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Physician Continuity Improves Outcomes for Heart Failure Patients Treated and Released From the Emergency Department

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ABSTRACT

OBJECTIVES The goal of this study was to evaluate the effect of physician continuity for patients with heart failure (HF) treated and released from the emergency department (ED).

BACKGROUND Although current guidelines recommend early follow-up after hospital discharge, it is unclear if it is beneficial in patients sent home from the ED and whether this follow-up should be with a familiar physician.

METHODS This was a retrospective cohort of all adults treated and released from 93 EDs in Alberta, Canada, from 1999 to 2009 with a first-time most responsible diagnosis of HF. Cox proportional hazards models with time-varying covariates for post-ED outpatient visits were used.

RESULTS In 12,285 patients (mean age 74.9 years), the rate of death or all-cause hospitalization at 6 months was lower in those who saw a familiar physician (37.3%; adjusted hazard ratio [aHR]: 0.89 [95% confidence interval (CI): 0.83 to 0.96]) in the first month versus those with no outpatient visits (58.1%; aHR: 1.00 [referent]) or visits only with unfamiliar physicians (40.2%; aHR: 1.04 [95% CI: 0.94 to 1.15]). Taking into account all outpatient visits over each observation period and excluding those without follow-up, death or hospitalization was less common in those patients being followed up by a familiar physician (aHR of 0.79 [95% CI: 0.71 to 0.89] at 3 months; aHR of 0.86 [95% CI: 0.77 to 0.95] at 6 months; and aHR of 0.87 [95% CI: 0.80 to 0.96] at 12 months compared with unfamiliar physician follow-up). Any follow-up within 30 days of ED release was associated with a lower risk of repeat ED visit or death at 6 months (aHR: 0.78 [95% CI: 0.73 to 0.82] for familiar physicians; aHR: 0.79 [95% CI: 0.72 to 0.86] for unfamiliar physicians).

CONCLUSIONS Early follow-up after an ED visit is associated with better outcomes, particularly if conducted with a familiar physician. (J Am Coll Cardiol HF 2014;2:368–76) © 2014 by the American College of Cardiology Foundation.

Heart failure (HF) is a growing burden on the healthcare system, responsible for >1 million U.S. emergency department (ED) visits yearly (1). HF is projected to have a total economic cost in the United States of $42.9 billion by 2020 (2). Although most patients with HF who present to the ED are admitted to the hospital, approximately 25% to 35% are discharged directly from the ED (3,4). Outcome data for these "treated and released" patients are limited because most studies of HF epidemiology and outcomes have focused on hospitalized patients. However, we have recently reported mortality and hospitalization rates in these patients that are as bad as those for patients admitted to the hospital (4), and another Canadian study reported that patients treated and released from the

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ED actually have worse 30-day outcomes than those admitted (3), suggesting less than optimal triage in EDs.

Early outpatient follow-up, especially with physicians familiar with that patient, is associated with better outcomes for HF patients discharged from the hospital (5,6). In those treated and released directly from the ED, early follow-up (within 4 weeks) has also been shown to be associated with reduced hospitalizations and mortality (7). However, those findings

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arose from a landmark analysis in which patients with events in the first 100 days of the ED visit were excluded, and patients were "locked in" to comparator groupings based on visits before the landmark time, a method shown to provide potentially distorted estimates of treatment effect (8). Although the 2013 American Heart Association Heart Failure Guidelines recommend early follow-up after hospital discharge, they do not make any specific recommendations for early follow-up post-ED release (9).

In many Canadian EDs, this follow-up is facilitated by referring the patient to an urgent access clinic associated with that ED; thus, the question of whether continuity of care is important arises. Several studies have shown that in patients admitted to the hospital, post-discharge follow-up with a physician familiar with that patient results in lower rates of mortality and/or rehospitalization (6,10–12). However, to our knowledge, there are no published studies evaluating whether the benefits of physician continuity extend to HF patients treated and released directly from the ED. This information is important because to achieve recommended target follow-up times, continuity is often sacrificed.

We thus designed the present study to examine whether outcomes differed for HF patients treated and released from the ED if they followed up with physicians who knew them (i.e., treated them previously or saw them during the ED visit) compared with following up with a physician unfamiliar with their case.

METHODS

STUDY SETTING AND DATA SOURCE. Alberta is a Canadian province with a government-funded universal healthcare system providing free access to physicians, hospitals, and EDs to 3.7 million people. We used de-identified linked data from 4 administrative databases for this study. The Ambulatory Care Classification System database records all patient visits to EDs with coding for up to 10 conditions, including the most responsible diagnosis assigned by the attending ED physician at the time of discharge from the ED. The Health Practitioner Claims Database tracks all physician claims for services and includes up to 3 diagnoses per encounter; it is linked with the College of Physicians & Surgeons of Alberta to provide information on physician specialty. The Alberta Health Care Insurance Plan registry tracks vital status of all Albertans and includes date of death or emigration from the province. The Discharge Abstract Database includes admission date, discharge date, most responsible diagnosis, up to 25 other diagnoses, and the acuity for all hospitalizations to any of the acute care hospitals in Alberta.

STUDY COHORT. We identified all patients discharged alive from an ED ("treated and released") between January 1, 1999, and June 30, 2009, with a most responsible diagnosis of HF (International Classification of Diseases-Ninth Revision-Clinical Modification, code 428.x or International Classification of Diseases-10th Revision, code 150.x). These diagnostic codes have been shown to be accurate in Alberta, with a positive predictive value of 91% when validated against a random chart audit of 4,008 patients (13). We selected only the patient's first ED treated-and-released visit for a most responsible diagnosis of HF for our analysis. Patients who were admitted to the hospital within 1 day of the index visit were excluded from our primary analysis because the databases we used only record day of service rather than time, and thus we could not be certain that an admission the day after an ED index visit was not part of the same episode of care. In a sensitivity analysis, patients admitted within 2 days of their index ED visit were excluded. Note that even if patients are held in the ED awaiting a ward bed in the hospital, they are coded as "admitted inpatients" in the Discharge Abstract Database from the date the decision to admit was made, not the date they finally arrived on an inpatient ward. In a separate sensitivity analysis, we excluded patients discharged from the ED back to a long-term care facility.

OUTCOMES. Our primary outcome of interest was death or urgent/emergent admission to the hospital within 6 months of an ED visit at which they were treated and released. This composite outcome is highlighted by the American Heart Association's Get With The Guidelines-Heart Failure project, the Canadian Cardiovascular Society, and the Joint Commission as a patient-relevant and important outcome (14–17). Our primary analysis used a 6-month time frame, but we also analyzed 3- and 12-month time frames as secondary outcomes and examined

ABBREVIATIONS AND ACRONYMS

ACE-I = angiotensin-converting enzyme inhibitor
aHR = adjusted hazard ratio
CI = confidence interval
HF = heart failure
ED = emergency department
UPC = usual provider of continuity

repeat ED visits and/or death as another secondary outcome.

COVARIATES. Comorbidities for each patient were identified by using International Classification of Diseases-Ninth Revision-Clinical Modification, and International Classification of Diseases-10th Revision, codes from the Ambulatory Care Classification System, the Discharge Abstract Database, and the Health Practitioner Claims Database, using data from the index ED visit and all healthcare visits in the previous 12 months. This method and these codes have previously been validated in the databases (6). Physicians were classified as specialists if their Alberta College of Physicians & Surgeons specialty was internal medicine or cardiology. We included patient postal codes, and patients were classified as rural based on the second character of their residence (18). ED volumes were defined on the basis of total number of visits for any diagnosis per year, and we created tertiles for risk adjustment because earlier research has shown outcome differences for patients seen in low- versus high-volume EDs (4).

CONTINUITY MEASURES (EXPOSURE OF INTEREST). Time-dependent covariates were used to capture physician continuity categories during the first month post-ED visit (no physician visits; ≥1 visit with a familiar physician; and all visits with unfamiliar physicians), thereby including all patients even if they had an event during this time and adjusting for potential differences in time to first (and subsequent) visits. Similar to previous studies (5-7,19), the physician continuity classification for our primary analysis was "locked in" at the end of the first month (or at the time of an outcome event if it occurred in that first month) and did not take into account additional outpatient visits during the remainder of the observation period for each patient.

We used the Physician Services Database to identify all physicians each patient saw in the year before and during their index ED visit and defined familiar physicians as those who had seen the patient at least twice in the year before the index HF ED visit or during the index HF ED visit. Patients with familiar physician follow-up could have had visits with both familiar and unfamiliar physicians in the first month after ED release. There is high concordance between patient self-report and Canadian administrative data for identifying providers of care; in a cross-sectional study, 79% of physicians having ≥2 outpatient visits in the previous year with a particular patient were classified by that patient as their regular care provider (20). All physician visits were included regardless of the billing diagnosis.

In a sensitivity analysis, provider continuity was expressed throughout the first 6 months after discharge (rather than the first 30 days alone) by using Breslau's usual provider of continuity (UPC) expressed as a time-varying covariate (thereby again taking into account potential differences between groups in timing of visits). The UPC is a commonly used measure (11,12) calculated as n/N, where n is the number of visits to the physician of interest and N is the total number of visits to any physician in a specified time frame (21). UPC scores range from 0 (perfect "discontinuity") to 1 (perfect continuity). Because the UPC is not normally distributed, we categorized UPC scores into 4 groups to be consistent with other studies using the UPC (0; 0.01 to 0.49; 0.5 to 0.99; and 1) (6). Because UPC is undefinable in patients without a physician visit, this analysis excludes patients with an outcome before any post-ED outpatient visits.

STATISTICAL ANALYSIS. Baseline characteristics were compared between continuity groups by using chi-square tests and analysis of variance for categorical and continuous variables, respectively. Crude Kaplan-Meier plots were used for visual display of comparisons between continuity groups based on the first 30 days after discharge from the ED. The effect of physician continuity on the composite outcome of death or urgent hospitalization was analyzed by using Cox proportional hazards models with time-varying covariates as already described and including prognostically and statistically significant baseline covariates. P values <0.05 were considered to be significant. All statistical analysis was performed by using SAS version 9.3 (SAS Institute, Inc., Cary, North Carolina) and R 2.12.2 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

PATIENT CHARACTERISTICS. Over 10 years, 12,285 (36.6%) of the 33,589 adult Albertans with a first-time diagnosis of HF assessed in an ED were treated and released (**Table 1**). Of these 12,285 patients, 2,531 (20.6%) did not see a physician for follow-up within 30 days of discharge. These patients were older (mean age 76.7 years), had more comorbidities, were more likely to live in a rural setting (37.8%), were more likely to visit a low-volume ED (49.9%), had the highest rates of ED visits in the previous year (mean visits 3.6), and were more likely to have been hospitalized at least once in the year preceding the ED visit (50.8%). These patients were also least likely to have previously received specialist care (31.4%).

Most patients with HF treated and released directly from the ED had at least 1 outpatient physician

follow-up visit in the first month post-release (79.4%). Approximately one-tenth saw only unfamiliar physicians for follow-up during these first 30 days (11.6%), whereas most patients had at least 1 visit with a familiar physician (n = 8,349 [67.9%]) in the 30 days after ED release. Of those patients with at least 1 familiar physician visit, the mean ± SD UPC score was 0.9 ± 0.2; 96.5% of patients followed up with a physician who saw them at least twice as outpatients in the year before their ED visit, and 19.7% had follow-up with a physician who saw them during their ED visit (16.2% had follow-up with both physicians who saw them before as well as during their ED visit). Patients receiving familiar physician follow-up after the index ED visits had more comorbidities (diabetes, hypertension, and atrial fibrillation) compared with the unfamiliar group and were also far more likely to have office visits in the preceding year (mean 16.4 vs. 8.6), including a higher proportion previously visiting a specialist (51.0% vs. 38.4%). There was no significant difference between the 3 patient groups in the rate of specialist consultation during the ED visit, although the absolute figure was low (3.8% to 4.2%).

OUTCOMES DURING FIRST 30 DAYS. At 30 days' post-ED release, more patients in the no follow-up visit group died or were admitted to the hospital (n = 643 [25.4%]) (Table 2) than those following up with an unfamiliar physician (n = 303 [21.6%]) or a familiar physician (n = 1,428 [17.1%]). Repeat ED visits within that month were also lower for the patients in the familiar follow-up group compared with the unfamiliar follow-up group (37.3% vs. 41.4%), despite the fact that the unfamiliar follow-up group were more likely to see a specialist in that first month (31.2% vs. 24.1%) and had fewer comorbidities at baseline.

EFFECT OF PHYSICIAN CONTINUITY WITHIN 30 DAYS AFTER INDEX ED VISIT. Familiar physician follow-up in the first 30 days' post-ED release was associated with a lower risk of death or hospitalization at 3, 6, and 12 months (Table 3, Fig. 1) compared with either no follow-up or follow-up with unfamiliar physicians only. This association remained essentially unchanged when the 421 patients released from the ED back to their long-term care facility were excluded (Online Table 1A) and when the 249 patients admitted to the hospital within 2 days of the ED visit were excluded (Online Table 2A). Unfamiliar physician follow-up in the first 30 days after an ED visit was not associated with any reduction in risk of death or hospitalization compared with no outpatient follow-up.

However, any physician follow-up (whether familiar or unfamiliar) within 30 days of ED release

TABLE 1 Baseline Characteristics

	Physician Continuity During First 30 Days				
	One or More Visits With Familiar Physician(s) (n = 8,349)	All Visits With Unfamiliar Physician(s) (n = 1,405)	No Visits (n = 2,531)	Overall (n = 12,285)	p Value
Male	4,385 (52.5)	754 (53.7)	1,222 (48.3)	6,361 (51.8)	0.0003
Age, yrs	74.7 ± 11.7	73.2 ± 13.5	76.7 ± 13.3	74.9 ± 12.3	<0.0001
Rural residence	2170 (26.0)	364 (25.9)	957 (37.8)	3,491 (28.4)	<0.0001
Health resource use					
At least 1 ED visit in previous 365 days	5,983 (71.7)	941 (67.0)	1,906 (75.3)	8,830 (71.9)	<0.0001
No. of ED visits in previous 365 days	3.0 ± 5.4	2.6 ± 4.4	3.6 ± 5.6	3.1 ± 5.3	<0.0001
At least 1 hospitalization in previous 365 days	3,949 (47.3)	568 (40.4)	1,287 (50.8)	5,804 (47.2)	<0.0001
No. of hospitalizations in previous 365 days	0.9 ± 1.3	0.8 ± 1.4	1.1 ± 1.6	0.9 ± 1.4	<0.0001
No. of physician office visits in previous 365 days	16.4 ± 12.1	8.6 ± 8.0	8.1 ± 7.4	13.8 ± 11.5	<0.0001
No. of unique providers (office claims) in previous 365 days	4.2 ± 2.5	3.4 ± 2.5	2.8 ± 2.1	3.8 ± 2.5	<0.0001
IM/cardiology specialist seen during index ED visit	350 (4.2)	53 (3.8)	103 (4.1)	506 (4.1)	0.76
IM/cardiology specialist seen during index ED visit or previous 365 days	4,365 (52.3)	570 (40.6)	847 (33.5)	5,782 (47.1)	<0.0001
Mean Charlson Comorbidity Index at index ED visit (1-year DAD and ACCS review)	3.3 ± 1.8	3.2 ± 1.7	3.5 ± 2.0	3.4 ± 1.8	<0.0001
Comorbidities at time of discharge from index ED visit (1-yr DAD and ACCS review)					
Diabetes	1,954 (23.4)	257 (18.3)	542 (21.4)	2,753 (22.4)	<0.0001
Hypertension	2,838 (34.0)	409 (29.1)	834 (33.0)	4,081 (33.2)	0.0015
Dementia	225 (2.7)	49 (3.5)	160 (6.3)	434 (3.5)	<0.0001
COPD	2,023 (24.2)	322 (22.9)	690 (27.3)	3,035 (24.7)	0.0021
Anemia	952 (11.4)	148 (10.5)	358 (14.1)	1,458 (11.9)	0.0002
Cerebrovascular disease	568 (6.8)	72 (5.1)	203 (8.0)	843 (6.9)	0.0025
Renal disease	712 (8.5)	98 (7.0)	271 (10.7)	1,081 (8.8)	0.0001
Cancer	423 (5.1)	65 (4.6)	136 (5.4)	624 (5.1)	0.59
PVD	512 (6.1)	88 (6.3)	152 (6.0)	752 (6.1)	0.95
Atrial fibrillation	1,887 (22.6)	223 (15.9)	499 (19.7)	2,609 (21.2)	<0.0001
Previous MI or revascularization	1,159 (13.9)	147 (10.5)	284 (11.2)	1,590 (12.9)	<0.0001
ED size (annual visits, all diagnoses)					
Low (<25,998 annual ED visits)	3,092 (37.0)	488 (34.7)	1,263 (49.9)	4,843 (39.4)	<0.0001
Medium (25,998–65,817 annual ED visits)	2,972 (35.6)	522 (37.2)	696 (27.5)	4,190 (34.1)	
High (>65,817 annual ED visits)	2,285 (27.4)	395 (28.1)	572 (22.6)	3,252 (26.5)	

Values are frequency (%) or mean ± SD. A familiar physician is defined as one who had seen the patient at least twice as an outpatient in the year before the index ED visit or at least once during their index ED visit.

ACCS = Ambulatory Care Classification System; COPD = chronic obstructive pulmonary disease; DAD = Discharge Abstract Database; ED = emergency department; IM = internal medicine; MI = myocardial infarction; PVD = peripheral vascular disease.

TABLE 2 Outcomes During First 30 Days Post-ED Treat and Release HF Visit

	Physician Continuity During First 30 Days				
	One or More Visits With Familiar Physician(s) (n = 8,349)	All Visits With Unfamiliar Physician(s) (n = 1,405)	No Visits (n = 2,531)	Overall (n = 12,285)	p Value
At least 1 outpatient visit (any cause)	8,349 (100.0)	1,405 (100.0)	0	9,754 (79.4)	<0.0001
IM/cardiology specialist office visit	2,010 (24.1)	439 (31.2)	0	2,449 (19.9)	<0.0001
Post-discharge ED visit (all-cause)	3,118 (37.3)	581 (41.4)	1,049 (41.4)	4,748 (38.6)	<0.0001
Nonelective hospital admission	1,374 (16.5)	290 (20.6)	555 (21.9)	2,219 (18.1)	<0.0001
Death	116 (1.4)	27 (1.9)	178 (7.0)	321 (2.6)	<0.0001
Death or nonelective hospital admission	1,428 (17.1)	303 (21.6)	643 (25.4)	2,374 (19.3)	<0.0001
Admitted to long-term care facility	140 (1.7)	33 (2.3)	248 (9.8)	421 (3.4)	<0.0001

Values are frequency (%).
HF = heart failure; other abbreviations as in Table 1.

was associated with a lower risk of repeat ED visit or death at 3, 6, and 12 months (Table 4).

EFFECT OF PHYSICIAN CONTINUITY THROUGHOUT OBSERVATION PERIOD. After excluding those patients with no outpatient visits post-ED release, we examined the relationship between physician continuity (using the UPC score) over the entire observation time (i.e., not just the first 30 days) and our primary outcome. We found that any degree of familiar follow-up was associated with significantly lower risks of death or hospitalization compared with follow-up only with an unfamiliar physician (Table 3): adjusted hazard ratio (aHR) of 0.79 (95% confidence interval [CI]: 0.71 to 0.89) at 3 months, aHR of 0.86 (95% CI: 0.77 to 0.95) at 6 months, and aHR of 0.87 (95% CI: 0.80 to 0.96) at 12 months. This association persisted when long-term care patients were excluded (Online Table 1B), when patients admitted to hospital within 2 days of the ED visit were excluded (Online Table 2B), and when those patients whose "familiar physician follow-up" was with the physician who had seen them during their index ED visit were excluded (Online Table 3B). A similar pattern was observed with lower rates of repeat ED visits/death in those with familiar follow-up compared with those with unfamiliar follow-up (Table 4): aHR of 0.90 (95% CI: 0.81 to 0.99) at 3 months; aHR of 0.91 (95% CI: 0.83 to 0.99) at 6 months; and aHR of 0.92 (95% CI: 0.84 to 0.997) at 12 months.

MEDICATION USE. Patients following up with familiar physicians had higher rates of use for angiotensin-converting enzyme inhibitors (ACE-Is), angiotensin receptor blockers, beta-blockers, and diuretics both before and after the index ED visit (Table 5). However, when we added ACE-I/angiotensin receptor blocker/beta-blocker use as covariates for our primary and secondary analyses, aHRs were essentially unchanged (Online Table 4).

DISCUSSION

We found that more than three-quarters of patients in Alberta treated and released from the ED with a most responsible diagnosis of HF were seen in an outpatient clinic within 30 days of ED discharge. We also found that more than two-thirds of these patients were followed up by a physician who had previously seen them. Both of these proportions are much higher than reports from the United States (5). Although follow-up with any physician post-ED visit was associated with reduced risk of a repeat ED visit, only follow-up with a familiar physician was associated with a statistically significantly lower risk of subsequent death or hospitalization. This pattern was evident within the first month and persisted when we extended the continuity observation period out as far as 12 months.

In 2 previous studies (7,22) examining patients with HF discharged directly from the ED, early physician follow-up was associated with better outcomes; neither study, however, evaluated the impact of physician continuity, and both combined the outcomes of death, hospitalization, or repeat ED visits into 1 composite endpoint. Thus, our study provides novel information and suggests that rather than arranging follow-up at an urgent access clinic where the patient would see a new physician, outcomes for these patients may be optimized by facilitating follow-up with a physician familiar with their case (either their primary care physician or a physician who had seen them during their ED visit).

Our present study corroborates our previous report showing the benefits of physician continuity for HF patients discharged from the hospital (6); in fact, we found a stronger association between continuity and better outcomes in this study of patients treated and released from the ED than in our study of hospitalized patients. Physician continuity has been

TABLE 3 Association of Physician Continuity With Time to Death or Urgent Admission

Observation Time	Continuity in Month 1	Proportion With Event	Events Per 100 PYs	Unadjusted HR (95% CI)	Adjusted HR* (95% CI)
Base Analysis—Continuity in Month 1 Captured as Time-Dependent Variable, All Patients Included					
3 months	No visits	49.3%	242	1.00 (referent)	1.00 (referent)
	All visits with unfamiliar physician(s)	30.4%	160	0.96 (0.86–1.08)	1.09 (0.97–1.22)
	≥1 visit with familiar physician(s)	25.2%	132	0.84 (0.78–0.91)	0.87 (0.81–0.95)
6 months	No visits	58.1%	183	1.00 (referent)	1.00 (referent)
	All visits with unfamiliar physician(s)	40.2%	115	0.92 (0.83–1.01)	1.04 (0.94–1.15)
	≥1 visit with familiar physician(s)	37.3%	104	0.87 (0.81–0.92)	0.89 (0.83–0.96)
12 months	No visits	68.1%	136	1.00 (referent)	1.00 (referent)
	All visits with unfamiliar physician(s)	51.7%	83	0.88 (0.80–0.96)	1.00 (0.91–1.10)
	≥1 visit with familiar physician(s)	51.8%	81	0.89 (0.84–0.94)	0.91 (0.85–0.97)
Sensitivity Analysis—Continuity Captured as Time-Dependent Variable Throughout Entire Duration of Observation, Excluding Patients Without Outpatient Visits					
Observation Time	**Continuity Throughout Observation Time**	**Proportion With Event†**	**Events Per 100 PYs†**	**Unadjusted HR (95% CI)**	**Adjusted HR* (95% CI)**
3 months	Outpatient visits but none with familiar physician	31.3%	161	1.00 (referent)	1.00 (referent)
	≥1 visit with familiar physician(s)				0.79 (0.71–0.89)
	<50% of visits with familiar physician(s)	15.1%	120	1.00 (0.81–1.23)	0.80 (0.64–0.99)
	50%–99% of visits with familiar physician(s)	15.6%	113	0.91 (0.80–1.04)	0.72 (0.62–0.84)
	All visits with familiar physician(s)	32.2%	147	0.90 (0.80–1.00)	0.81 (0.72–0.92)
6 months	Outpatient visits but none with familiar physician	41.8%	116	1.00 (referent)	1.00 (referent)
	≥1 visit with familiar physician(s)				0.86 (0.77–0.95)
	<50% of visits with familiar physician(s)	22.6%	82	0.96 (0.82–1.12)	0.81 (0.69–0.95)
	50%–99% of visits with familiar physician(s)	25.6%	88	0.997 (0.90–1.11)	0.81 (0.72–0.92)
	All visits with familiar physician(s)	52.4%	121	0.98 (0.89–1.08)	0.88 (0.79–0.98)
12 months	Outpatient visits but none with familiar physician	54.9%	86	1.00 (referent)	1.00 (referent)
	≥1 visit with familiar physician(s)				0.87 (0.80–0.96)
	<50% of visits with familiar physician(s)	34.9%	63	1.00 (0.89–1.14)	0.85 (0.74–0.96)
	50%–99% of visits with familiar physician(s)	39.9%	69	1.06 (0.96–1.16)	0.85 (0.76–0.94)
	All visits with familiar physician(s)	75.1%	101	1.01 (0.93–1.11)	0.89 (0.81–0.99)

*Covariates included in adjusted models at each time frame include: age, gender, rural versus urban residence, Charlson Comorbidity Index at baseline, number of ED visits for any cause in 6 months before the index HF ED visit, number of outpatient office visits for any cause in the year before the index HF ED visit, specialist involvement during index HF ED visit, outpatient visits for any cause with specialist before index HF ED visit, long-term care facility admission, and presence/absence of diabetes, atrial fibrillation, dementia, and previous MI or coronary revascularization. For the sensitivity analysis, the number of outpatient visits after ED visit were included up to the various time frames. †Note that the crude data (proportion with event and events per 100 patient-years [PYs]) are misleading in the sensitivity analysis. For the time-varying groups used in the Cox models, each patient will always start with a usual provider of continuity (UPC) of 1 or 0 after their first follow-up visit. Subsequent follow-up time (i.e., the denominator for the PYs column) will continue to accrue in their starting group if their UPC remains 0 or 1, switch to one of the intermediate groups ($0 < UPC < 0.5$ or $0.5 < UPC < 1$) as soon as they see a different physician, or will be censored if they have an event. Thus, patients having an event while in the UPC 1 or UPC 0 group will count in the numerator for that group but without further accrual of follow-up time in the denominator; on the other hand, as patients who have not had an event transition into the intermediate groups ($0 < UPC < 0.5$ or $0.5 < UPC < 1$), their follow-up PYs will accrue in the intermediate group denominators, thus providing misleadingly low "events per 100 PYs" in those groups. This is not an issue in the Cox models used to generate the HR for the sensitivity analysis since the risk sets are re-evaluated at each time point based on the time-varying UPC values.

CI = confidence interval; HR = hazard ratio; other abbreviations as in Tables 1 and 2.

shown to improve outcomes in ambulatory patients with chronic conditions (23) and has been studied after discharge for various other illnesses (10,11). The impact of provider continuity on ED visits has been less well studied. Some studies have shown a decrease in ED visits in outpatients with greater physician continuity, regardless of medical diagnosis (24–26), but they did not specifically follow up these patients after being treated and released from an ED to see if post-ED physician continuity was also associated with better outcomes. Thus, our findings fill an important knowledge gap in the continuity literature.

Why did we observe a greater effect of continuity in these HF patients discharged from the ED? Until recently, ED physicians did not have a tool to risk-stratify new acute HF patients; whether the Emergency Heart Failure Mortality Risk Grade improves outcomes for HF patients treated and released from the ED is an open question (27). Other authors have shown that hospitalized HF patients often have cardiovascular medications initiated, whereas patients treated and released from the ED are more likely to have these agents stopped (28). In our cohort, we found significantly higher use of beta-blockers, ACE-Is, and diuretics among patients following up with a familiar physician, which may have mitigated the negative effect of ED visit on pharmacotherapy. However, although ACE-Is and beta-blockers are known to improve outcomes in HF patients, controlling for their use in our multivariate

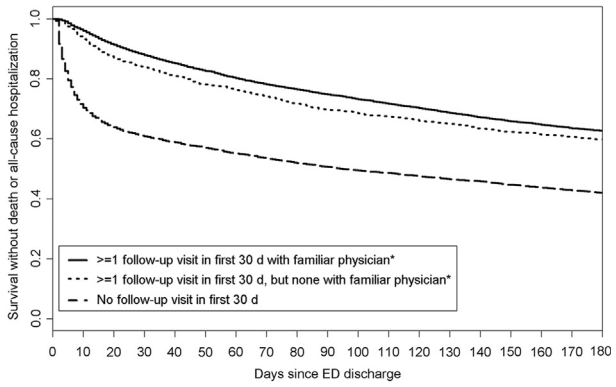

FIGURE 1 Unadjusted Kaplan-Meier Curve for the Time to Death or Hospitalization After Index ED Treat-and-Release Visit, Based on Follow-Up Patterns Within the First 30 Days

*Familiar physician was defined as one who had seen the patient at least twice in the year before the index emergency department (ED) visit or once during the index ED visit.

analysis did not change our results, indicating that there are factors other than medications through which provider continuity affects outcomes.

STUDY LIMITATIONS. There are several strengths to our study: we were able to categorize physician continuity and define outcomes by using population-based data in a universal healthcare setting with 100% capture of all outpatient, ED, and hospital visits in a single Canadian province. The Alberta administrative databases do not include indicators of severity of HF; these indicators (elevated creatinine and heart rate, lower blood pressure, lower ejection fraction, and length of ED stay) have all been shown to negatively affect outcomes in HF patients in the ED (3,27). The outcomes we did examine (death, all-cause hospitalization, and all-cause ED visits) are relevant to all HF patients and system planners. Of note, we examined all-cause hospitalizations or ED visits but do recognize that less than one-third of repeat visits in patients with HF are for a most responsible diagnosis of HF. In contrast to many previous studies examining physician continuity, we used time-varying covariate analyses to account for immortal time bias and did not exclude early events (as was done in landmark analyses) (29). Although we were unable to assess and control for the dissemination of information from the ED to outpatient physicians, even direct verbal communication between hospital and outpatient physicians was not found to have any impact on readmission rates in a recent study (30). Because the present study was based on secondary analysis of administrative data, we cannot determine whether the ED physician recommended follow-up for patients or whether such appointments were scheduled at the time of ED discharge. Moreover, we do not have any information on the length of follow-up visits or the quality/comprehensiveness of care offered at those visits. Although more than two-thirds of patients in both arms had at least 1 ED visit or hospitalization for any cause in the previous year, there were differences in the number of outpatient visits that may have led to erroneous undercoding of comorbidities in the unfamiliar physician arm, although the mean Charlson Comorbidity Index were very similar (3.3 vs. 3.2) (**Table 1**). Despite the large number of sensitivity analyses we ran, we did not use adjustments for multiple comparisons because these were not conducted to answer our primary research question but rather only to confirm the robustness of our main analysis results. Differences in baseline patient characteristics were unavoidable due to the observational nature of our study, but we mitigated these by using multivariate analyses.

Finally, the most important limitation to any observational study such as ours is the possibility of unmeasured confounders (including confounding by indication) driving the results: patients who are sicker (and have worse outcomes) may be more likely to receive early outpatient visits with new physicians not previously involved in their care, thereby lowering their continuity scores. However, we found that patients with familiar physician follow-up actually had greater comorbidity burdens than those with unfamiliar physician follow-up. On the other hand, attending a follow-up visit with a familiar physician may be a marker for the healthy user effect, which could have biased our results to favor familiar physician follow-up. Thus, we cannot definitively conclude that physician continuity improves outcomes despite the strength and consistency of the associations we report. However, because the only randomized trial on this topic was conducted nearly 30 years ago (31), we believe it is unlikely that a randomized trial will ever answer this question, and observational data will be the best evidence we can bring to bear on this question. By the same token, we cannot be certain that any benefits accruing from familiar physician follow-up are not merely arising from reduced fragmentation of care.

CONCLUSIONS

Our findings present clear evidence for physicians and policy makers to guarantee that systems are in place to ensure prompt follow-up of HF patients after an ED visit. Early follow-up can reduce repeat ED visits, a major driver of ED overcrowding and wait times. However, even more important than prompt follow-up is our finding that HF patients following up

TABLE 4 Association of Physician Continuity to Time to Death or Repeat ED Visit

Observation Time	Continuity in Month 1	Proportion With Event	Events Per 100 PYs	Unadjusted HR (95% CI)	Adjusted HR* (95% CI)
Base Analysis—Continuity in Month 1 Captured as Time-Dependent Variable, All Patients Included					
3 months	No visits	78.2%	695	1.00 (referent)	1.00 (referent)
	All visits with unfamiliar physician(s)	47.2%	294	0.72 (0.65–0.79)	0.81 (0.73–0.89)
	≥1 visit with familiar physician(s)	45.4%	282	0.73 (0.69–0.77)	0.75 (0.71–0.80)
6 months	No visits	84.7%	540	1.00 (referent)	1.00 (referent)
	All visits with unfamiliar physician(s)	58.7%	214	0.70 (0.64–0.76)	0.79 (0.72–0.86)
	≥1 visit with familiar physician(s)	60.8%	221	0.76 (0.72–0.80)	0.78 (0.73–0.82)
12 months	No visits	90.8%	420	1.00 (referent)	1.00 (referent)
	All visits with unfamiliar physician(s)	73.2%	165	0.71 (0.66–0.77)	0.80 (0.74–0.87)
	≥1 visit with familiar physician(s)	75.8%	176	0.78 (0.74–0.82)	0.78 (0.74–0.83)
Sensitivity Analysis—Continuity Captured as Time-Dependent Variable Throughout Entire Duration of Observation, Excluding Patients Without Outpatient Visits					
Observation Time	**Continuity Throughout Observation Time**	**Proportion With Event†**	**Events Per 100 PYs†**	**Unadjusted HR (95% CI)**	**Adjusted HR* (95% CI)**
3 months	Outpatient visits but none with familiar physician	48.4%	299	1.00 (referent)	1.00 (referent)
	≥1 visit with familiar physician(s)				0.90 (0.81–0.99)
	<50% of visits with familiar physician(s)	27.9%	239	1.07 (0.89–1.28)	0.94 (0.78–1.13)
	50%–99% of visits with familiar physician(s)	31.3%	246	1.06 (0.95–1.19)	0.91 (0.80–1.03)
	All visits with familiar physician(s)	53.5%	310	1.02 (0.93–1.13)	0.89 (0.81–0.99)
6 months	Outpatient visits, but none with familiar physician	61.2%	225	1.00 (referent)	1.00 (referent)
	≥1 visit with familiar physician(s)				0.91 (0.83–0.99)
	<50% of visits with familiar physician(s)	39.6%	164	1.03 (0.89–1.18)	0.89 (0.77–1.03)
	50%–99% of visits with familiar physician(s)	44.8%	180	1.08 (0.98–1.18)	0.90 (0.81–0.996)
	All visits with familiar physician(s)	74.3%	257	1.06 (0.98–1.16)	0.92 (0.84–1.00)
12 months	Outpatient visits but none with familiar physician	75.4%	173	1.00 (referent)	1.00 (referent)
	≥1 visit with familiar physician(s)				0.92 (0.84–0.997)
	<50% of visits with familiar physician(s)	56.9%	124	1.03 (0.92–1.16)	0.91 (0.80–1.02)
	50%–99% of visits with familiar physician(s)	63.0%	140	1.10 (1.01–1.19)	0.90 (0.82–0.99)
	All visits with familiar physician(s)	90.6%	225	1.09 (1.01–1.19)	0.93 (0.85–1.01)

*Covariates adjusted for same as in Table 3. †See Table 3 Footnote.
Abbreviations as in Tables 1 to 3.

TABLE 5 Physician Continuity and Medication Usage in Patients Age ≥65 Years

	Physician Continuity During First 30 Days				
	One or More Visits With Familiar Physician(s) (n = 6,783)	**All Visits With Unfamiliar Physician(s) (n = 1,060)**	**No Visits (n = 2,108)**	**Total (n = 9,951)**	**p Value**
Age, yrs	79.0 ± 7.5	79.3 ± 8.1	81.3 ± 8.2	79.5 ± 7.8	<0.0001
Medications in 90 days up to and including index ED visit					
ACE-I/ARB	3,762 (55.5)	503 (47.5)	944 (44.8)	5,209 (52.3)	<0.0001
BB	2,590 (38.2)	319 (30.1)	552 (26.2)	3,461 (34.8)	<0.0001
ACE-I/ARB and BB	1,800 (26.5)	217 (20.5)	392 (18.6)	2,409 (24.2)	<0.0001
Diuretic	3,820 (56.3)	536 (50.6)	1,068 (50.7)	5,424 (54.5)	<0.0001
Digoxin	1,175 (17.3)	131 (12.4)	336 (15.9)	1,642 (16.5)	0.0002
Statin	1,699 (25.0)	218 (20.6)	319 (15.1)	2,236 (22.5)	<0.0001
Medications in 90 days after index ED visit					
ACE-I/ARB	4,443 (65.5)	626 (59.1)	1,028 (48.8)	6,097 (61.3)	<0.0001
BB	2,698 (39.8)	355 (33.5)	510 (24.2)	3,563 (35.8)	<0.0001
ACE-I/ARB and BB	2,102 (31.0)	265 (25.0)	386 (18.3)	2,753 (27.7)	<0.0001
Diuretic	5,543 (81.7)	848 (80.0)	1,355 (64.3)	7,746 (77.8)	<0.0001
Digoxin	1,450 (21.4)	198 (18.7)	374 (17.7)	2,022 (20.3)	0.0005
Statin	1,759 (25.9)	225 (21.2)	313 (14.8)	2,297 (23.1)	<0.0001

Values are mean ± SD or n (%).
ACE-I = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; BB = beta-blocker; other abbreviation as in Table 1.

with a familiar physician exhibited the lowest risk of death or all-cause hospitalization at all time periods examined. Physicians should strive to optimize continuity with HF patients after ED release, and healthcare systems should introduce strategies to ensure early outpatient follow-up with the patients' regular physician or a physician who had seen them in the ED. The popular current practice in Canada of referring patients to an urgent access clinic with no previous experience with that patient should be re-examined.

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REFERENCES

1. Hugli O, Braun JE, Kim S, Pelletier AJ, Camargo CA. United States emergency department visits for acute decompensated heart failure, 1992 to 2001. Am J Cardiol 2005;96:1537–42.

2. Go AS, Mozaffarian D, Roger VL, et al. Executive summary: heart disease and stroke statistics—2013 update: a report from the American Heart Association. Circulation 2013;127:143–52.

3. Lee DS, Schull MJ, Alter DA, et al. Early deaths in patients with heart failure discharged from the emergency department: a population-based analysis. Circ Heart Fail 2010;3:228–35.

4. Brar S, McAlister FA, Youngson E, Rowe BH. Do outcomes for patients with heart failure vary by emergency department volume? Circ Heart Fail 2013;6:1147–54.

5. Hernandez AF, Greiner MA, Fonarow GC, et al. Relationship between early physician follow-up and 30-day readmission among Medicare beneficiaries hospitalized for heart failure. JAMA 2010;303:1716–22.

6. McAlister FA, Youngson E, Bakal JA, Kaul P, Ezekowitz J, van Walraven C. Impact of physician continuity on death or urgent readmission after discharge among patients with heart failure. CMAJ 2013;185:e681–9.

7. Lee DS, Stukel TA, Austin PC, et al. Improved outcomes with early collaborative care of ambulatory heart failure patients discharged from the emergency department. Circulation 2010;122:1806–14.

8. Austin PC, Mamdani MM, Van Walraven C, Tu JV. Quantifying the impact of survivor treatment bias in observational studies. J Eval Clin Pract 2006;12:601–12.

9. Yancy CW, Jessup M, Bozkurt B, et al., Writing Committee Members. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:1495–539.

10. Kuo YF, Goodwin JS. Association of hospitalist care with medical utilization after discharge: evidence of cost shift from a cohort study. Ann Intern Med 2011;155:152–9.

11. Van Walraven C, Taljaard M, Etchells E, et al. The independent association of provider and information continuity on outcomes after hospital discharge: implications for hospitalists. J Hosp Med 2010;5:398–405.

12. Van Walraven C, Oake N, Jennings A, Forster AJ. The association between continuity of care and outcomes: a systematic and critical review. J Eval Clin Prac 2010;16:947–56.

13. Quan H, Li B, Saunders LD, et al., for the IMECCHI Investigators. Assessing validity of ICD-9-CM and ICD-10 administrative data in recording clinical conditions in a unique dually coded database. Health Serv Res 2008;43:1424–41.

14. Heidenrich PA, Hernandez AF, Yancy CW, Liang L, Peterson ED, Fonarow GC. Get With The Guidelines program participation, process of care, and outcome for Medicare patients hospitalized with heart failure. Circ Cardiovasc Qual Outcomes 2012;5:37–43.

15. Specifications manual for national hospital inpatient quality measures. Oakbrook Terrace, IL: Joint Commission; 2013. Available at: http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx. Accessed December 9, 2013.

16. Bonow RO. Measuring quality in heart failure: do we have the metrics? Circ Cardiovasc Qual Outcomes 2008;1:9–11.

17. Lee DS, Tran C, Flintoft V, Grant FC, Liu PP, Tu JV, Canadian Cardiovascular Outcomes Research Team/Canadian Cardiovascular Society HF Quality Indicator Panel. CCORT/CCS quality indicators for congestive HF care. Can J Cardiol 2003;19:357–64.

18. Gamble JM, Eurich DT, Ezekowitz JA, Kaul P, Quan H, McAlister FA. Patterns of care and outcomes differ for urban versus rural patients with newly diagnosed heart failure, even in a universal healthcare system. Circ Heart Fail 2011;4:317–23.

19. Ezekowitz JA. Impact of specialist follow-up in outpatients with congestive heart failure. CMAJ 2005;172:189–94.

20. Shah BR, Hux JE, Laupacis A, Zinman B, Cauch-Dudek D, Booth GL. Administrative data algorithms can describe ambulatory physician utilization. Health Serv Res 2007;42:1783–96.

21. Breslau N, Reeb KG. Continuity of care in a university-based practice. J Med Educ 1975;50:965–9.

22. Feldman DE, Huynh T, Lauriers JD, et al. Access to heart failure care post emergency department visit: do we meet established benchmarks and does it matter? Am Heart J 2013;165:725–32.

23. Nyweide DJ, Anthony DL, Bynum JP, et al. Continuity of care and the risk of preventable hospitalization in older adults. JAMA Intern Med 2013;173:1879–85.

24. Gill JM, Mainous AG III, Nsereko M. The effect of continuity of care on emergency department use. Arch Fam Med 2000;9:333–8.

25. Almaawiy U, Pond GR, Sussman J, Brazil K, Seow H. Are family physician visits and continuity of care associated with acute care use at end-of-life? A population-based cohort study of home-care cancer patients. Palliat Med 2014;28:176–83.

26. McCusker J, Tousignant P, Borgès Da Silva R, et al. Factors predicting patient use of the emergency department: a retrospective cohort study. CMAJ 2012;184:E307–16.

27. Lee DS, Stitt A, Austin PC, et al. Prediction of heart failure mortality in emergent care: a cohort study. Ann Intern Med 2012;156:767–75.

28. Ezekowitz JA, Bakal JA, Kaul P, Westerhout CM, Armstrong PW. Acute heart failure in the emergency department: short and long-term outcomes of elderly patients with heart failure. Eur J Heart Fail 2008;10:308–14.

29. van Walraven C, Davis D, Forster AJ, Wells GA. Time-dependent bias was common in prominent medical journals. J Clin Epidemiol 2004;57:672–82.

30. Oduyebo I, Lehmann CU, Pollack CE, et al. Association of self-reported hospital discharge handoffs with 30-day readmissions. JAMA Intern Med 2013;173:624–9.

31. Wasson JD, Sauvigne AE, Mogielnicki RP, et al. Continuity of outpatient medical care in elderly men. A randomized trial. JAMA 1984;252:2413–7.

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APPENDIX For supplemental tables, please see the online version of this article.