Consultation with cardiologists for persons with new-onset chronic heart failure: A population-based study

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BACKGROUND: It is recommended that persons recently diagnosed with heart failure consult with a specialist in heart failure.

OBJECTIVES: To determine whether patients who were diagnosed with new-onset chronic heart failure (CHF) by a noncardiologist consulted with a cardiologist, and identify the factors associated with delayed consultation.

METHODS: Physician reimbursement administrative data were obtained for all adults with suspected new-onset CHF in the year 2000 in Quebec, defined operationally as a physician visit for CHF (based on the *International Classification of Diseases, 9th Revision* diagnostic codes), with no previous physician visit code for CHF in the preceding three years. Among those first diagnosed by a noncardiologist, Cox regression modeling was used to identify patient and physician characteristics associated with time to cardiology consultation.

RESULTS: Of the 13,523 persons coded as having incident CHF, 54.9% consulted a cardiologist within the next 2.5 to 3.5 years, and 67.4% were seen by an internist or cardiologist. Older patients, women, and those with lower comorbidity and socioeconomic status had significantly longer times to cardiology consultation.

CONCLUSION: The data suggest that many patients with suspected new-onset CHF do not receive prompt cardiology care, as stipulated by current recommendations. Equity of access for women and those with lower socioeconomic status appears to be problematic.

Key Words: Congestive heart failure; Health policy; Referral to cardiologists

Chronic heart failure (CHF) is a common cause of hospitalization in persons older than 65 years of age (1). The prognosis for patients is relatively poor, with high readmission (2,3) and mortality rates (4-9). New developments in the treatment of CHF have led to improvements in survival, decreased hospital admissions and improved quality of life (6,10). Thus, access to specialists who can implement new treatments and optimize outcomes is extremely important. This importance has been recognized by the Canadian Cardiovascular Society Access to Care Working Group (11), which recommended wait time benchmarks for evaluating heart failure patients. Specifically, severe high-risk cases should be seen within 24 h by a congestive heart failure specialist; urgent cases (including patients who visited an emergency room, or those who were hospitalized two or more times within the past year, and those recently diagnosed with heart failure) should be seen within two weeks. Thus, consultations with specialists may be regarded as an element of quality of care received by newly diagnosed CHF patients.

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Consultation en cardiologie pour insuffisance cardiaque chronique d'apparition récente : Étude de population

HISTORIQUE : On recommande aux personnes qui viennent de recevoir un diagnostic d'insuffisance cardiaque de consulter un spécialiste en la matière.

OBJECTIFS : Déterminer si les patients qui ont reçu d'un non-cardiologue un diagnostic d'insuffisance cardiaque chronique (ICC) d'apparition récente ont consulté un cardiologue et identifier les facteurs associés au retard de la consultation.

MÉTHODES : Les données administratives sur la rémunération des médecins ont été obtenues pour toutes les consultations d'adultes soupçonnés de souffrir d'une ICC d'apparition récente au cours l'année 2000 au Québec, définies aux fins de la présente étude comme des consultations médicales pour ICC (selon la Classification internationale des maladies, 9^e révision des codes diagnostiques), sans code de visite médicale pour ICC au cours des trois années précédentes. Parmi les patients qui ont d'abord reçu leur diagnostic d'un non-cardiologue, le modèle de régression de Cox a été appliqué pour identifier les caractéristiques des patients et des médecins pouvant être associées à l'intervalle avant la consultation en cardiologie.

RÉSULTATS : Parmi les 13 523 personnes à qui on a assigné le code d'ICC incidente, 54,9 % ont consulté un cardiologue au cours des 2,5 à 3,5 années suivantes et 67,4 % ont été vues par un interniste ou un cardiologue. Les patients plus âgés, les femmes et les patients présentant un statut comorbide et socioéconomique plus faible ont consulté significativement plus tardivement en cardiologie.

CONCLUSIONS : Les données laissent penser que de nombreux patients soupçonnés de souffrir d'une ICC d'apparition récente ne reçoivent pas de soins cardiologiques rapidement, comme le stipulent les recommandations actuelles. L'équité en matière d'accès aux soins pour les femmes et les personnes de plus faible statut socioéconomique semble problématique.

A variety of factors may be associated with access to specialized care in CHF. These include characteristics related to the patient, the physician and availability of services. The objectives of the present study were to estimate consultation rate with cardiologists among patients who were diagnosed with new-onset CHF by a noncardiologist and to identify factors associated with time to consultation with a cardiologist. We examined variations in consultations with respect to availability of services, the characteristics of diagnosing physicians, and patient-related differences.

METHODS

Data were obtained from a physician claims administrative database that covers all residents of the province of Quebec. The study population consisted of all adults, 18 years of age and older, who visited a physician for CHF (*International Classification of Diseases, 9th Revision* code 428) at least once in the year 2000 (n=54,699). Data on all

medical services provided to these persons were obtained for the period between January 1997 and June 2003.

All persons who had at least one *International Classification of Diseases, 9th Revision* code visit for CHF in the year 2000 and no previous visit to a physician or hospitalization for CHF in the preceding three years, or hospitalization for CHF within that time period were termed as having incident CHF ($n=22,298$ persons). Within this group, 13,523 (60.6%) persons had their incident CHF diagnosed by a noncardiologist, ie, potentially a 'referring physician' (Figure 1). The presumption was that a physician who records a CHF visit believes that the person has CHF, and on that basis, may (or may not) recommend consultation with a cardiologist.

Using Andersen's model of health services use (12) as the theoretical framework, predisposing factors (patient sex, age, socioeconomic status and comorbidity) and enabling factors (characteristics of the diagnosing doctor: experience, sex and service availability) potentially associated with cardiology consultation were identified. A third component of the model was perception of need; it was believed that all CHF patients should have at least one consultation with a cardiologist. Because of the data-based design of the present study, patient and physician preferences or perceptions of need with regard to consultation with specialists could not be determined.

The rate of cardiology consultations was described and factors associated with time to consultation for these persons were explored. Patient-related factors were age, sex, comorbidity, socioeconomic status and proximity to available services. Comorbidity was characterized by the Deyo et al adaptation (13) of the Charlson comorbidity index (14). Socioeconomic status was based on a validated indicator that uses postal codes to estimate neighborhood socioeconomic status, and provides an ecological index of material and social deprivation (15). Socioeconomic status was dichotomized into the top two and lower three quintiles. Physician-related factors were physician's sex, years since graduation and type of specialty (internist or other specialist versus general practitioner). Service availability was assessed by a patient's proximity to available services. Proximity to available services was classified according to the density of primary and secondary care establishments, and classified as high, moderate or low, depending on whether both, one or none of the primary and secondary services were available. Statistics Canada definitions of rural and urban residence were used, the latter being an agglomeration of 10,000 or more people.

Statistical analysis

As a preliminary analysis, the characteristics of all persons who had an incident diagnostic visit in 2000 ($n=22,298$) were described and categorized according to who made the initial diagnosis (general practitioner, cardiologist, internist or other specialist). The characteristics of patients of general practitioners and cardiologists were then compared using the χ^2 test for binary and categorical characteristics, and the t test for continuous characteristics.

Next, the data on those persons whose incident diagnosis was made by a physician other than a cardiologist ($n=13,523$) were analyzed. Specifically, a bivariate analysis consisted of comparing patients who consulted with a cardiologist at any time during follow-up with those who did not have a consultation, using the same standard statistical tests as those mentioned for the preliminary analysis. Survival analysis methods were also used to analyze the data. In these analyses, the incident CHF visit corresponded to 'time zero' and the time until the first visit to the cardiologist was defined as the 'event time'. Subjects who did not visit a cardiologist until the end of their follow-up (end of the study – June 30, 2003 – or death) were censored at that time. The probability of not consulting with a cardiologist (ie, probability of 'surviving' in a standard survival analysis) was estimated using Kaplan-Meier analysis (also known as the product-limit estimator). The multivariable Cox proportional hazards regression model (16) was then used to estimate independent effects of the following patient characteristics: sex, age, comorbidity and socioeconomic status, and service availability, as well as the characteristics of the physician who made the initial (incident)

Figure 1 Flow chart describing the study population. There were 54,699 persons with a diagnostic visit for chronic heart failure (CHF) in the year 2000. Of these, 22,298 had no CHF coded visit in the previous three years and were considered incident cases of CHF. Among these, 10,900 were first diagnosed (time zero [t_0]) by a general practitioner (GP), 1,709 by an internist (specialist in internal medicine), 914 by another specialist and 8,775 by a cardiologist. Subsequent to the first diagnosis, consultation with a cardiologist is indicated

CHF diagnosis (general practitioner versus internist or other specialist, sex, and years since graduation). The proportional hazards assumption was checked using the method proposed by Grambsch and Therneau (17). The conventional Cox model assumes independence of the observations, which may be incorrect if consultation time depends on the particular practice style of the physician who made the first diagnosis (the potential referring physician) (18,19). To account for this, a novel bootstrap resampling procedure (20,21) was used to ensure approximately correct standard errors, CIs and type I error rates in the Cox regression analyses of clustered data (22,23). Specifically, a two-stage bootstrap procedure was used, in which both physicians and their individual patients were resampled (24).

To explore possible effect modifications, the forward selection procedure (with a $P<0.05$ entry criterion) was used to select those among the prespecified interactions that improved the model significantly. The following sets of interactions were considered:

1. Patient sex with patient age and comorbidity;
2. Specialty of physician who made the incident diagnosis (general practitioner versus specialist) with each of the following: patient sex, patient age, service availability, comorbidity and socioeconomic status; and
3. Socioeconomic status with each of the following: service availability, patient sex and patient age.

RESULTS

The characteristics of the 22,298 persons who had incident CHF visits in 2000 are described in Table 1 according to who made the first diagnosis. Compared with those first diagnosed by a general practitioner, those first diagnosed by a cardiologist were more likely to be men, urban residents, have higher socioeconomic status, reside in high service availability areas, be younger and have a higher comorbidity index ($P<0.001$ for each comparison).

Among the 22,298 persons with incident diagnostic visits in 2000, 13,523 were first assigned a CHF diagnosis by a noncardiologist, mostly by a general practitioner (80.6% of the 13,523; Figure 1). Subsequent to being newly diagnosed with CHF, 7,423 of the 13,523 persons (54.9%) first diagnosed by a noncardiologist consulted with a cardiologist within the study period (Figure 1). If being seen by an internist or a cardiologist subsequent to a diagnosis by a general practitioner or other specialist was

TABLE 1
Characteristics of persons with incident chronic heart failure (CHF) (n=22,298) with a first coded diagnostic visit in 2000 by a general practitioner (GP), cardiologist, internist or other specialist

	GP (n=10,900)	Cardiologist (n=8775)	Internist (n=1709)	Other specialist (n=914)
Women, %	55.4	47.7	54.8	50.3
Urban residents, %	75.1	86.3	68.4	85.4
High socioeconomic status, %	33.7	41.7	31.6	45.6
Availability of services, %				
High	81.1	91.3	69.3	87.7
Medium	13.7	5.9	22.9	8.9
Low	5.3	2.8	7.8	3.4
Patient age, years	72.5±14.8	69.8±14.3	66.7±16.3	64.4±17.2
Charlson Index	4.1±1.8	4.4±1.9	3.9±1.8	4.2±1.9

Data presented as mean ± SD unless otherwise indicated

Figure 2 The time from first diagnosis of chronic heart failure (CHF) until consultation with a cardiologist. The x-axis is in days and the y-axis displays the percentage who have not yet consulted. At time zero days, no one had consulted, and as time progressed, more people consulted. By the end of the study period, 45% had not consulted with a cardiologist

included, the percentage increased to 67.4% (9115 of 13,523). Figure 2 describes the estimated probability of not consulting a cardiologist for the 13,523 persons diagnosed with CHF by a noncardiologist. In particular, 35.1% were seen by the cardiologist in the first three months, 40.8% were seen by six months and 46.3% were seen within 12 months. Among those who did consult a cardiologist during the study period, the mean time between the first diagnostic visit and consultation with the cardiologist was 158.2±255.2 days (median 33 days; interquartile range two to 191 days).

Bivariate analyses indicated that men were more likely to consult a cardiologist than women (59.9% versus 50.8%, $P<0.0001$), as were those who lived in urban centres compared with rural areas (58.9% versus 43.4%, $P<0.0001$) and in areas with high service availability (58.7% in areas with high availability versus 39.8% in areas with medium and low availability). Persons who were younger ($P<0.0001$), had a higher comorbidity index ($P=0.02$) and higher socioeconomic status were more likely to consult a cardiologist (62.6% versus 52.9%, $P<0.0001$). Those first diagnosed with CHF by a female physician were more likely to consult a cardiologist than those first diagnosed by a male physician (58% versus 54.1%, $P=0.0003$), as were those whose diagnosing physicians had been in practice longer ($P=0.0001$). Persons

TABLE 2
Cox regression analysis: Factors associated with time until consultation with a cardiologist

Factor	Consultation with a cardiologist, adjusted HR* (95% CI) [†]
Patient age (per 10 years)	0.91 (0.89–0.94) [‡]
Women versus men	0.78 (0.74–0.82) [‡]
Comorbidity index	1.12 (1.10–1.14) [‡]
Higher versus lower socioeconomic status	1.20 (1.12–1.28) [‡]
Availability of services	
High (reference)	1
Medium	0.55 (0.50–0.62) [‡]
Low	0.67 (0.59–0.76) [‡]
Medical doctor who made first diagnosis	
General practitioner (reference)	1
Internist	0.24 (0.14–0.42) [‡]
Other specialist	0.99 (0.98–1.00)
Medical doctor who made first diagnosis	
Female versus male sex	1.04 (0.93–1.15)
Medical doctor who made first diagnosis	
Time since graduation (per 10 years)	0.90 (0.84–0.95) [‡]
Patient age [‡] (internist made diagnosis)	1.01 (1.01–1.02) [‡]
Patient age [‡] (other specialist made diagnosis)	1.03 (1.02–1.04) [‡]

*A hazard ratio (HR) lower than one indicates that a given covariate was associated with a longer time to consultation, while an HR higher than one indicates a shorter time; [†]95% CI was obtained by the bootstrap technique, to account for the clustering of patients within physicians' practices; [‡] $P<0.05$ (ie, bootstrap-based 95% CI excludes the value 1)

who were initially diagnosed by an internist were the least likely to consult a cardiologist (41.7%) compared with those initially diagnosed by a general practitioner (56.5%) and those diagnosed by other specialists (59.9%) ($P<0.0001$).

Cox multivariable regression was used to model time to consultation with a cardiologist as a function of the factors described above (Table 2). An adjusted hazard ratio of less than one indicates that a given characteristic is associated with a longer time to consultation and an adjusted hazard ratio higher than one indicates a shorter time (ie, higher probability of having a consultation during the follow-up period). Older patients, women, those with a lower comorbidity index and lower socioeconomic status, and living in areas with medium or low service availability had significantly longer times to cardiology consultation. Also, those who were first diagnosed by an internist and whose doctor had more experience (longer time since graduation) were less likely to consult and had a longer time to consultation with a cardiologist. Neither urban location nor physician sex were statistically significant in the multivariate model. There were statistically significant interactions between a patient's age and the specialty of his or her physician (Table 2). The estimated interaction coefficients indicated that the tendency for older persons to have a longer time to consultation with a cardiologist was weaker among those who had CHF diagnosed by an internist and especially by other specialists, than by general practitioners. These interactions also imply that the mean time to consultation for those who were initially diagnosed by different types of doctors gets closer as patients get older. No other interactions were statistically significant at the 0.05 level.

DISCUSSION

Slightly more than one-half of patients first diagnosed with CHF by a noncardiologist consulted with a cardiologist over the next 2.5 to 3.5 years. For those who did consult with a cardiologist, the mean time to consultation was approximately five months, although the median time was approximately one month. Current benchmarks regarding

consultation with a specialist range between one day and one month, depending on the urgency of the condition (11). Although the data from the present study predate the recommendations that have been issued regarding these benchmarks, there were other recommendations in place that suggested that patients with higher-risk CHF be managed by multidisciplinary hospital-based clinics staffed with physicians, nurses and other health care professionals with expertise in CHF (25,26).

Disease severity may impact the perceived need for consultation because those with more severe disease may be diagnosed sooner and specialized treatment may be considered more urgent (27,28). Although there is no direct indicator of severity in the database, those with higher comorbidity consulted a cardiologist sooner. Higher consultation rates for persons with more comorbidities has been reported by other authors (28-30). Also, we cannot know whether consultations constitute all referrals because some patients may not have followed through with their referrals. We were not able to address other issues related to accessibility, such as wait times to book an appointment or difficulties on the part of patients to access care (eg, physical disabilities, lack of transportation, inclement weather, etc).

We found that men consulted a cardiologist more often and had a shorter time from diagnosis to consultation. This observation is supported by the findings that there are more men than women admitted to specialized CHF disease management programs (31,32) and that women tend to be followed more by general practitioners than by specialists (33,34).

Older age was associated with less cardiology consultation and longer delays to consultation. This is consistent with results for persons with suspected rheumatoid arthritis consulting with rheumatologists (35,36). Patients first diagnosed by internists consulted cardiologists later than other physicians. This stands to reason, because many internal medicine specialists follow their patients with complex medical conditions such as CHF.

Persons with higher socioeconomic status consulted a cardiologist earlier than those with lower socioeconomic status. We found a similar result when comparing time to referral to specialized CHF clinics (37). Moreover, this was shown previously in studies assessing care for myocardial infarction and rheumatoid arthritis (35,36,38-40). Even in a socialized medicine context, there appears to be a propensity for those with higher socioeconomic status to access services sooner, indicating problems with equity of access.

It is not surprising that persons who resided in areas with high service availability consulted with cardiologists more often and sooner than those living in areas with lower or medium service availability. Some patients living in areas with low service availability may undergo appropriate evaluations by general practitioners (41). Nevertheless, we need to be alerted to this potential problem of access inequity.

Persons first diagnosed by physicians with more experience (longer time since graduation) tended to consult cardiologists later. Forrest et al (28) reported that discretionary referral to specialists was higher for physicians with fewer years in practice. Possibly those with more experience refer less rapidly, and prefer to investigate and manage their patients before consulting a specialist in cardiology.

Limitations

Data-based studies such as ours have inherent limitations. These include a lack of quality control over diagnostic coding and no indication of the severity of disease. We contend that if a patient receives a coded diagnosis of CHF by their physician, then the physician likely believes that the patient has CHF. Thus, we evaluated the rate of consultation to cardiology for those who were diagnosed with CHF by their noncardiologist physician. This did not include those patients for whom the physicians did not code a diagnosis of CHF but may have suspected it and referred to cardiology for confirmation of diagnosis or further investigation. In general, the specificity of the coded CHF diagnosis is considered to be high, although the sensitivity may be only fair to good (42). There may have been cases that were missed, as well as undercounted comorbidities. Nevertheless, the prevalence of CHF was one per 100 patients,

which is consistent with the estimated 300,000 cases of heart failure in Canada (43). We classified persons as having suspected new-onset CHF if they did not visit a physician for CHF in the previous three years. The cumulative incidence of CHF was 4.1 per 1000 patients, which is slightly higher than the 3.8 per 1000 patients reported elsewhere (44). Some cases of CHF may not have had a coded visit for CHF in the past three years and may have been erroneously included as incident cases in our cohort. They may have been more likely to have consulted with a cardiologist because they may have done so in the past. If that is the case, then the rate of consultation among truly incident CHF cases in our study may actually be lower than that reported. Finally, in the present data-based study, we had no information regarding patient preferences and other types of consultations that were not recorded in the administrative databases (informal consultations, consultations with physicians who are either on salary or do not subscribe to the public insurance regime, consultations with a nurse, etc).

CONCLUSIONS

Slightly more than one-half of the patients diagnosed by a noncardiologist with new-onset CHF consulted a cardiologist. Equity of access for women and those with lower socioeconomic status may be problematic and may require further investigation. We should also be aware of management problems in areas with lower service availability.

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