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The impact of an outpatient heart failure clinic on hospital costs and admissions

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Keywords

Health services, Heart, Outpatients, Cost analysis

Abstract

This study of 216 congestive heart failure (CHF) patients at a large teaching hospital in south-central Ontario was undertaken to determine whether the patients managed in an outpatient heart failure clinic used fewer hospital resources (as expressed in number of admissions, complexity of admission, and length of stay (LOS)) than a matched cohort who were not managed in an outpatient clinic. Statistical significance of LOS opportunities could not be demonstrated (owing to sample size), however, the heart failure clinic is making a positive impact on all types of admissions (CHF and non-CHF) in terms of LOS and suggests that management in an outpatient setting for chronic disease states is important for acute care hospitals to consider.

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Introduction and background to the study

Congestive heart failure (CHF) is the leading cause of hospitalization in elderly Canadians and a frequent cause of death (Naylor and Slaughter, 1999), This syndrome is characterized by frequent hospitalizations, a generally poor quality of life, a mortality rate of approximately 10 per cent per year and an annual five-year survival rate of 50 per cent (Naylor and Slaughter, 1999). The impact of this illness on inpatient and outpatient health care costs has been estimated to range from US$10-38 billion per year (Stanley, 1997; Smith *et al.*, 1997; Paul, 1997; Parmley, 1996; Schulman *et al.*, 1998; Fonarow *et al.*, 1997). The highest proportion of the costs for treating heart failure resides in acute care admissions. These costs exceed those of physician visits, home care and medications (Smith *et al.*, 1997; Parmley, 1996; Stewart *et al.*, 1999; Giles, 1996). Giles (1996) further challenges that management of chronic disease states involves identification of the major impacts to costs and targeting interventions to address the impacts. Given that the major cost in the management of CHF is repeated hospitalizations due to exacerbations of the illness, interventions should be targeted at decreasing hospitalizations and managing the co-morbidities related to this syndrome. The health care system in Canada has undergone an unprecedented level of systemic change in speed and scope, beginning in the early 1990s. Acute care, long-term care and community care agencies have all been affected by the restructuring of the health care system and various health delivery models have been implemented across provinces and regions. Limited availability of health care resources and the need for operational efficiencies have motivated a shift over this decade to outpatient management of both surgical interventions, as well as to greater outpatient management of chronic disease states and syndromes such as diabetes and CHF.

The primary purpose of this study was to understand the impact of an outpatient heart failure clinic on hospital costs and admissions at a large, multi-site teaching hospital in South Central Ontario, Hamilton Health Sciences (HHS). A secondary reason for undertaking this study was to understand and provide context to the hospital health care budget impact of CHF admissions in Ontario and at HHS.

Methodology for the study

An outpatient heart failure clinic was established at HHS in 1999 as a joint funding partnership between the hospital and the private sector with a primary goal to provide comprehensive clinical service to CHF patients by optimizing the use of proven therapy, thereby decreasing hospitalizations, improving quality of life and survival. Four cardiologists in a weekly clinic rotation and two cardiology nurse clinicians working half-time each support the HHS heart failure clinic. Patients are seen in clinic on a routine basis; however, a large component of care is the telephone contact, health teaching and monitoring that patients and caregivers receive from the nurse clinicians.

This study comprised two levels of analysis: part one and part two. Part one analyzed two matched cohorts of patients (those referred to the heart failure clinic and those not referred to the clinic) to determine whether management in the heart failure clinic impacted positively on hospital costs and admissions. Part two analyzed hospital utilization and hospital direct costs related to heart failure in the province of Ontario. The data utilized in part two of this study were accessed from the Canadian Institute for Health Information (CIHI), Ontario provincial abstract database and the Ontario case costing (OCDM) Ministry of Health Web site facility comparisons for fiscal 1998/1999 and fiscal 2000/2001.

Part one

This part of the study comprised a quantitative, retrospective, cohort analysis with a primary endpoint of hospital utilization as expressed in number of admissions, patient days, and LOS (for both the control and intervention groups).

Population

The intervention (clinic) group was made up of 72 patients who were managed in the heart failure clinic, named the Heart Function Clinic (HFC), at HHS.

The control group was made up of 144 patients (two to one matching with the control group) who were not followed in the HFC. A search of the CIHI discharge abstract database (DAD) identified the control group, who were matched to the intervention group on age, gender, and postal code. Further, the control group patients were matched as closely as possible for a hospital admission that coincided by date with the first intake to clinic of their match in the intervention group.

The cutoff date for inclusion in this study was the availability of abstracted data for HHS discharges in the DAD for a minimum of six months post-clinic intake. At the time of commencing this study CIHI DAD data were available and complete through October 2001, thus the study inclusion cutoff date was April 2001. Patients who were admitted early in the clinic's history would have at most 18 months of follow-up on their hospitalization pattern at HHS post clinic.

Design

An analysis of hospital admissions, lengths of stay and complexity levels related to admissions for both cohorts was undertaken to determine whether management in the outpatient HFC resulted in a decrease in the number of hospital admissions and hospital days. Table I details the study design in part one.

Analysis

The statistical analyses were conducted using the software program SPSS version 8.0. An alpha of less than or equal to 0.05 was considered significant. The continuous variables were calculated by using either two-sided *t*-tests or analysis of variance depending on the data. The categorical variables were evaluated using chi-square or a Fisher's exact test. Correlations have been conducted as appropriate using the Pearson

Table I Part one study design

Intervention (clinic) group – time one **(n = *72 patients*)**	***Control group – time one*** **(n = *144 patients*)**
Admissions and patient day utilization one year prior to HFC intake	Admissions and patient day utilization one year prior to HFC availability – October 1998
Intervention (clinic) group – time two **(n = *72 patients*)** Admissions and patient day utilization for an average of one year (minimum six months/maximum 18 months) post-admission to the HFC	***Control group – time two*** **(n = *144 patients*)** Admissions and patient day utilization for an average of one year post-HFC matched intake date (minimum six months/maximum 18 months)

correlation coefficient (R) and the Spearman rho for non-parametric data.

Part two

An analysis was undertaken of hospital utilization patterns and direct costs for patient discharges with heart failure at HHS, at peer teaching hospitals and across Ontario employing CIHI DAD data. The sum of cases in each CMG™[1] related to heart failure was analyzed with respect to relative distribution percentages of total heart failure admissions. The cases discharged from HHS were compared to those hospitals identified as Ontario teaching peer comparators, all Ontario teaching hospitals and all cases in Ontario hospitals at two points in time: 1998/1999 and 2000/2001. Peer teaching comparators were identified based on those hospitals similar in size, complexity and services offered, as identified through decision support services, HHS. In order to understand the hospital admission costs for patients at HHS and in Ontario, an analysis of direct costs multiplied by weighted cases was undertaken. Direct costs were chosen for this analysis as they include inpatient acute and day surgical costs including laboratory and diagnostic costs. Two fiscal years were reviewed, 1998/1999 (prior to heart failure clinic at HHS) and 2000/2001 (post-heart failure clinic availability at HHS). Hospitals report direct costs on an annual basis. The actual direct costs for HHS and the Ontario median direct cost were used in a calculation to provide a financial context to the impact of heart failure admissions (source: OCDM Facility Comparison Costs).

Population

All discharges coded for the four primary CMG related to heart failure in fiscal 1998/1999 and fiscal 2000/2001 at HHS, at peer teaching hospitals and at all Ontario hospitals were included in this analysis. They are described as the sum of weighted cases (RIW™ calibration[2]) and the sum of patient days. This time frame reflects a period prior to the opening of the HFC at HHS and one-year post availability of the HFC.

The CMG that were used are defined as follows:

- CMG 201 – acute myocardial infarction with cardiac catheterization with CHF.
- CMG 205 – acute myocardial infarction without cardiac catheterization with CHF.
- CMG 215 – cardiac catheterization with CHF.
- CMG 222 –heart failure.

Design

The design is shown in Table II.

Results – part one

The groups were well matched in terms of age, gender and residential location, as these indicators were used in defining the control cohort as a match for the intervention (clinic) group. The ratio of males to females is common in cardiac admissions and age was normally distributed (Table III).

Case mix groups were analyzed for the two cohorts, pre- and post-clinic. There was no significant difference between the two groups, either before (p = 0.482) or after clinic startup (p = 0.928) relative to the distribution of the CMG.

Table II

CMG	Fiscal 1998/1999	Fiscal 2000/2001
201, 205, 215, 222	HHS weighted cases/patient days × direct costs Peer teaching weighted cases/patient days Ontario weighted cases/patient days × median direct costs	HHS weighted cases/patient days × direct costs Peer teaching weighted cases/patient days Ontario weighted cases/patient days × median direct costs

Table III General descriptive statistics

	Clinic (n = 72)	Control (n = 144)
Age (years)	69.6 ± 11.9	69.7 ± 11.9
Gender: male to female (%)	62.5: 37.5	60.6: 39.4
County (Hamilton-Wentworth) (%)	87.5	97.2
Region (Central-South) (%)	97.2	97.2
City (Hamilton) (%)	61.1	61.1

Notes: All numbers represented as mean ± standard deviation unless otherwise noted. Percentages are within group

There was no significant difference between age and gender for the two groups although there was a trend towards the female patients being older than the male patients, regardless of group (p = 0.011).

Overall, the females were 2.82 ± 1.8 years older than the males. The males were on average 68.5 years of age, and the females were 71.4 years of age. There was no significant difference between the clinic and control groups in complexity of CMG before (p = 0.719) or after (p = 0.331) opening of the HFC (Table IV)[3]. It is of interest to note, however, that while significance was not demonstrated, hospital admissions at the lower levels of complexity (Plx™ 1 and 2) decreased in the clinic population by 15.7 percent (total of 1 and 2 pre-clinic = 56.3 percent and post-clinic = 40.6 percent) while the control population remained fairly constant for admissions at Plx levels one and two (62.8 percent pre-clinic and 59.6 percent post-clinic).

Table IV Complexity of hospital admission (CMG 201, 205, 215, 222)

	Clinic				Control			
	Pre-clinic		Post-clinic		Pre-clinic		Post-clinic	
Plx level	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
1	31	38.8	9	28.1	41	47.7	17	36.2
2	14	17.5	4	12.5	13	15.1	11	23.4
3	18	22.5	9	28.1	17	19.8	11	23.4
4	17	21.3	10	31.3	15	17.4	8	17.0
Total	80		32		86		47	

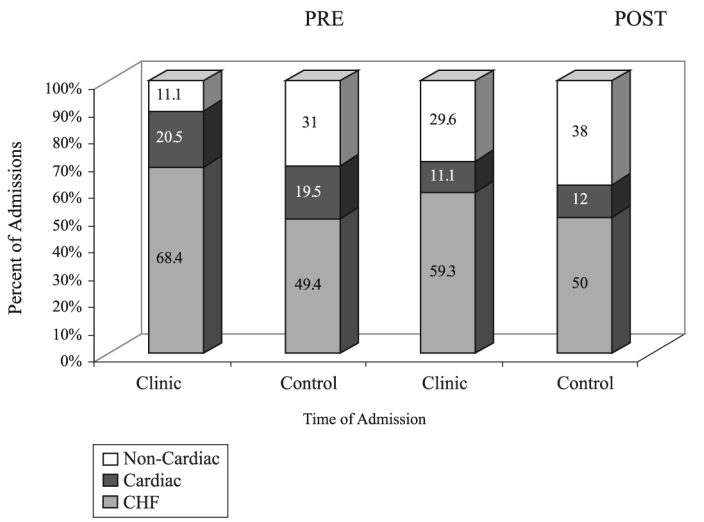
After finding that females were generally older in both groups, an analysis of gender and complexity was performed to look for any relationship between the gender and complexity levels for the admissions pre and post HFC startup. Despite the trend for females to be older, there were no significant gender differences for time (before or after clinic).

Hospital utilization and length of stay data

A significant difference was found between the two groups' pre-clinic hospitalizations with respect to the primary condition for hospitalization ($p < 0.0001$) (Figure 1 and Table V). Pre-clinic implementation, the clinic group had significantly higher numbers of admissions per patient for CHF admissions (1.62 ± 1.3 days) than did the control group (1.23 ± 0.51 days). Further, while statistical significance could not be demonstrated, likely due to sample size, the clinic patients did have a decrease in the LOS per admission post-clinic by 1.14 ± 13.6 days, while control patients had an increase in LOS of 0.451 ± 11.8 days, expressed as the difference between ELOS (expected length of stay) and LOS[4]. Admissions for CHF remained the most common reason for hospitalization in both groups pre- and post-clinic.

The distribution of typical cases (where length of stay is either under the ELOS benchmark or beyond the ELOS benchmark but inside the statistical trim factor) versus atypical cases (deaths, sign-outs, transfers, LOS beyond the statistical trim factor) between the two groups was analyzed. There were no significant differences between the two groups for relative distribution of typical and atypical cases for each admission. A further drill down on only those admissions coded as typical for all diagnoses (including CHF and non-CHF admissions) was conducted. Patients in both

Figure 1 Type of admission, pre- and post-clinic



groups had shorter actual lengths of stay (LOS) than expected (ELOS) both pre- and post-clinic availability at HHS. The difference between the two groups pre-clinic availability favoured the control group who stayed 0.5 days less per admission than the clinic group. Post-clinic implementation, however, the clinic patients had shorter length of stays than those in the control population. The clinic patients, post-clinic intake, stayed 3.1 days ± 6.0 days less per admission than the control group who stayed 0.73 days ± 10.5 days less per admission. This difference was not found to have statistical significance (Table VI). However, this difference becomes important in costing the benefit to an organization of avoided hospitalizations.

Typical case distribution between the two groups for CHF admissions only was also analyzed. There were no statistical differences for typical CHF admissions between the two groups pre- or post-heart failure clinic startup. There was a significant main effect for gender (p = 0.045) where the males (10.8 ± 1.1) had significantly shorter lengths of stay as compared to females (14.2 ± 1.3). There was a trend towards a between group difference in length of stay but this did not reach significance (p = 0.087) (Figure 2).

Results – part two

Age distribution of CHF admissions

The relative impact of CHF for each age group as represented by total cases for HHS and the province of Ontario was analyzed (Table VII). It is evident that the oldest age cohort (70+) represents almost 75 percent of cases of CHF admitted to Ontario hospitals each year.

Percentage of CHF admission by CMG

In both years reviewed, the number of CHF admissions by CMG were concentrated in CMG 205 (acute myocardial infarction without cardiac catheterization with CHF) and CMG 222 (heart failure) across all Ontario facilities. Table VIII demonstrates this distribution and percentage of total cases for each hospital or group of hospitals.

CHF admissions were further compared for relative distributions of case mix groups over all case mix groups presenting to Ontario hospitals. All cases at HHS and all cases in Ontario were reviewed at both points in time: 1998/1999 and 2000/2001. Overall, the total number of CHF admissions represents about 2.7 percent of the total admissions for HHS and 2.5 percent of the total admissions for the province of Ontario. There was a general trend towards a reduction in the number of admissions from 1998/1999 to 2000/2001 for

Table V Admissions and length of stay, clinic vs control

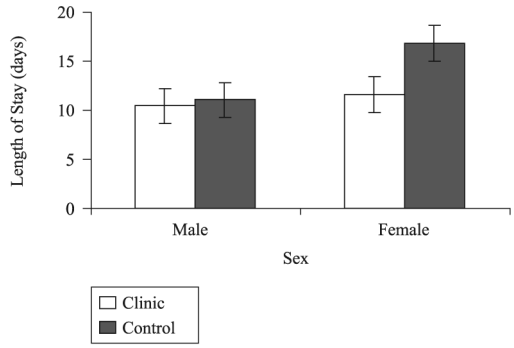
	Clinic (n = 72)		Control (n = 142)		
	Pre-clinic	Post-clinic	Pre-clinic	Post-clinic	P value
No. of admissions/patient	1.62 ± 1.3	0.76 ± 1.0	1.23 ± 0.51	0.65 ± 1.45	< 0.0001
Length of stay in days	11.6 ± 10.95	10.3 ± 13.1	13.9 ± 18.5	12.5 ± 18.2	0.19
Expected length of stay (in days)	11.2 ± 5.2	11.4 ± 5.2	11.8 ± 7.4	12.0 ± 9.5	0.47
Expected length of stay – length of stay (in days)	–0.368 ± 10.5	*1.14 ± 13.6*	–2.11 ± 16.0	*–0.451 ± 11.8*	0.24

Note: Includes all discharges coded: typical and atypical

Table VI Length of stay for typical admissions (which includes CHF and non-CHF admissions)

	Clinic		Control		
	Pre-clinic	Post-clinic	Pre-clinic	Post-clinic	*P* value
No. of admissions (*n* = 373)	102	42	143	86	
Length of stay	9.89 ± 7.14	7.6 ± 5.81	9.48 ± 9.94	10.4 ± 16.47	0.31
Expected length of stay	11.0 ± 5.2	10.7 ± 5.3	11.1 ± 7.5	11.3 ± 7.7	0.69
Expected length of stay – length of stay	1.1 ± 6.3	*3.1 ± 6.0*	1.6 ± 7.1	*0.73 ± 10.5*	0.28

Figure 2 Length of stay by gender



both HHS and the province of Ontario, although HHS had a greater relative decline (0.16 percent) as compared to the province (0.04 percent).

A search of the CIHI provincial (Ontario) DAD for the fiscal period 2000/2001 revealed 27,002 cases discharged and 250,338 patient days utilized in the four case mix groups related to heart failure. Patients above the age of 70 accounted for 75 percent of these total cases (20,117 cases) making up 78 percent of total hospital days (196,026 days). In short, in Ontario alone, in 2001/2002, the equivalent of 685 beds with 90 percent occupancy were allocated to heart failure admission on any given day, with elderly patients (those greater than age 70) occupying 483 of those beds. This provides one context of hospital utilization for this patient group.

Table IX displays the results of the costing exercise and demonstrates the increase in CHF weighted cases year over year. At HHS CHF weighted cases increased by 40 percent while in Ontario CHF weighted cases increased 12 percent. In fiscal 2000/2001, approximately $6,671,601 of the budget at HHS was required for direct costs related to CHF admissions and approximately $117,004,266 was spent on the direct care costs related to CHF admissions in the province of Ontario.

Table VII Impact of CHF across age groups, HHS and province of Ontario

	HHS				Ontario			
	1998-1999		2000/2001		1998/1999		2000/2001	
Age group	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
0-17 years	7	0.6	5	0.2	56	0.2	55	0.2
18-69 years	269	24.7	253	24.9	7,642	26.1	6,830	25.3
70+ years	*815*	*74.7*	*75.7*	*74.6*	*21,548*	*73.7*	*20,117*	*74.5*

Table VIII Percentage distribution of CMG 205,222 in Ontario hospitals

Hospital(s)	CMG	1998/1999 percentage of total CHF cases	2001/2002 percentage of total CHF cases
HHS	205,222	92.2	88.8
Peer comparators	205,222	85.4	87.5
All teaching hospitals	205,222	86.2	86.5
All Ontario hospitals	205,222	95.9	94.8

Table IX HHS versus Ontario hospitals costs per weighted CHF cases 1998/1999 and 2000/201

	1998/1999		2000/2001			
Hospital(s)	No. of weighted cases for CHF	Costs ($)	No. of weighted cases for CHF	Costs ($)	Year over year cost change ($)	Percentage change
HHS	2,196	5,953,356	3,093	6,671,601	718,245	10.7
Ontario	50,156	100,863,716	56,442	117,004,266	16,140,550	13.8

Discussion

Hospital admissions and consequent hospital days (length of stay) are driven by progression and exacerbation of the CHF syndrome. Naylor and Slaughter (1999, p. 19) in their five-year review of hospitalizations prepared for the Cardiovascular Health and Services in Ontario (*ICES Atlas Report 1992/1993 to 1996/1997*) state:

> . . . hospitalization rates for CHF averaged 296 admissions per 100,000 adult men and 279 admissions per 100,000 adult women.

They further note that the rates of hospitalization increase dramatically with age for both men and women.

A number of authors (Smith *et al.*, 1997; Stewart *et al.*, 1999; Cline *et al.*, 1998; Cintron *et al.*, 1983; Rich *et al.*, 1995) have studied outpatient heart failure management and the resultant impact on hospital costs. Their studies document fewer hospital admissions and shorter LOS for patients followed in a heart failure clinic. However, one group of authors (Wienberger *et al.*, 1996) presents a contrasting view of the results. In a multi-centre, randomized, controlled trial of outpatient disease management (1,396 patients with diabetes, heart failure, or chronic obstructive pulmonary disease) they noted that despite more intensive primary care than the controls, the intervention group had significantly higher rates of readmission and more days of hospitalization. In other words, the intervention group, despite being closely followed by a nurse and primary care physician post-discharge from hospital, were found to have significantly higher rates of readmission and more days of rehospitalization that the control group.

The primary objective of this study and the focus of part one of the research design was to understand the impact of an outpatient heart failure clinic on hospital costs and admissions at HHS by comparing a group of patients managed in the heart failure clinic with a matched cohort who were not managed in clinic. The question to be answered was whether an outpatient heart failure clinic reduced hospital admissions or utilization as expressed in LOS. A number of variables were analyzed in the clinic and control groups:

- age;
- gender;
- complexity;
- heart failure clinic utilization;
- hospital admissions;
- case mix groups;
- lengths of stay; and
- costs by complexity.

The findings indicated that HHS patients (clinic and control) are elderly (age 70 and older), and that female patients are on average 2.82 ± 1.8 years older than male patients. Patients referred to the clinic averaged 5.7 ± 3.8 clinic visits during the period of this analysis and were followed in the clinic for 28.8 ± 22.5 weeks.

Male patients had significantly shorter lengths of stay as compared to the females ($p = 0.011$). When this was discovered, further analysis was carried out to look at the interaction between gender and complexity as a potential explanation for this difference. There were no significant gender differences pre- or post-clinic. Given this, one potential explanation for the shorter lengths of stays in males may be that the younger population of males in this sample (both clinic and control) was more likely to have had a living spouse. Elderly females are more likely to be widowed and living alone. Living alone without home support can be a barrier to discharge and contribute to longer lengths of stay. Attention to community supports or networks for females in the heart failure clinic setting may have a significant impact on future hospital admissions and subsequent lengths of stay.

Patients were not matched based on an objective marker of disease severity such as the commonly used New York Heart Association Class. This is of interest, given that without disease severity as matching criteria, the sample was distributed for complexity without significance between the study groups. On average, 49.6 percent of clinic and control admissions, post clinic, were at complexity levels 3 and 4 respectively (3 complexity related to serious/important condition(s) and 4 complexity related to life-threatening condition(s) (CIHI, 2000)). This has important implications for hospitals, as complexity and age are important determinants for case weighting calculations and hence estimated inflows of revenue based on weighted cases. Clinic patients were not being admitted at the lower levels of complexity post-clinic and the likely explanation for this is that the support of the heart failure clinic provided them with options other than hospital admission to manage changes in this chronic condition.

Analysis of the two study groups for CMG distribution for heart failure found no statistical difference between the groups pre-clinic or post-clinic. The findings demonstrate a similar distribution of volumes of patients in CMG 205 and 222 at both HHS and across Ontario hospitals.

The clinic group had a higher number of CHF admissions prior to their entry into the clinic than did the control group (68.4 percent versus 49.4 percent). This analysis included all admissions: typical and atypical. This may point to selection for referral to the clinic based on a sicker population of patients existing in physician's practices who were more complex to manage. This difference between the distributions disappeared after the first clinic admission ($p = 0.534$) although admissions for CHF remained to be the most common type of admissions in both the clinic and the control groups (59.3 percent and 50 percent respectively). This may well point to intervention and optimization of treatment in the clinic for this population of patients such that they improved to the point that post clinic analysis of admissions demonstrated no significant difference from the control group.

While statistically no difference was demonstrated in terms of length of stay for typical CHF admissions between the clinic and control groups in this study, there were differences in lengths of stay for the clinic group versus the control group for all admissions when both CHF and non-CHF admissions were included in the analysis. When ELOS versus actual LOS was calculated for the clinic group, post-clinic, for all admissions, there was a positive variance in the number of days "saved" (3.1 ± 6.0 days). In contrast, the control group post-clinic days "saved" actual LOS versus ELOS was 0.73 ± 10.5 days. While these values were not found to be statistically significant, it appears that the heart failure clinic is having a positive impact on the number of admissions for co-morbid conditions. A nurse clinician in the heart failure clinic confirms that many of the telephone interactions with patients/caregivers, as well as portions of the time at clinic visits, are spent on prevention and health teaching on co-morbid conditions. A larger sample of clinic patients with a matched cohort may have been able to demonstrate significance in cost outcomes as admission type ($p = 0.090$), and the interaction between complexity and admission type ($p = 0.095$) approached significance in this review.

The secondary focus of this research was to document the hospital health care budget impact of heart failure admissions in Ontario and at HHS through review of weighted cases and direct hospital costs. The relative impact of CHF admissions at HHS and in Ontario was examined by age and CMG. At both levels, the oldest age cohort (70+) represents almost 75 percent of all cases of CHF at HHS and in Ontario hospitals. The majority of the patients are clustered in CMG 205 and 222. This is a consistent pattern across peer comparators, other teaching hospitals, and all hospitals in Ontario. Overall, the volume of CHF admissions represents about 2.7 percent of the total admissions for HHS and 2.5 percent of the admissions for Ontario over both years. A general trend towards a reduction in the number of admissions from 1998/1999 to 2000/2001 for both HHS and Ontario was observed, although HHS had a greater relative decline (0.16 percent) as compared to the province (0.04 percent).

A comparison of HHS' experience with CHF admissions to that of the province at both points in time in terms of weighted cases and costs was performed. The median cost for all hospitals reporting direct costs per weighted case was used to calculate provincial costs for CHF admissions. By 2000/2001, provincially, there had been a 12.5 percent increase in CHF weighted cases (versus 41 percent HHS) and the provincial median direct cost had increased by 16 percent (versus 12 percent at HHS) to $117,004,266.

The findings in part two of this research study demonstrate that HHS is serving a different population with respect to weighted cases for CHF admissions as the increase in weighted cases exceeded that of peer comparators and of the province. The Hamilton District Health Council projected growth by age group for the Hamilton population in their 2001/2002 Operating Plan. A 15-16 percent increase was projected for the population aged 45-64 years both in Hamilton and in Ontario between 2001 and 2006. And the 75+ year age group is expected to increase substantially to 12 percent in Hamilton and almost 14 percent in Ontario over the same time period. In 2010 the first baby boomers will be turning 65 and coronary artery disease, which begins to present in this age group, is a leading implication for the later development of CHF. We can expect a swell in the population living with this chronic syndrome who will have high expectations of the health care system in both treatment and diagnosis.

While the analysis of the clinic group versus the control group did not find statistically significant differences in lengths of stay for typical CHF admissions, a promising difference was noted in LOS for all typical admissions (CHF and other) in favour of clinic participants. The actual LOS for clinic participants decreased 3.1 days $\pm$ 6.0 days over ELOS. Control patients demonstrated a 0.73 $\pm$ 10.5 day decrease. In terms of admissions per patient, the 72 clinic patients had a total of 42 admissions post clinic (0.58 admissions per patient in the year following admission to the clinic) and the control group had slightly less at 86 admissions for the 142 patients for a ratio of 0.61 admissions per patient.

Since its inception the heart failure clinic at HHS has had a total of 295 patient referrals of which 161 remain currently active in the clinic with a further 27 referred who have not yet attended their first visit (n = 188). Discharges and deaths totaled 54 and 53 respectively. Using the clinic admission/patient numbers in a modeling exercise, we could expect the population currently managed in the heart failure clinic (188 patients) to have a total of 109 admissions per year at an average of 7.6 days/admission (829 days). A total of 188 patients that were not followed in the clinic could be expected to have 115 admissions at an average of 10.4 days/admission (1,196 days). The net result would be 367 fewer days (1,196 –367) utilized for all typical admissions by the 188 patients followed in the heart failure clinic.

In order to estimate a cost benefit to the organization in this modeling exercise, three methodologies were used to determine and apply a cost factor to avoided patient days. The days were brought to a weighted case value, were multiplied by the *per diem* costs, and the direct cost per weighted case was calculated to a daily rate. The cost benefit varied by methodology from a low of $241,584 to a high of $390,855. The lowest value was used to represent avoided costs at HHS so as not to overstate any potential cost benefit.

The data included in the cost/benefit analysis for HHS in operating this clinic are demonstrated in Table X.

A net positive cost benefit to the organization is demonstrated when expenses over revenue are applied against even the lowest cost value of avoided days at HHS ($241,584).

To reiterate, this net benefit is significant as the business case analysis was conducted assuming full costs to HHS of the expenses incurred annually. Currently, this clinic is funded in a partnership model with industry and one of the outcomes of this study was to the

Table X Cost/benefit analysis HHS HFC

Expenses ($)	Revenue ($)	Avoided inpatient costs ($)	Net ($)
103.122[a]	22,635[b]	241,584	161,097

Notes: [a] Expenses include annual salaries, operating supplies, laboratory testing; [b] Revenue related to outpatient echocardiography, which is part of usual follow-up for heart failure clinic patients

ability to determine real costs and impacts on the organization if this partnership funding can no longer be sustained.

Limitations of the study

A larger sample size and a randomized controlled trial would have added to the rigor of this study and may have contributed to statistically significant findings with respect to admissions, lengths of stay and hospital costs of heart failure. To achieve significance in analysis of LOS versus ELOS a sample of 2,003 patients (alpha of 0.05 and power of 80 percent: using a two-sided *t*-test) would have been necessary. A multi centre trial would be required to achieve these patient volumes.

Qualitative analysis for quality of life and functional indicators would have added depth to this study and could have assisted in understanding the impact of the heart failure clinic on the patients participating and their significant others.

Challenges were faced in deriving and comparing costs from one facility to another and across the province. Direct costs as reported to the Ministry of Health and Long Term Care were used as the basis for calculating the provincial and peer comparator costs (median and average). They can be used as estimates only for the purpose of putting context to the hospital impact of CHF admissions.

Future studies that included total health care access points and costs (emergency room visits, family doctor visits, etc.) would further add to our understanding of the impact of an outpatient management approach to heart failure on total health care costs.

Conclusions

The HFC at HHS is making a positive impact on all types of admissions (CHF admissions and other) in terms of length of stay and suggests that management of co-morbid conditions and health teaching provided in an outpatient setting for chronic disease states may be important for acute care hospitals to consider in analyzing the impact and costs of being in the business of providing outpatient care.

From a financial perspective, the HFC business case analysis reveals a positive benefit to the organization of $143,058 annually when the cost of avoided inpatient avoided days was calculated. While these are not costs that can be removed from the budget of any given unit, they do represent the fact that these beds continue to be staffed and filled with patients with varying diagnoses and acuity requiring inpatient admission. This is an important consideration given that demographic projection for growth in cardiac disease in the service area for HHS between 2001 and 2006 is estimated at 15-16 percent. Avoidance of admissions and LOSs may assist HHS as it accommodates this growth within current funded bed allotments with the support of this outpatient treatment model.

Notes

1 Registered trade mark of the Canadian Institute for Health.
2 RIW™ calibration is derived from the Canadian Institute discharge abstract database (DAD) representing 12 months of discharge abstract data. Only typical cases are used to calculate RIW™ values. Typical cases do not include the following categories: outliers (patient's total LOS is greater than the statistical trim point for LOS); deaths (in-hospital death); signouts (signouts against medical advice); transfers (transferred to or from another acute care institution) (Canadian Institute for Health Information, n.d.).
3 "The design of CIHI's complexity overlay, Plx, is intended to enhance the prediction of resource utilization in acute care" (p. 7). Plx entails dividing each CMG into groupings where co-morbidities and age are overlaid to assist in the prediction of LOS and resource utilization (Canadian Institute for Health Information, n.d.).
4 ELOS is the expected length of stay for a typical CMG which factors in co-morbities and age (Canadian Institute for Health Information, n.d.).

References

Canadian Institute of Health Information (CIHI) (2000), *DAD Resource Intensity Weights*, CIHI, Ottawa.
Canadian Institute of Health Information (CIHI) (n.d.), Provincial (Ontario) Acute Discharge Abstract Database, Fiscal 2000/2001 and Fiscal 20001/2002.
Cintron, G., Bigas, D., Linares, E., Aranda, J.M. and Hernandez, E. (1983), "Nurse practitioner role in a

chronic congestive heart failure clinic: in hospital time, costs and patient satisfaction", *Heart Lung*, Vol. 12, pp. 237-42.

Cline, C.M.J., Israelsson, B.Y.A, Willenheimer, R.B., Broms, K. and Erhardt, L.R. (1998), "Cost-effective management programme for heart failure reduces hospitalization", *Heart*, Vol. 80, pp. 442-6.

Fonarow, G.C., Stevenson, L.W., Walden, J.A., Livingston, N.A., Steimle, A.E., Hamilton, M.A,. Moriguchi J., Tillisch, J.H. and Woo, M.A. (1997), "Impact of a comprehensive heart failure management program on hospital readmission and functional status of patients with advanced heart failure", *Journal of the American College of Cardiology*, Vol. 30, pp. 725-32.

Giles, T. (1996), "The cost-effective way forward for the management of the patient with heart failure", *Cardiology*, Vol. 87 (suppl. 1), pp. 33-9.

Naylor, C.D. and Slaughter, P.M. (1999), C*ardiovascular Health and Services in Ontario: an ICES Atlas*, Institute for Clinical Evaluative Sciences (ICES), Toronto.

Parmley, W.W. (1996), "Cost-effective cardiology", *Clinical Cardiology*, Vol. 19, pp. 240-2.

Paul, S. (1997), "Implementing an outpatient congestive heart failure clinic: the nurse practitioner role", *Heart Lung*, Vol. 26, pp. 486-91.

Rich, M.W., Beckham, V., Wittenberg, C., Leven, C.L., Freedland, K.E. and Carney, R.M. (1995), "A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure", N*ew England Journal of Medicine*, Vol. 333, pp. 119-1195.

Schulman, K.A., Mark, D.B. and Califf, R.M. (1998), "Outcomes and costs within a disease management program for advanced congestive heart failure", *American Heart Journal*, Vol. 35, pp. S285-92.

Smith, L.E., Fabbri, S.A., Pai, R., Ferry, D., Heywood, J.T. and Pettis, J.L., (1997), "Symptomatic improvement and reduced hospitalization for patients attending a cardiomyopathy clinic", *Clinical Cardiology*, Vol. 20, pp. 949-54.

Stanley, M. (1997), "Current trends in the clinical management of an old enemy: congestive heart failure in the elderly", *AACN Clinical Issues*, Vol. 8 No. 4, pp. 616-26.

Stewart, S., Vandenbrock, A.J., Pearson, S. and Horowitz, J.D. (1999), "Prolonged beneficial effects of a home-based intervention on unplanned readmissions and mortality among patients with congestive heart failure", *Archives of Internal Medicine*, Vol. 159, pp. 257-61.

Weinberger, M., Oddone, E.Z. and Henderson, W.G. (1996), "Does increased access to primary care reduce hospital readmissions?, Veterans Affairs Cooperative Study Group on Primary Care and Hospital readmission", *New England Journal of Medicine*, Vol. 34 No. 22, pp. 1441-7.