CHF Patients Who Received Care Through Telehealth Are No More Likely to Be Hospitalized Than Patients Who Received In-Person Care

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Key Findings:

- Telehealth care for patients diagnosed with congestive heart failure (CHF) is not associated with an increased likelihood of emergency department (ED) visits or hospital admissions related to CHF compared to in-person care.

Congestive heart failure (CHF) is a condition that impairs the heart's ability to pump sufficient blood throughout the body, potentially leading to complications such as difficulty breathing, kidney damage, and other cardiac conditions.[1] CHF is the second most common non-maternal cause of hospitalizations in the United States.[2] Among patients hospitalized for heart failure, the risk of death or rehospitalization is high.[3]

To assess whether telehealth care for CHF patients is correlated with a change in the likelihood of visiting an emergency department (ED) or being admitted to a hospital due to a CHF exacerbation, we studied 62,129 patients diagnosed with CHF between January 1, 2017, and December 31, 2022, who had five in-person outpatient and/or telehealth visits in the year following their CHF diagnosis. We selected the same visit count for all patients to minimize the potential for confounding due to potential differences in the amount of care received during the study period. We evaluated whether the patient had a CHF-related ED encounter or admission in the second year after CHF diagnosis. We adjusted for age, sex, race, ethnicity, Social Vulnerability Index quartile, diuretic or digoxin prescriptions, smoking status, presence of an ED visit or admission in the previous year, setting where CHF was initially diagnosed (ED, outpatient, or admission), and history of comorbidities.

We found that CHF patients with a higher proportion of telehealth visits were no more likely to have an ED visit or admission for CHF than patients who had only in-person visits, as seen in Figure 1.

Likelihood of a CHF-Related Admission or ED Visit by Proportion of Visits Done Through Telehealth

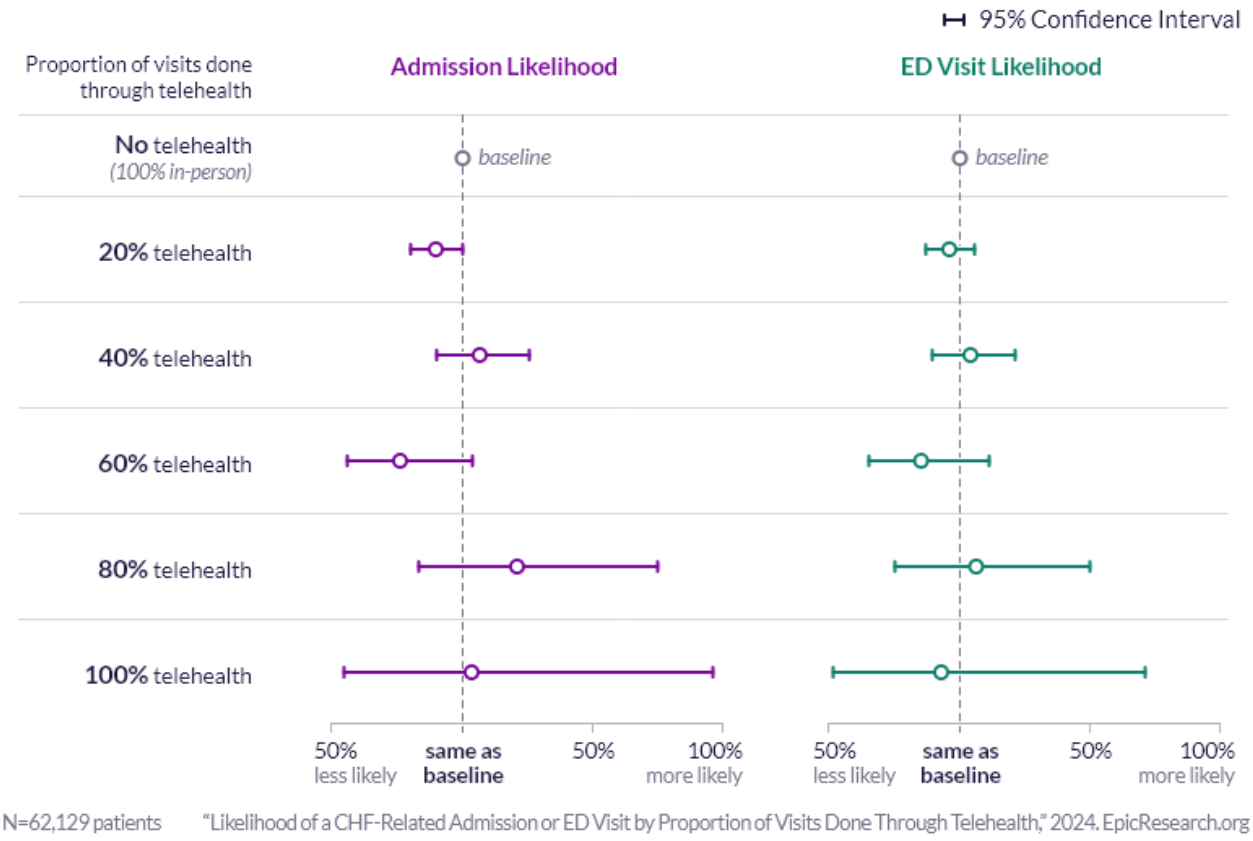

Figure 1. Likelihood of a patient being admitted to the hospital or visiting the ED for CHF by proportion of visits completed through telehealth.

A sensitivity analysis expanding the population to patients with any number of visits in the year after CHF diagnosis also showed no difference in the likelihood of CHF-related ED visits or admissions by the volume of telehealth visits the patient had. Our study did not consider specific indicators of CHF disease severity such as ejection fraction, which may influence whether a patient is more likely to receive care in person than through telehealth.

These findings suggest telehealth may be considered a substitute for in-person office visits for patients with CHF without affecting the likelihood of CHF-related ED visits or hospital admissions.

These data come from Cosmos, a dataset created in collaboration with a community of Epic health systems representing more than 262 million patient records from 1,500 hospitals and more than 34,500 clinics from all 50 states and Lebanon. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

1. Heart failure. *MedlinePlus*. Published online May 20, 2024. https://medlineplus.gov/heartfailure.html. Accessed July 12, 2024.
2. McDermott KW, Roemer M. Most Frequent Principal Diagnoses for Inpatient Stays in U.S. Hospitals, 2018. In: Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville (MD): Agency for Healthcare Research and Quality (US); July 13, 2021.

3. Butler J, Yang M, Manzi MA, et al. Clinical course of patients with worsening heart failure with reduced ejection fraction. J Am Coll Cardiol. 2019;73(8):935-944. doi:10.1016/j.jacc.2018.11.049

Data Definitions

Term	Definition
Study period	1/1/2017 to 12/31/2023
Study population	Patients with first known encounter diagnosis of **CHF** between 1/1/2017 and 12/31/2022. • Cases: Outcome of interest 365 to 730 days after that diagnosis • Controls: No outcome of interest between day 365 and 730 • Excluded: Outcome of interest in less than 90 days Inclusion criteria: • At least one face-to-face outpatient visit after the study period • At least one face-to-face outpatient visit more than a year prior to the **CHF** diagnosis • Between 50 and 110 years old
Exposures	Total number of telehealth visits: • Any encounters of types: Telemedicine, E-Visit, E-Consult, or Telephone with a CPT billing code of 99441, 99442, or 99443 or an appointment with a CPT billing code of 99441, 99442, or 99443 Total number of outpatient face-to-face visits: • Excluding encounter types of Telemedicine, E-Visit, E-Consult, or Telephone
CHF-associated visits	ED visit or admission during the observation period with one of the following: • Chief complaint of Breathing problem, Shortness of breath, Foot swelling, Ankle swelling, Leg swelling, or Weight gain • Diagnosis with one of the following ICD-10-CM codes: ▪ Shortness of breath: R06 ▪ Peripheral edema: R60* ▪ Pulmonary edema: J81* ▪ Congestive heart failure: I50* ▪ Respiratory distress: J80*
Confounders	Age: 50-64, 65-79, 80+ Sex: male or female **Race and ethnicity** SVI Quartile **Medications** Non-telehealth face-to-face visits Active or former smoking status **Comorbidities** present before **CHF** diagnosis
CHF	Diagnosis with ICD-10-CM code I50* or SNOMED code 421518007, 56675007, 445236007, 410431009, 48447003, 195112003, 206586007, 42343007, 195111005, 418304008, 462172006, 471880001, 898208007, 788950000, 446221000, 703272007, 10091002, 46113002,

	85232009, 25544003, 276514007, 314206003, 367363000, or 417996009
Comorbidities	Pulmonary edema: diagnosis with ICD-10-CM code J81* Diabetes: diagnosis with ICD-10-CM code E11* Hypertension: diagnosis with ICD-10-CM code I10 Atrial fibrillation: diagnosis with ICD-10-CM code I48.0*, I48.1*, or I48.2* Valvular disease: diagnosis with ICD-10-CM code I34*, I35*, I36*, I37*, I38*, or I39* Ischemic heart disease: diagnosis with ICD-10-CM code I20, I21, I22, I23, I24, or I25 Pulmonary embolism: diagnosis with ICD-10-CM code I26* CKD stage 3+: diagnosis with ICD-10-CM code N18.3*, N18.4*, N18.5*, or N18.6*

Medications	Diuretics (group)
	• Thiazide diuretics
	  • Metolazone - 6916
	  • Hydrochlorothiazide - 5487
	  • Chlorthalidone - 2409
	  • Indapamide - 5764
	  • Methyclothiazide - 6860
	  • Bendroflumethiazide - 1369
	  • Chlorothiazide - 2396
	• Loop diuretics
	  • Furosemide - 4603
	  • Bumetanide - 1808
	  • Ethacrynic acid - 4109
	  • Torsemide - 38413
	• Potassium-sparing diuretics
	  • Spironolactone - 9997
	  • Eplerenone - 298869
	  • Triamterene - 10763
	  • Amiloride - 644
	Digoxin: 3407

Race and Ethnicity	Boolean variables for Hispanic ethnicity and race of Black and White. Race variables computed as at least one matching documented race.

Table 1: Likelihood of a CHF-Related Admission or ED Visit by Proportion of Visits Done Through Telehealth

		Odds Ratio	OR-1	CI Low	CI High
IP Admission	100% Telehealth	1.04	0.04	0.55	1.96
	80% Telehealth	1.21	0.21	0.84	1.75
	60% Telehealth	0.77	-0.24	0.56	1.04
	40% Telehealth	1.07	0.07	0.90	1.26
	20% Telehealth	0.90	-0.10	0.80	1.00

ED	100% Telehealth	0.93	-0.07	0.51	1.71
	80% Telehealth	1.07	0.06	0.76	1.50
	60% Telehealth	0.85	-0.15	0.66	1.11
	40% Telehealth	1.04	0.04	0.90	1.21
	20% Telehealth	0.96	-0.04	0.87	1.06