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ORIGINAL ARTICLE

An electronic consultation program impacts on heart failure patients' prognosis: implications for heart failure care

Pilar Mazón-Ramos[1,2,3], Belén Álvarez-Álvarez[1,2,3], Cristina Ameixeiras-Cundins[4], Manuel Portela-Romero[2,3,5], David Garcia-Vega[1,2,3], Pedro Rigueiro-Veloso[1,2,3], Daniel Rey-Aldana[2,3,4], Ricardo Lage-Fernández[2,3], Sergio Cinza-Sanjurjo[2,3,6]* and José R. González-Juanatey[1,2,3]

[1]*Servicio de Cardiología, Complejo Hospitalario Universitario de Santiago de Compostela, Santiago, Spain;* [2]*Instituto de Investigación Sanitaria de Santiago de Compostela (IDIS), Santiago, Spain;* [3]*Centro de Investigación Biomédica en Red-Enfermedades Cardiovasculares (CIBERCV), Santiago, Spain;* [4]*CS A Estrada, Área Sanitaria Integrada Santiago de Compostela, Santiago, Spain;* [5]*CS Concepción Arenal, Área Sanitaria Integrada Santiago de Compostela, Santiago, Spain; and* [6]*CS Porto do Son, Área Sanitaria Integrada Santiago de Compostela, Santiago, Spain*

Abstract

Aims e-consults are asynchronous, clinician-to-clinician exchanges that answer focused, non-urgent, patient-specific questions using the electronic medical record. We instituted an e-consultation programme (2013–2019) for all general practitioners (GPs) referrals to cardiologists that preceded patients' in-person consultations when considered. In our study, we aimed to analyse the clinical characteristics, 1 year prognosis and the prognostic determinants of patients with a previous diagnosis of HF referred for an e-consult, categorized by their previous HF-related hospitalization status (recent hospitalization, $<$1 year before; remote hospitalization, $>$1 year before or never been hospitalized because of HF), and to analyse the impact of reducing the time elapsed between e-consultation and response by the cardiologist in terms of prognosis.

Methods and results Epidemiological and clinical data were obtained from 4851 HF patients referred by GPs to the cardiology department for an e-consultation 2013 and 2020. The delay of time to e-consults were solved was 8.6 + 8.6 days with 84.3% solved in $<$14 days. For the 1 year prognosis evaluation after the e-consult were assessed the cardiovascular hospitalizations, HF-related hospitalizations, HF-related mortality, cardiovascular mortality, and all-cause mortality. Compared with the group without a previous hospitalization, patients with recent and remote HF hospitalization were at higher risk of a new HF-related hospitalization (OR: 19.41 [95% CI: 12.95–29.11]; OR: 8.44 [95% CI: 5.14–13.87], respectively), HF-related mortality (OR: 2.47 [95% CI: 1.43–4.27]; OR: 1.25 [95% CI: 0.51–3.06], respectively), as well as cardiovascular hospitalizations and mortality and all-cause mortality. Reduction in the time elapsed because e-consultation was solved was associated with lower risk of HF-related mortality (OR: 0.94 [95% CI: 0.89–0.99]), cardiovascular mortality (OR: 0.96 [95% CI: 0.93–0.98]), and all-cause mortality (OR: 0.98 [95% CI: 0.97–1.00]).

Conclusions A clinician-to-clinician e-consultation programme between GPs and cardiologists in patients with HF allows to solve the demand of care in around 25% e-consults without an in-person consultation; the patients with a previous history of HF-related hospitalization showed a worse 1 year outcome. A reduction in the time elapsed because e-consultation was solved was associated with a mortality reduction.

Keywords Heart failure; Electronic consultation; Healthcare management; Cardiovascular outcomes

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**Correspondence to: Sergio Cinza-Sanjurjo, CS Porto do Son, Área Sanitaria Integrada Santiago de Compostela, Rúa Atalaia s/n, 15970, Porto do Son, A Coruña, Spain. Tel: +34605352334. Email: sergio.cinza.sanjurjo@sergas.es*

Introduction

Multidisciplinary care plans that comprise professionals from different levels of care optimize the diagnosis and treatment of patients with heart failure (HF). Telemedicine is effective for their follow-up—it allows to adapt the clinical management at each moment, which is fundamental at the start of a decompensation to reduce hospitalizations and mortality, as the TIM-HF2 study proved.[1] The quick incorporation of telemedicine programmes for HF patients during the COVID-19 pandemic has made the continuity of care easier without increasing the need of in-person consultations or the mortality.[2–4]

Most of the available literature about how telemedicine impacts on HF patients focuses on programmes that connect patients and clinicians. However, publications about clinician-to-clinician telematic programmes—in particular, between general practitioners (GPs) and cardiologists—and their impact on health outcomes is scarcer.[5–8]

Additionally, clinical practice guidelines recommend a follow-up visit between 7 to 14 days after the hospital discharge for patients who had been hospitalized due to acute HF, in order to avoid early hospital readmissions.[9] A recent publication suggests that these in-person visits could be replaced with telematic consultations with no change in health outcomes.[10] These considerations are also valid for the follow-up of HF patients in whom their GP has identified clinical signs of a decompensation or other issues related with the patient care, and so they need to be referred to a Cardiology Department (CD).[11]

As far as we are concerned, health outcomes of a clinician-to-clinician electronic consultation (e-consultation) programme for HF patients at any stage of their disease, involving all the referrals from GPs to a CD, using an integrated electronic health record, have not been reported.

Our objective was to analyse the clinical characteristics, 1 year prognosis and the prognostic determinants of patients with a previous diagnosis of HF, categorized by their previous HF-related hospitalization status ($<$1year or $>$1 year before or never hospitalized), referred by GPs to a CD by an e-consultation. In addition, we analysed the prognostic impact that reducing the elapsed time until the e-consultation was solved.

Methods

Patients

The CD of Santiago de Compostela healthcare area, which provides coverage to 450 000 people, started a new outpatient care programme in 2013. In this programme, all the referrals from the GPs to the CD have to be made by an e-consultation, which is later assessed by a cardiologist (universal e-consultation programme). Before 2013, all patients were seen in an in-person consultation. The characteristics and outcomes of our outpatient care programme have already been published.[5] This e-consultation is made via our integrated electronic health record, which comprises all the patient information from all the levels of care (primary care and hospitals) in the Spanish region of Galicia. The e-consultation must contain all the clinically relevant information, and the cardiologist, who sees the e-consultation a few days later, can also check all the additional tests performed in the primary care setting (mainly electrocardiogram, chest X-ray, and blood tests), as well as all the previous relevant information about the patient's disease (i.e. if they had ever been hospitalized due to HF, and when). Using all this information, the cardiologist can stratify the patient's risk, and decide which type of consultation is the best for the patient. They may solve the consultation without an in-person visit, writing down answer to the e-consultation in the same electronic health record, or may cite the patient in an in-person single-act consultation. After this in-person consultation, the patient may be referred back to their GP, or may be followed up in a specific care programme of the CD (valvopathies, congenital heart diseases, HF, arrythmias, etc.).

Using the information in our database, we analysed the clinical characteristics of HF patients referred by their GPs from 2013 to 2020. We studied the whole cohort, and then subdivided it into three groups of diagnosis: patients who had never been hospitalized due to HF, patients with a recent HF-related hospitalization ($<$1 year), and patients with a remote HF-related hospitalization ($\geq$1 year). To assess 1 year prognosis after e-consultation, we analysed the following health outcomes: HF-related hospitalizations, cardiovascular hospitalizations, HF-related mortality, cardiovascular mortality and all-cause mortality. We search for the prognostic determinants, especially those related with the clinical characteristics of the patients and the management strategy (elapsed time to e-consultation response and type of consultation they were referred to).

This study was approved by the local ethics committee at 23 March 2022, with this 2021/496 reference.

Statistics

Qualitative variables are expressed as percentages (%), and quantitative continuous variables as means (standard deviation), or medians (interquartile range) if the distribution was asymmetric. To verify differences between groups, χ^2 was used for quantitative variables, and ANOVA for qualitative variables. We consider the statistical significance at $P < 0.05$.

For the analysis of the prognosis, we considered HF-related and cardiovascular hospitalizations, and HF-related, cardio-

vascular, and all-cause mortality, happening up to 1 year after the e-consultation. A multivariate logistic regression was performed for each one of those outcomes, and the variables included in the model were those that could influence the prognosis, such as personal characteristics (age, gender) and comorbidities (arterial hypertension, diabetes mellitus, ischaemic heart disease, atrial fibrillation, cerebrovascular disease, and peripheral arterial disease), and features that had to do with the disease management (group of diagnosis regarding the previous hospitalizations status, waiting time until the e-consultation was answered, type of consultation the patient was referred to, and number of visits to the emergency department during the 1st year after the e-consultation, number of previous HF-related hospitalizations).

For data analysis, we used the statistic package SPSS, version 22.0 (SPSS Inc., USA).

Results

A total of 4851 patients were included in our study, all of them referred for the first time by GPs for a cardiologist e-consult. Of them, 2666 patients were referred only once, and the rest had subsequent e-consultations during the study period. For the analysis presented in this manuscript we have considered the first episode of e-consult. Alongside the study period, 1363 had two e-consults and 825 three or more.

The mean age was 64.3 (18.4) years, and 49.1% were women. Of them, 2833 (58.4%) patients had never been hospitalized before the e-consultation, and they were younger (63.6 [18.4] years), mostly women (51.9%), and had a lower prevalence of hypertension (P = 0.010), ischaemic heart disease ($P < 0.001$) and peripheral arterial disease (P = 0.001) compared with the groups of patients with a previous HF-related, recent or remote, hospitalization, (*Table 1*).

Table 1 Baseline characteristics and outcomes of each group of diagnosis

	Total (4851)	Never hospitalized due to HF	Recent HF-r hospitalization (<1 year)	Remote HF-r hospitalization (≥1 year)	*P*-value[d]
	4851	2833	1600	418	
Women (%)	49.1	51.9	46.3	40.9	<0.001
Age[a] (years)	64.3 (18.4)	63.6 (18.4)	78.4 (9.6)	77.7 (10.1)	0.013
Co-morbidities					
Arterial hypertension (%)	79.5	79.4	81.1	74.4	0.010
Diabetes *mellitus* (%)	34.1	29.0	40.9	42.1	<0.001
Ischaemic heart disease (%)	19.4	17.6	20.6	26.8	<0.001
Atrial fibrillation (%)	51.2	49.3	53.3	55.5	0.008
Cerebrovascular disease (%)	7.4	7.1	7.9	7.7	0.551
Peripheral arterial disease (%)	7.5	6.3	9.4	8.1	0.001
E-consultation resolution					
Time to answer[a] (days)	7.8 (6.0)	7.8 (6.0)	8.1 (6.0)	7.6 (5.9)	0.575
E-consultation solves (%)	27.2	28.4	24.7	28.9	0.002
1 single-act consultation (%)	39.4	40.3	38.9	35.4	
1 or several follow-up visits (%)	33.4	31.3	36.4	35.6	
Healthcare activity[b]					
Emergency department visits (%)	57.6	50.3	68.9	63.4	<0.001
Total hospitalizations (%)	20.1	16.4	25.9	24.0	<0.001
Cardiovascular hospitalizations (%)	16.2	7.9	30.2	19.8	<0.001
HF-r hospitalizations (%)	5.3	1.1	11.6	9.8	<0.001
Deaths[b]					
Total (%)	9.7	8.3	10.5	16.0	<0.001
Cardiovascular deaths (%)	4.8	3.6	6.1	7.2	<0.001
HF-related deaths (%)	1.6	1.2	2.4	1.4	0.008
Death causes[c]					
HF (%)	16.7	11.1	22.6	16.7	<0.001
Cancer (%)	11.6	17.2	6.9	7.9	
Ischaemic cardiopathy (%)	10.2	9.8	10.2	11.4	
Valvopathy (%)	3.8	3.1	4.9	3.1	
Ischaemic stroke (%)	3.2	3.5	3.0	2.6	
Respiratory infection (%)	2.3	3.0	1.7	2.2	
COPD (%)	1.7	2.2	1.0	2.6	

Abbreviations: COPD, chronic obstructive pulmonary disease; e-consultation, electronic consultation; HF, heart failure; HF-r, heart failure-related.
[a]Mean ± (standard deviation).
[b]1st year after the e-consultation.
[c]Percentages over the total number of deaths.
[d]Statistics: χ^2 test and ANOVA, statistical significance at $P < 0.05$.

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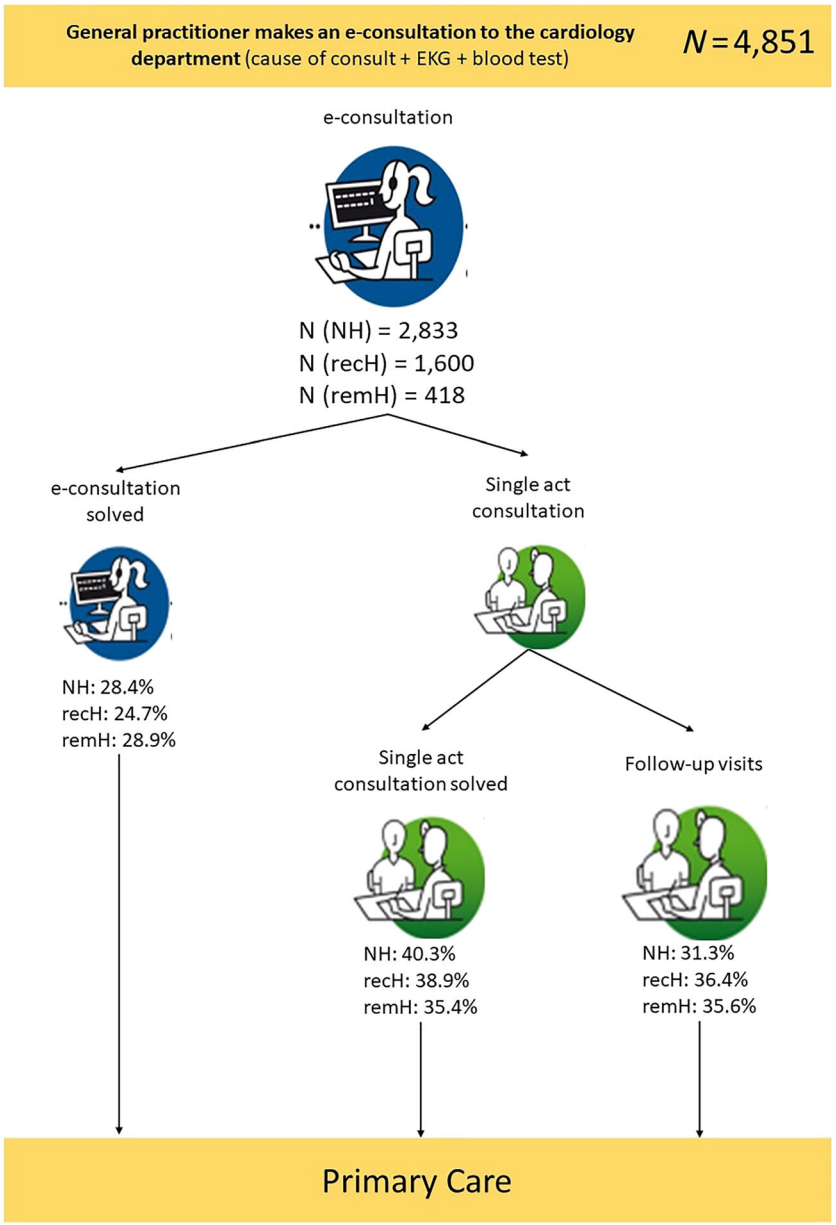
Patients who had been hospitalized, both recently and remotely, visited the emergency department more frequently than those who were never hospitalized (68.9%, 63.4%, and 50.3%, respectively, $P < 0.001$); and had a higher 1 year risk of hospitalizations and mortality after the e-consult (*Table 1*).

The e-consultation, with no need for further in-person visits, solved the problem of patients with a recent HF-related hospitalization less frequently than in other two groups, and they had to undergo follow-up visits at the CD more frequently ($P = 0.002$), *Figure 1* and *Table 1*. However, the elapsed time that patients had to wait until the e-consultation was answered was similar in the three groups ($P = 0.575$), and globally, 64.5% of them were seen in ≤7 days, and 84.3% in ≤14 days. The e-consults solved without need of an in-person consultation were more frequent in older patients ($P < 0.001$) and women ($P < 0.001$). Those patients considered for in-person consultation showed a significantly higher prevalence of ischaemic heart disease and a worse 1 year outcomes after e-consultation (*Table 2*).

In the multivariate analysis, patients with a recent HF-related hospitalization were at higher risk of readmission due to HF (odds ratio [OR]: 19.41 [95% confidence interval

Figure 1 Algorithm of the type of consultation that patients were referred in our sample. EKG, electrocardiogram; GP, general practitioner; NH, never hospitalized; recH, recent hospitalization; remH, remote hospitalization.



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(CI): 12.95–29.11]), HF-related mortality (OR: 2.47 [95% CI: 1.43–4.27]), cardiovascular hospitalizations (OR: 4.45 [95% CI: 3.70–5.35]), cardiovascular mortality (OR: 1.86 [95% CI: 1.33–2.62]) and all-cause mortality (OR: 1.33 [95% CI: 1.03–1.72]), than patients who had never been hospitalized due to HF. Patients with a remote HF-related hospitalization were also at higher risk of hospital readmission (OR: 8.44 [95% CI: 5.14–13.87]), cardiovascular hospitalizations (OR: 2.42 [95% CI: 1.80–3.24]), cardiovascular mortality (OR: 2.09 [95% CI: 1.35–3.23]) and all-cause mortality (OR: 2.06 [95% CI: 1.50–2.82]), but there were no significant differences in HF-related mortality (OR: 1.25 [95% CI: 0.51–3.06]), *Figure 2* and *Table 3*.

Meanwhile, compared with the group of patients in which e-consult is solved without the need of an in-person consultation, patients who required in-person consultations (both only one single-act consult and those considered for subsequent follow-up visits) were at higher risk of HF-related mortality (OR: 4.90 [95% CI: 1.95–12.30] and OR: 2.86 [95% CI: 1.14–7.20], respectively), cardiovascular mortality (OR: 2.41 [95% CI: 1.49–3.89] and OR: 2.08 [95% CI: 1.31–3.29], respectively), and all-cause mortality (OR: 3.23 [95% CI: 2.29–4.56] and OR: 2.15 [95% CI: 1.54–3.00], respectively), but were not at higher risk of HF-related hospitalization (OR: 0.75 [95% CI: 0.51–1.09] and OR: 1.32 [95% CI: 0.92–1.89], respectively). Only the patients with follow-up visits had higher risk of cardiovascular hospitalizations (OR: 2.65 [95% CI: 2.11–3.33]), *Table 3*.

Besides, the reduction in the waiting time until the e-consultation was answered was associated with a lineal reduction in HF-related mortality (OR: 0.94 [95% CI: 0.89–0.99]), cardiovascular mortality (OR: 0.96 [95% CI: 0.93–0.98]), and all-cause mortality (OR: 0.98 [95% CI: 0.97–1.00]). However, it did not was associated with the risk of HF-related hospitalizations (OR: 1.00 [95% CI: 0.98–1.01]) or cardiovascular hospitalization (OR: 0.99 [95% CI: 0.95–1.03]), *Table 3*.

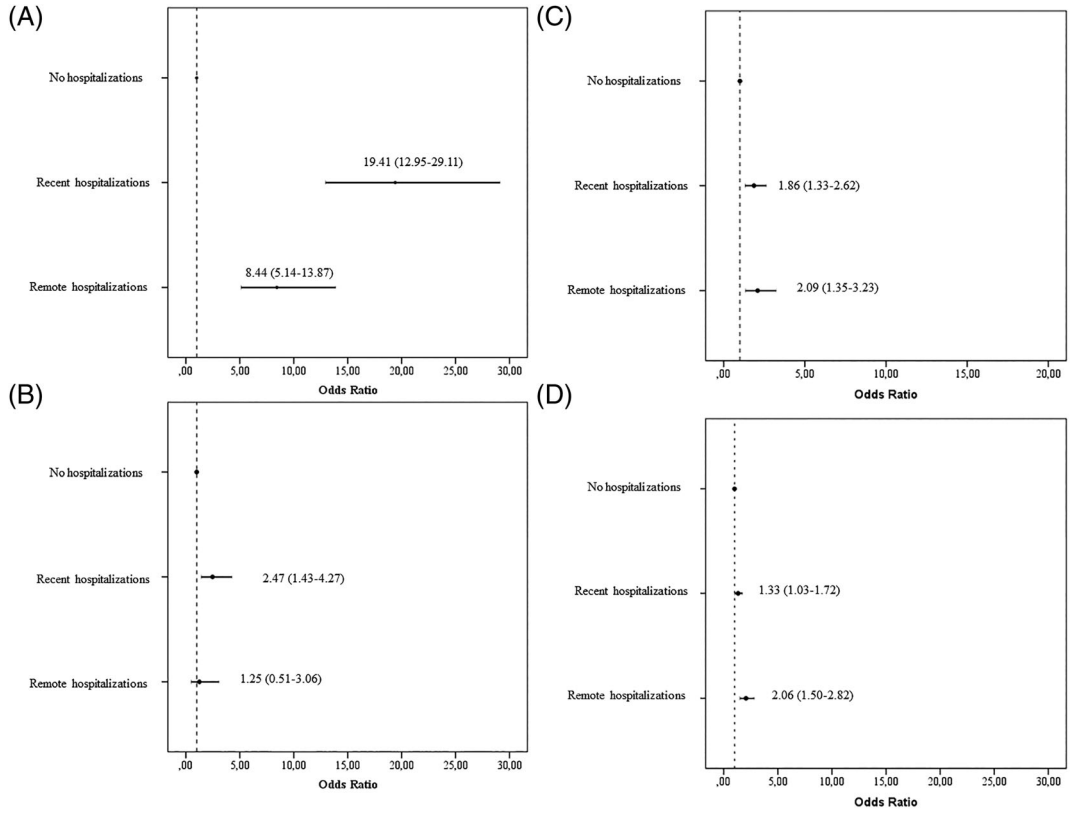
Finally, the number of visits to the emergency department after the e-consultation predict the risk of HF-related hospitalizations (OR: 1.25 [95% CI: 1.19–1.31]), CV hospitalizations (OR: 1.19 [95% CI: 1.15–1.24]), HF-related mortality (OR: 1.10 [95% CI: 1.00–1.20]), cardiovascular mortality (OR: 1.09 [95% CI: 1.03–1.15]), and all-cause mortality (OR: 1.16 [95% CI: 1.11–1.22]), *Table 3*.

Table 2 Baseline characteristics and outcomes of each group of diagnosis

	Total	E-consultation solves	1 single-act consultation	1 or several follow-up visits	*P*-value[d]
	4851	1321	1911	1619	
Women (%)	49.1	53.6	51.2	42.9	<0.001
Age[a] (years)	78.5 (9.8)	81.3 (9.9)	78.4 (9.0)	76.2 (9.9)	<0.001
Co-morbidities					
Arterial hypertension (%)	79.5	79.9	79.9	78.9	0.682
Diabetes mellitus (%)	34.1	33.0	34.0	35.0	0.561
Ischaemic heart disease (%)	19.4	18.9	16.9	22.6	<0.001
Atrial fibrillation (%)	51.2	52.8	49.1	52.3	0.062
Cerebrovascular disease (%)	7.4	8.6	6.5	7.5	0.098
Peripheral arterial disease (%)	7.5	7.0	7.1	8.3	0.294
E-consultation resolution					
Time to answer[a] (days)	7.8 (6.0)	7.9 (6.0)	7.8 (6.1)	7.8 (5.8)	0.316
Healthcare activity[b]					
Emergency department visits (%)	57.6	53.0	54.9	64.4	<0.001
Total hospitalizations (%)	20.1	17.9	18.3	24.0	<0.001
Cardiovascular hospitalizations (%)	16.2	10.9	12.0	25.4	<0.001
HF-r hospitalizations (%)	5.2	4.5	3.7	7.7	<0.001
Deaths[b]					
Total deaths (%)	9.7	5.0	9.8	15.4	<0.001
Cardiovascular deaths (%)	4.8	2.8	4.7	7.2	<0.001
HF-related deaths (%)	1.6	0.6	1.5	3.0	<0.001
Death causes[c]					
HF (%)	16.7	19.4	15.1	16.0	0.002
Cancer (%)	11.6	10.0	12.7	11.8	
Ischaemic cardiopathy (%)	10.2	7.8	9.6	13.2	
Valvopathy (%)	3.8	3.7	4.3	3.4	
Ischaemic stroke (%)	3.2	1.8	3.7	3.9	
Respiratory infection (%)	2.3	3.5	1.7	2.0	
COPD (%)	1.7	2.4	1.7	1.2	

Abbreviations: COPD, chronic obstructive pulmonary disease; e-consultation, electronic consultation; HF, heart failure; HF-r, heart failure-related.
[a]Mean ± (standard deviation).
[b]1st year after the e-consultation.
[c]Percentages over the total number of deaths.
[d]Statistics: χ^2 test and ANOVA, statistical significance at $P < 0.05$.

Figure 2 One year after the e-consultation odds ratios (95% confidence interval)* of heart failure-related hospitalization (A), heart failure-related mortality (B), cardiovascular mortality (C), and total mortality (D), in patients with heart failure classified by their previous hospitalization status. *Odds ratios adjusted in a multivariate analysis including age, gender, co-morbidities, number of emergency department visits, time until the e-consultation is answered, type of consultation they were referred to (see *Table* 2).



Discussion

Our study, which included 4851 patients with HF, describes how a clinician-to-clinician e-consultation programme between GPs and cardiologists impacts on HF patients at different stages of their disease. Our programme allows to solve the demand of care in around 25% e-consults without the need of an in-person consultation and was associated with a better 1 year outcomes compared with the groups of patients considered for in-person visits (both, a single visit or considered for subsequent follow-up visits). Those patients with a previous history of HF-related hospitalization showed a higher need for in-person consultation and a worse 1 year outcome. A reduction in the time elapsed because e-consultation was solved (<15 days in 84.3% of the referrals) was associated with a mortality reduction.

To our knowledge, this is the first time that the results of a clinician-to-clinician e-consultation programme to manage the demand of care in HF patients have been described, analysing the results on 1 year outcomes as a function of the need for in-person consultation, previous history of HF-related hospitalization and time elapsed because e-consult was solved. We understand that our experience in HF patients, in the context of shared integrated electronic medical records throughout health care levels (in our case GPs and cardiologists), can improve their clinical management by reducing delay time in care compared with the in-person consultation models, solving the demand of care without the need of in-person visits in a proportion of the referrals and are associated with better outcomes. After e-consult, those patients who are considered to need cardiologist care were identified and treated much sooner than under the traditional model; and may be of special relevance in patients with HF, a clinical condition characterized by a high risk of suffering worsening events.

Our data suggest that the current European guidelines on HF[9] recommendation to organize an early follow-up visit (<15 days) after the hospital discharge[9,12,13] should be extended to patients referred by their GP. We think that all HF patients whose GP has referred to a CD must be evaluated by a cardiologist in a short period of time, and that this assessment can be made using telemedicine (in our case, via e-consultation). Apart from improving their prognosis, this

Table 3 Multivariate analysis of factors linked to heart failure hospitalization and death

	HF-r hospitalization OR (95% CI)	CV hospitalization OR (95% CI)	HF-r mortality OR (95% CI)	CV mortality OR (95% CI)	All-cause mortality OR (95% CI)
Age	1.01 (0.99–1.02)	1.01 (0.99–1.02)	***1.10 (1.06–1.15)***	***1.08 (1.06–1.11)***	***1.08 (1.06–1.10)***
Gender					
Woman (reference)	1.00	1.00	1.00	1.00	1.00
Man	1.15 (0.86–1.53)	1.12 (0.94–1.33)	1.40 (0.84–2.35)	***1.44 (1.07–1.96)***	***1.83 (1.47–2.29)***
Co-morbidities					
Arterial hypertension	1.08 (0.75–1.56)	0.85 (0.69–1.05)	0.55 (0.31–0.96)	0.86 (0.59–1.23)	0.82 (0.63–1.07)
Diabetes mellitus	1.21 (0.90–1.61)	1.15 (0.96–1.38)	0.87 (0.49–1.55)	1.09 (0.79–1.50)	1.25 (0.99–1.57)
Ischaemic cardiopathy	1.17 (0.84–1.61)	***1.27 (1.04–1.56)***	1.18 (0.63–2.19)	1.17 (0.82–1.66)	1.07 (0.82–1.39)
Atrial fibrillation	1.11 (0.83–1.48	1.09 (0.92–1.29)	1.23 (0.74–2.05)	0.91 (0.67–1.22)	0.94 (0.76–1.16)
Cerebrovascular disease	1.35 (0.84–2.16)	***1.48 (1.10–1.98)***	0.47 (0.15–1.55)	0.80 (0.45–1.41)	0.75 (0.49–1.14)
Peripheral arterial disease	0.76 (0.46–1.23)	0.81 (0.59–1.11)	1.42 (0.59–3.42)	***1.74 (1.09–2.77)***	***1.75 (1.23–2.48)***
Healthcare activity					
Number of visits to the emergency department (1 year)	***1.25 (1.19–1.31)***	***1.19 (1.15–1.24)***	***1.09 (1.00–1.20)***	***1.09 (1.03–1.15)***	***1.16 (1.11–1.22)***
Reduction in waiting time until the e-consultation is answered	1.00 (0.98–1.01)	0.99 (0.95–1.03)	***0.94 (0.89–0.99)***	***0.96 (0.93–0.98)***	***0.98 (0.97–1.00)***
E-consultation solves (reference)	1.00	1.00	1.00	1.00	1.00
Single act visit	0.75 (0.51–1.09)	1.10 (0.87–1.39)	***4.90 (1.95–12.30)***	***2.41 (1.49–3.89)***	***3.23 (2.29–4.56)***
Follow-up visits	1.32 (0.92–1.89)	***2.65 (2.11–3.33)***	***2.86 (1.14–7.20)***	***2.08 (1.31–3.29)***	***2.15 (1.54–3.00)***
HF group					
Never hospitalization (ref)	1.00	1.00	1.00	1.00	1.00
Recent hospitalization	***19.41 (12.95–29.11)***	***4.45 (3.70–5.35)***	***2.47 (1.43–4.27)***	***1.86 (1.33–2.62)***	***1.33 (1.03–1.72)***
Remote hospitalization	***8.44 (5.14–13.87)***	***2.42 (1.80–3.24)***	1.25 (0.51–3.06)	***2.09 (1.35–3.23)***	***2.06 (1.50–2.82)***

Note: In bold: statistically significant factors ($P < 0.05$)

Abbreviations: CI, confidence interval; CV, cardiovascular; ER, emergency room; e-consultation, electronic consultation; HF, heart failure; HF-r, heart failure-related, OR, odds ratio.

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programme could reduce the in-person healthcare burden, avoid unnecessary patient and caregiver's vehicle journeys,[14] and improve the management of patients with this disease, which is prevalent and frequently decompensates.[15] Thus, this decision would directly affect the actual organization of the outpatient HF care programmes.

Several publications have analysed the impact of the use of telemedicine for the communication between professionals and HF patients,[16] a model that expanded exponentially during the COVID-19 pandemic.[2–4,17,18] The recent results of the AMULET clinical trial describe the effects of an interventional telemedicine programme on 605 patients who had been recently hospitalized due to acute HF, whose follow-up was conducted remotely by nurses, and, if the cardiologist had to make any decision, it was also made remotely. Compared with routine follow-up, the AMULET intervention programme was associated with a significant reduction in the risk of the composite outcome of HF-related hospitalizations and cardiovascular mortality for 12 months, though it had no effect on cardiovascular mortality alone.[19] However, Gorodeski *et al*. conducted another randomized clinical trial with 108 HF patients who had been discharged between 2018 and 2019, for whom telematic consultations did not make a difference in mortality, visits to the emergency department or hospital readmissions for the next 45 days, compared with in-person consultations.[20] On the contrary, the risk stratification of the patients' complexity facilitated by our universal e-consultation programme, may be associated with the improved health outcomes of the patients in our cohort, for both hospitalization and mortality outcomes.

Besides, Salzano *et al*. evaluated the usefulness of a programme using different modalities of telemedicine (telephonic consultations, online chats, and video consultations). It was conducted from 11 March and 4 May 2020, during the most critical period of the COVID-19 pandemic. Compared with a similar cohort who assisted to in-person consultations in 2019, telemedicine was associated with a lower risk of HF-related hospitalization but similar risk of death.[21] These results are similar to those described by Sammour *et al*., who, after matching 4541 patients who did a telematic visit to similar patients who were seen in person in the immediately previous years, concluded that telematic consultations avoid patient and caregivers' journeys without increasing the risk of urgent visits or mortality. They also concluded that programmes that have capability of a risk stratification of the patients, some of them do not require to be seen in person, like clinician-to-clinician e-consultations, should be developed in order to reduce the healthcare burden.[2] These last results agree with our own observations and conclusions.

In another recent article, Xu *et al*. reported that telematic visits incorporated in an electronic health record, compared with in-person consultations, in HF patients who had recently been hospitalized during the COVID-19 pandemic, were similarly effective for a composite outcome of readmissions and mortality within 14 days after the discharge. Also, the risk of this composite outcome was significantly higher in patients who were not followed up in a structured manner. About 30 days hospital readmissions, this happened to 14.2% of the patients who were early followed-up and 23.1% of those who were not followed-up.[10]

In our study, 11.6% of HF patients who had been recently hospitalized (<1 year before) and whose GP thought appropriate to make an e-consultation, were hospitalized within the 1st year. This percentage was significantly lower than in those who had been hospitalized more than 1 year ago (9.8%) and in those who had never been hospitalized (1.1%). Not only is having been previously hospitalized due to HF associated with a significantly worse 1 year prognosis, but also being stratified to an in-person consultation (especially those who need follow-up visits) or having to visit the emergency department. All these factors were independently associated with a worse prognosis.[22] These results reinforce the idea that our e-consultation model and our outpatient HF care programme is useful and safe and that clinician-to-clinician telemedicine programmes may have a core role in HF care plans. With programmes like these, all the patients referred by the GPs can have a risk stratification by a cardiologist, and the best type of consultation can be chosen.

On the other hand, reducing the waiting time until the e-consultation is answered significantly correlates with 1 year prognosis, in particular, it reduces the HF-related, cardiovascular and all-cause mortality, even though nearly 90% of them were solved in <15 days. Nevertheless, were not found an association between time elapsed to e-consultation solved by a cardiologist and HF-related and cardiovascular hospitalizations. We may speculate that this outcome discrepancy can be related with the fact that hard endpoints, like mortality, are more sensible to be affected by a sooner identification and treatment of the HF, cardiovascular or other cause worsening episodes. The fact that the vast majority of the e-consultations were solve in a short period of time may also influence our findings. Nevertheless, the study design, based on a large retrospective cohort of HF patients, does not allow for a clear direct-causality effect to be established, as other factors may influence our findings.

In our view, these results suggest that an early consultation with a healthcare provider should not be recommended only for patients who have been recently discharged, but also for those who are referred to a CD by other specialists, whatever the reason. In our model, these referrals are made by a GP through an e-consultation, though these early consultations could be a complement to healthcare programmes that include telematic consultations between patients and healthcare providers, which have been thoroughly developed on the last few years. However, we think that a HF care programme in which HF-related consultations can be stratified using an integrated electronic health record, the same one that clinicians use to communicate among themselves, has

great potential. This kind of health records make clinician-to-clinician communication more fluent and contain all the necessary information to optimize the resolution of the HF patient clinical problem.

We have already published our experience using this model for more than 10 years in our healthcare area and demonstrated that the use of a universal e-consultation programme between GPs and the CD as the first step to manage the referrals, is associated with a reduction in the waiting list and better health outcomes, for both all patients[5] and HF patients.[11] Furthermore, our e-consultation programme significantly improved the accessibility of the CD for patients who lived further away from the hospital, particularly those >80 years old.[6,23] So our data indicate that these clinician-to-clinician programmes improve healthcare equity and quality, and we think this is especially important for HF patients, who benefit from structured follow-up programmes, not only after a hospital discharge, but also when their GP finds signs of clinical destabilization and thinks they need to be referred to the CD.

However, we recognize our study has some limitations. We made our analysis with no regard to the phenotypical classification of the HF based on the left ventricular ejection fraction. Also, regarding information bias, our data is retrospective and, though we are aware of all the deaths that happened during the follow-up period, in many cases it is not possible to know the exact cause of death, and this could have nuanced some of our findings. Another possible information bias is that the diagnosis of HF of the group of patients who had never been hospitalized was codified as that in the patients' electronic health record, but it was not possible for us to corroborate it clinically. Besides, we have no data on any visits that some patients may have paid to private healthcare providers, which could also influence our results. Anyhow, we think these limitations are not enough to dismiss our experience with a large cohort of patients with HF, on whom we have relatable demographic, clinical, and prognostic information, all of it included in an integrated electronic health record. These characteristics make our data relevant both clinically and for healthcare management purposes. We even ran a satisfaction survey among clinicians and patients, which results indicate that a healthcare model that includes telemedicine is well accepted.[5]

Our findings describe what impact an e-consultation programme between GPs and cardiologists, using an integrated electronic health record, may have on HF patients, classified in three groups by their previous hospitalization status. The time elapsed because e-consultation was solved by a cardiologist has been associated with health outcomes. Besides, the e-consultations were solved with no need of an in-person consultation in 27.2% of the cases and was associated with a better 1 year outcomes compared with the groups of patients considered for in-person visits (both, a single visit or considered for subsequent follow-up visits), so this model es effective for the stratification of the patient complexity and allows to choose the best type of consultation for each patient. These findings suggest that clinician-to-clinician e-consultations are not only suitable for HF patients who have recently been discharged from hospital (as it is currently recommended in HF clinical guidelines), and that an early follow-up is beneficial for any HF patient who is referred by a clinician to a CD.

Conflicts of interest

The authors declare no conflicts of interest in relation to this article.

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