidity between the groups[6]. The socio-demographic profile of the two groups and the number of admissions to HSS and other hospitals during the last two years before the index stay were similar.

Health outcomes for the two groups have been previously published[6]. These data are repeated in Table 2 along with a cost calculation for each health service.

Index stay

Physician cost is a result of registered length of stay for each patient multiplied by the unit cost. The costs per patient in the two groups are shown in Table 3. The mean physician cost for the acute admissions to the HSS amounts to 57% of the corresponding cost for similar patients admitted to RS ($p < 0.01$).

The costs per patient for transportation to and from the index stay are listed in Table 3. The mean cost of transportation for the acute admissions to HSS was 19% of the corresponding cost for similar patients admitted to RS ($p < 0.01$).

Follow-up year

The cost of specialist care per patient during the follow-up year appeared higher in the group originally admitted to RS than in the group admitted to HSS, but the differences were not statistically significant (Table 3). The difference in the cost of transportation was not statistically significant ($p = 0.959$).

The groups' consumption of municipal health services show the same pattern. The average cost per patient appeared higher in the RS group than in the HSS group, for both inpatient stays in nursing

homes and home-care services. For GP-related consultations, there was a small difference in the opposite direction. However, none of these differences was statistically significant.

Overall, the group admitted to HSS generated a total health-care cost during the follow-up year of € 585,598, and an average per-patient cost of € 17,745. Corresponding figures for the group admitted to RS were € 718,772 and € 26,621. The differences were not statistically significant ($p = 0.557$).

Discussion

The purpose of the study was to compare the cost of two similar groups of patients acutely admitted to HSS and RS, respectively, including their overall treatment cost the following year. The differences in costs between the two groups were statistically significant for the index stay with higher costs for patients admitted to RS than to HSS. This was related to the physicians' cost and patient transportation. There were no significant differences between the two groups in treatment costs during the follow-up year.

The RCT method is a strength of our study. Additionally, costs and clinical data have been collected from two institutions having joint administrative and technical management. This made it possible to exclude a number of factors that usually hamper comparisons of patients in two different inpatient facilities. The fact that the two groups have equal lengths of stay, and can be considered equivalent when it comes to medical needs, makes it possible to identify factors that have different costs during the index stay and the follow-up year.

Index stay

Several previous studies have compared costs at intermediate departments, GP hospitals or CHs with those of general hospitals[7–10]. The results are not conclusive. In particular, the comparison of nurse-led intermediate departments with hospitals has shown variations in costs[7], with the stay at nurse-led intermediate departments often longer than at the hospitals. At HSS, the mean length of stay for emergency admissions was equal to the length of stay at the hospital.

Studies from several countries indicate that treatment at a CH costs less than treatment at a general hospital[8–10]. However, none of these studies is based on an RCT, and there could not be found any health economy analysis based on an RCT regarding acute admissions in the literature.

Eriksen has pointed out that patients eligible for alternatives to hospital care constitute a less resource-intensive group than the average hospital patient[11]. Therefore, when comparing the index stays the day-costs for an average hospital patient were not used. Instead, an analysis were performed on which costs may be the same or different for two patient groups with virtually identical treatment needs. Because HSS is a part of RS, the operational, administrative and treatment costs per patient during the index stays were presumed to be the same. This assumption may be questioned, especially concerning treatment cost. Admissions to general hospitals have been shown to generate more drug prescriptions and more expensive and extensive examinations and tests than admissions to CHs[12,13]. This is probably also the case when comparing the costs at RS and HSS. If these costs are in fact higher at RS than HSS, the cost difference between the two institutions may be higher than our estimate.

Follow-up year

An English RCT study evaluated the cost-effectiveness of follow-up treatment and rehabilitation of older patients admitted to CHs[14]. In this study, quality-adjusted life years (QALYs) were used to measure the patients' health after a six-month follow-up period. The study found that the cost-effectiveness was similar at the CHs and the general hospital.

In a Norwegian RCT study, patients acutely admitted to a general hospital were randomized into two groups regarding follow-up intermediate care; one group of patients was transferred to a CH and the other received continued care at the general hospital[15]. During the one-year follow-up period, the CH group generated a lower health-care cost than the general hospital group. Much of the saving was due to a significant reduction in the number of readmissions during the follow-up year.

Should alternative treatments outside general hospitals be worthwhile, they must be realized without loss of health outcome or increased health costs. In a previous part of our study, no

significant health outcome differences were found during the follow-up period of one year between the two groups[6]. In the present part of the study there was not found any increased health costs for patients acutely admitted outside the general hospital. This corresponds well with the two studies noted above indicating that health outcomes of certain groups of patients treated outside general hospitals can be as good as or better than similar patients treated at the general hospital[14,15].

Limitations

Even though the data were not normally distributed, the average cost was chosen as a key factor rather than median cost. This is justified because the incidence of some high values must be regarded as a normal situation in health care. If the median cost had been used, these high values would have been concealed. The large spread in the data is the reason behind the high p-values.

P-values have not been Bonferroni corrected for the high number of tests performed; however, such a correction would not have changed the conclusions, because few differences were significant. As the number of tests is large, and there were no significant differences in the follow-up year, the table do not present confidence interval and p-values for more than the main groups (Table 3).

In our study, transport expenses and the physicians' costs were found to be the two main cost variables constituting the difference between the two groups. The result came out in favour of HSS. The costs of the ambulance service are largely related to emergency preparedness rather than mileage. The costs of the physicians' work are related to the organization of doctors on call. Therefore, a generalization of the demonstrated financial gain requires caution.

No significant differences between the two groups regarding costs of medical care during the follow-up year were found. This does not necessarily imply that the costs are equal, however. There may be a type II error in the analysis, masking significant economic differences. A larger number of patients in the sample would have given a better statistical interpretation.

The daily cost of care at HSS during the follow-up year appears high compared with the daily cost at the municipal nursing homes of the area (Table 2), and when compared with a similar institution in

Norway[15]. Costs for the general hospital's specialized tasks appear to be transferred to HSS with our chosen method of calculation. The daily cost differences between HSS and RS may therefore be underestimated.

Internationally, our study should be of interest for health providers seeking alternatives to hospitalization. In Norway, the study will be of importance for the ongoing work of establishing municipal inpatient services for patients in need of emergency care. It should be noted that the data were collected before the municipal statutory duty to establish municipal beds for emergency care came into effect[2]. The study was carried out at a single institution and on a limited number of patients; generalizations should thus be made with caution.

Conclusions

This RCT study has shown that acute admissions to an intermediate department cost less than similar admissions to a general hospital for certain groups of patients. The difference is due to savings in medical transportation and lower physicians' costs. In a follow-up year, there were no statistically significant differences between the two groups concerning the cost of health care. The results of our study contribute to further research and discussions regarding the organization of differentiated emergency care systems as alternatives to the general hospital.

Abbreviations

CH: Community hospital

HSS: Hallingdal Sjukestugu, a community hospital in Ål, Hallingdal, Norway, run by RS

IBM: International Business Machines, an American multinational technology corporation

RCT: Randomized Controlled Trial

RS: Ringerike Sykehus, a general hospital in Hønefoss, Norway, 150 km from HSS

SPSS: Statistical Package for the Social Sciences, a software package used for statistical analysis

VVHF: Vestre Viken Helseforetak, a hospital trust in Norway, where RS is one of four general hospitals

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

The authors alone are responsible for the content and writing of the paper. ØL is the main author.

The article is part of a PhD study at the University of Oslo. As supervisors, TPH and PH have contributed to the analysis, drafting and revising of the manuscript. All three authors have read and approved the final manuscript.

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Table 1 Inclusion and exclusion criteria for the research project

Inclusion criteria	<ul style="list-style-type: none">• The patient's clinical status had to be in accordance with the current guidelines for acute admissions to HSS• The specialist on call at RS had to give his or her consent to the acute admission to HSS• The patient had to be a resident of one of the six municipalities of Hallingdal• The patient had to be competent to give his or her consent
Exclusion criteria	<ul style="list-style-type: none">• Patients with injuries or acute illnesses who were in need of diagnosis, treatment or monitoring at a general hospital• Childbirths• Psychiatric disorders

Table 2 Description of registered health services within specialist and municipal health-care services. Cost per unit in Euros (2011).

Registered health care	Description	Source	Cost per unit
Specialist health care			
Physicians at RS (cost per bed per day)	Salaries, including social costs, for physicians at the Internal Medicine Department of RS. The calculation is limited to physicians' work in the ward and on call, which are considered to constitute 90% of the total work of interns, 67% of physician services in specialist training and 50% of specialists.	VVHF	108
Physicians at HSS (cost per bed per day)	Salaries, including social costs, for physicians at HSS. The calculation applies to work on the ward and to daily phone readiness until 21.00, and includes the cost of purchased physician services from the municipal emergency care and with the estimated value of emergency preparedness set to 50% of the municipal cost.	VVHF	65
Health-express bus Index stays (cost per travel)	All patients discharged from RS after the index stay were assumed to be transported to the patients' home municipalities using the health-express bus. Cost for a standard journey between Hallingdal and RS includes VAT, but excludes the patients' payments.	VVHF	44
Ambulances (cost per km)	Emergency admissions to RS and HSS were assumed to have been transported by ambulance. Mean cost per km was calculated from the operating expenses of the five ambulance bases in Hallingdal.	VVHF	9
Health-express bus Follow-up year (cost per km)	Travel by health-express bus to or from the hospital/outpatient clinic. Cost per km to or from the municipal centre includes VAT, but excludes the patients' payment.	VVHF	0.23
Taxi (cost per km)	Average cost per km based on a price agreed upon between VVHF and six taxi companies in Hallingdal. The cost includes VAT, but excludes the patients' payment. Costs of transport within the municipality are not included.	VVHF	2.29
One day's stay at RS or HSS	Operating expenses for the wards including emergency, anaesthesia, surgery and intensive care. No capital expenditure. Operating expenses were divided by the number of beds and calculated per day. For joint holdings between RS and HSS, discretionary distributions have been made.	VVHF	RS 1,330 HSS 917
Outpatient consultations	Estimated operating cost per DRG points for RS. This was multiplied by the individual outpatient's DRG points regardless of where the consultation took place. Only outpatient consultations for VVHF and X-rays were included, as no other outpatient data were available.	VVHF	4,597
Municipal health care			
One day's stay at nursing home	The cost is equal to the price agreed upon by Hallingdal municipalities for the purchase of one day's stay at a nursing home. The price is also based on calculations from HELED.	Ål municipality HELED	256
Home nursing (cost per hour)	The costs are based on micro cost analysis from Heled carried out in one municipality and compared with statistics from several other municipalities. There is one cost for ambulant outpatient services and one cost for home services without transport.	HELED	64 (amb) 53 (without transport)
Practical assistance (cost per hour)	The costs are based on micro cost analysis from Heled carried out in one municipality and compared with statistics from several other municipalities. There is one cost for ambulant outpatient services and one cost for home services without transport.	HELED	55 (amb) 51 (without transport)
GP consultations (cost per consultation)	Includes per capita grants per consultation and mean reimbursement for use of GPs' fees, plus patients' payments.	HELFO	57
Consultations with nurses at the GPs' offices	Includes mean reimbursement for use of GPs' fees for consultations with nurses at the GPs' offices, plus patients' payments.	HELFO	8

All cost data are in Euros, one € equals 7.7974 NOK (Exchange rate is set to the average rate of 2011).

Abbreviations: Amb: ambulant, DRG: diagnosis related group classification; HSS: Hallingdal Community Hospital; km: kilometre; RS: Ringerike General Hospital; HELED: Department of Health Management and Health Economics, Faculty of Medicine, University of Oslo; HELFO: Norwegian Health Economics Administration, Norwegian Directorate of Health; VVHF: Vestre Viken Hospital Trust.

Table 3 Consumption of registered health care in HSS and RS groups, and comparison of the average cost per patient in Euros (2011).

Health care	HSS (n = 33)		RS (n = 27)		Difference in cost	95% Confidence interval		p-value
	No.	Cost per patient	No.	Cost per patient		Lower	Upper	
INDEX STAY								
Transport		290		1,539	1,249	1,126	1,371	< 0.001 ¹
Physicians' work		331		576	245	74	438	0.006 ²
FOLLOW-UP YEAR								
<i>Specialist health care</i>								
Total expenditure		10,246		14,586	4,340	-6,201	17,371	0.994 ²
Stays at hospital (days)	245	8,374	300	12,355	3,981	-5,223	15,510	0.909 ²
RS	117	4,714	131	6,451	1,737			
HSS	118	3,280	156	5,300	2,020			
Others	10	381	13	605	224			
Outpatient (DRG points)	2,01	280	2,73	464	184	-316	927	0.582 ²
Transport (km)	25668	1,591	22763	1,766	175	-1,139	1,474	0.959 ²
Ambulances	4239	1,203	4129	1,432	229			
Health-express bus	17634	125	16359	141	16			
Taxi	3795	264	2275	193	-71			
<i>Municipal health care</i>								
Total expenditure		7,500		12,035	4,535	-3,590	14,002	0.778 ²
Stays at nursing homes (days)	355	2,759	524	4,978	2,219	-2,689	8,261	0.078 ²
Home services (hours)	2415	4,232	3019	6,599	2,367	-3,046	8,653	0.808 ²
Home nursing (amb)	1054	2,048	1629	3,869	1,821			
Home nursing (stat)	929	1,480	1040	2,025	545			
Pract. assistance (amb)	275	460	280	572	112			
Practical assistance (stat)	157	244	70	133	-111			
Physician consultations	470	509	352	458	-51	-281	181	0.562 ²
Regular consultation	263	458	193	411	-47			
Consultation with staff	207	51	159	48	-3			
Total expenditure follow-up year		17,745		26,621	8,876	-7,027	27,068	0.557 ²

¹ Two-sample t-test (with assumed equal variance), ² Mann-Whitney U test, independent samples

All cost data are in Euros, one € equals 7.7974 NOK (Exchange rate is set to the average rate of 2011).

Abbreviations: Amb: ambulant; DRG: diagnosis related group classification; HSS: Hallingdal Community Hospital; pract: practical; RS: Ringerike General Hospital; stat: stationary.