# Clinical pathways of patients with heart failure with preserved ejection fraction hospitalized for acute heart failure: Insights from the National Multi-Centre HF-POL Registry

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#### **INTRODUCTION**

Heart failure with preserved ejection fraction (HFpEF) accounts for approximately half of heart failure (HF) cases worldwide [1, 2]. In recent years, significant efforts have been made to draw attention to patients with HFpEF, as these patients face a risk of death comparable to those with heart failure with reduced ejection fraction [1, 2]. Furthermore, the causes of death in HFpEF patients often extend beyond cardiology, reflecting multimorbidity prevalent in this population [3]. Understanding the clinical journey and care schemes for HFpEF patients could significantly contribute to optimizing healthcare organization and improving prognoses. Our study aimed to describe the real-life care pathways for patients before and during hospitalization for acute HF in Polish HFpEF patients with and without a history of previous HF hospitalization.

## **METHODS**

#### **Data source**

The data was provided by the Heart Failure Poland (HF-POL) study, a multicenter observational registry including patients with HF and left ventricular ejection fraction >40%, conducted by the Heart Failure Association of the Polish Cardiac Society in cooperation with the Committee for Clinical Initiatives of the Executive Board as part of the Scientific Platform initiative. The HF-POL study included patients with diagnosed HF (according to the 2021 European Society of Cardiology guidelines), with documented ventricular ejection fraction >40%, who were either treated for HF on ambulatory basis or hospitalized for HF (HF exacerbation or HF de novo) with administration of intravenous therapy (diuretics and/or catecholamines and/or nitrates) [4]. The rationale and design of the HF-POL registry and baseline characteristics of all patients enrolled in the database were previously described [5, 6]. Our study included hospitalized HFpEF patients (EF ≥50%) who met the inclusion criteria of the HF-POL study. The study was registered in the ClinicalTrials. gov database (NCT06030661).

## Study group

The study included all HFpEF patients hospitalized for acute (*de novo* or decompensated)

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HF requiring administration of intravenous therapy and reported to the HF-POL Registry. Patients were assigned to two groups: without (n = 444) and with (n = 91) a history of previous heart failure hospitalization (HFH).

## Statistical analysis

The normality of the variables was verified using the Shapiro–Wilk normality test. None of the continuous variables had normal distribution; thus, they were described as medians and interquartile ranges. The number of observations and the corresponding percentage (%) were given for categorical variables. The non-parametric Mann–Whitney U test was used to compare two independent groups. Pearson's  $\chi^2$  test of independence (with Yates correction where necessary) was used to compare qualitative variables between groups. Results with *P* <0.05 were considered significant. STATISTICA PL v. 13.3 and PQStat 1.8.6 packages were used for calculations.

# **RESULTS AND DISCUSSION**

The study included 535 patients with HFpEF hospitalized for acute HF, of whom 91 (17.0%) had at least one HFH in the last 12 months. The median age of patients was 76 (69–84) and 76 (72–84) for patients without and with at least one previous HFH, respectively. The EF median was 55 (52–60) in both groups, and N-terminal pro B-type natriuretic peptide levels were 2072 (896–4791) and 2542 (1125–5394) pg/ml, respectively. More than half of the patients (51.7%) with HFH had at least three episodes of hospitalization for HF in the last 12 months. The baseline characteristics are presented in Table 1.

Patients in both groups had similar age, sex, body mass index, heart rate, systolic and diastolic blood pressure, and N-terminal pro B-type natriuretic peptide levels. There were no differences in the clinical presentation on hospital admission. The main difference in the medical history was the etiology of heart failure, with a significantly higher percentage of ischemic HF in patients with prior HFH. This was associated with a more frequent history of myocardial infarction, percutaneous coronary intervention, and coronary artery bypass grafting in this group. Patients without previous HFH more often had non-cardiovascular comorbidities (Table 1).

Patients with HFpEF and a history of at least one HFH were twice as likely to have a visit to outpatient centers before admission. Moreover, they were almost exclusively hospitalized in cardiology departments, while individuals without prior HFH were equally distributed between internal medicine and cardiology departments. Most patients without HFH were transferred to the hospital by emergency services — hospital emergency department and ambulance service. Individuals with HFH were mainly referred by general practitioners (GPs) and outpatient centers (Table 1).

Our study, which analyzed the clinical pathways of HFpEF patients in the Polish healthcare system, shows some important facts. Firstly, most patients with the first HFH are referred to the hospital by emergency services. This suggests an insufficient awareness of heart failure among patients and GPs. Most patients admitted for the first time with acute HF presented symptoms that had been developing over a long period. If patients had appropriate awareness of HF signs and symptoms, they would consult a primary care physician in advance to avoid disease exacerbation, which would result in a referral to the hospital.

The primary intervention during hospitalization was intravenous diuretic therapy. Both GPs and educated, cooperating patients (self-managing HF) should be encouraged to intensify oral diuretics therapy in the initial phase of HF exacerbation to avoid urgent HFH. Secondly, almost all patients subsequently hospitalized for heart failure were admitted to the cardiology department. To efficiently distribute healthcare resources, patients should be triaged for an appropriate department specialization, depending on the clinical stage of the disease. Not all patients with HF exacerbation require hospitalization in cardiology departments. However, our results may be biased because the HF-POL registry gathered data from selected hospitals in Poland, most of which were cardiology centers. Nevertheless, there is a need to create mechanisms to treat patients with mild HF in regional centers and to refer patients with more severe HF to tertiary centers. Lastly, the frequency of sodium-glucose co-transporter 2 use may be lower than expected because patients were enrolled before the last focus update of the European Society of Cardiology guidelines. Therefore, patients had sodium-glucose co-transporter 2 administered for diabetes mellitus-related indications and not HF. Some of the problems mentioned above were described in detail in the expert opinion of the Heart Failure Association of the Polish Cardiac Society [7].

To conclude, the analysis of data on the clinical journey of HFpEF patients from the HF-POL registry hospitalized for acute HF showed significant differences in the management of hospital treatment between patients with and without a previous history of hospitalization for acute HF. Some of those observed elements require further analysis and optimization.

#### Article information

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**Open access:** This article is available in open access under Creative Common Attribution-Non-Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0) license, which allows downloading and sharing articles with others as long as they credit the authors and the publisher, but without permission to change them in any way or use them commercially. For commercial use, please contact the journal office at polishheartjournal@ptkardio.pl Table 1. Baseline characteristics and clinical pathways of patients with heart failure with preserved ejection fraction with and without previous heart failure hospitalization (HFH)

Age, median (IQR), years     76 (69–84)     76 (72-84)       Females, n (%)     194 (43.7)     35 (38.5)       BM, median (IQR), mm Hg     130 (115–145)     130 (120–145)       D8P, median (IQR), bpm     77 (70–90)     78 (64–83)       HR, median (IQR), bpm     77 (70–90)     78 (64–83)       MR, median (IQR), bpm     77 (70–90)     78 (64–83)       NYHA at admission, n (%)     109 (24.6)     38 (14.18)       NYHA 1     19 (42.3)     3 (3.3)       NYHA 1     96 (22.1)     20 (22.0)       NYHA 1     96 (22.1)     20 (22.0)       NYHA 1     96 (23.1)     0       EF, median (IQR), mg/ml     2027 (36–4791)     254 (21.25–534)       GFR, median (IQR), milkg/1.23 m²     55 (50–58)     55 (52–60)       NT-proBNP, median (IQR), mg/ml     2027 (36–4791)     254 (21.125–534)       GFR, median (IQR), milkg/1.23 m²     55 (40–61)     52 (22.3)       Vart medical history     Prior heart failer, m (%)     279 (62.8)     91 (100)       No. dr previous HFH     0     23 (25.3)     2     0     47 (13.2)       1	HFH	P-value
BML, median (IQR), mm Hg     29 (25-33)     29 (26-32)       SPP, median (IQR), mm Hg     130 (115-145)     130 (115-145)       DRP, median (IQR), mm Hg     77 (70-90)     79 (64-95)       Ischemic etiology, n(%)     109 (43)     33.31       VTHA at admission, n(%)     98 (22.1)     20 (22.0)       NYHA II     19 (43)     33.31       NYHA II     19 (43.5)     51 (65.2)       NYHA II     19 (43.5)     51 (65.2)       NYHA II     15 (635.1)     53 (58.2)       NYHA II     15 (55.1)     53 (52.60)       NYHA II     10     55 (60-58)     55 (52-60)       NT-proBNF, median (IQR), mg/ml     207 (296-4791)     224 (11-57)       Part median IQR, mg/ml     279 (62.3)     91 (100)       No data     0     21 (23.1)       Part median IQR, mg/ml     279 (62.3)     91 (100)       No forevious HFH     0     23 (25.3)       Part median IGR, mg/ml     26 (21.5)     78 (85.7)       Stroke, n (%)     26 (26.5)     38 (41.8)       O     21 (23.1)     33 (23.1) <t< td=""><td></td><td>0.28</td></t<>		0.28
SBP, median (IQR), mm Hg     130 (115-145)     130 (120-145)       DBP, median (IQR), mm Hg     72 (70-93)     72 (66-83)       IR, median (IQR), bpm     70 (70-90)     38 (41.8)       NYHA at admission, n (%)     19 (4.3)     3 (3.3)       NYHA II     98 (22.1)     20 (22.0)       NYHA III     55 (65-53)     55 (50-50)       NYHA III     55 (50-53)     55 (50-50)       NYHA MU     2072 (896-4791)     2542 (1125-5394)       GFR, median (IQR), m/g/ml     2072 (896-4791)     2542 (1125-5394)       GFR, median (IQR), m/g/ml     2072 (962.4791)     2542 (1125-5394)       Strength of hospital stay, median (IQR), days     20 (72 (962.4791)     2542 (1125-5394)       GFR, median (IQR), m/g/ml     2072 (962.4791)     2542 (1125-5394)       Strength of hospital stay, median (IQR), days     20 (27 (962.4791)     261 (27.170)       Part Bedical history     20 (27.100)     20 (23.1		0.36
DBP, median (QR), mm Hg     76 (70-83)     73 (66-83)       HR, median (QR), bpm     77 (70-90)     79 (64-95)       Exchemic etilology, n (%)     109 (24.6)     38 (41.8)       NYHA at admission, n (%)     9     20 (22.0)       NYHA III     98 (22.1)     20 (22.0)       NYHA IIII     156 (35.1)     33 (68.2)       NYHA IV     113 (25.5)     15 (16.5)       No data     55 (50-58)     55 (52-60)       RF, median (QR), mk/kg/1.73 m <sup>2</sup> 55 (40-61)     52 (1125-5394)       GFR, median (QR), mk/kg/1.73 m <sup>2</sup> 55 (40-61)     52 (21.6)       Past medical history     77 (62.8)     91 (100)       No. of previous HFH     0     21 (23.1)       1     0     21 (25.3)       2     0     21 (23.1)       3     0     21 (23.1)       3     0     21 (23.1)       2.3     0     21 (23.1)       3     0     21 (23.1)       3.4     10 (24.5)     38 (41.8)       1     0     21 (23.1)       3.5		0.87
HR, median (IQR), bpm     77 (70-90)     79 (64-95)       Ischemic etiology, n (%)     10     38 (41.8)       NYHA at admission, n (%)     3 (3.3)       NYHA II     19 (4.3)     3 (3.3)       NYHA III     96 (52.1)     53 (58.2)       NYHA III     96 (52.1)     53 (58.2)       NYHA III     96 (52.1)     53 (58.2)       NYHA IIII     96 (52.1)     53 (55.26)       No data     55 (50-58)     55 (52-60)       Nr-proBNP, median (IQR), %     55 (50-58)     55 (52-60)       Nr-proBNP, median (IQR), mulkg/1, 7m <sup>2</sup> 55 (50-68)     55 (52-60)       Nr-proBNP, median (IQR), mulkg/1, 7m <sup>2</sup> 57 (50-68)     25 (21-67)       Part medical history     7     7     7       Phor heart faum, n(%)     279 (52.8)     9 (100)       No. of previous HFH     7     0     21 (23.1)       1     0     21 (23.1)     23     0     47 (51.7)       Hypertipidemia, n (%)     36 (28 (15.3)     38 (41.8)     06 (21.6)     33 (65.3)       1     0     52 (50.5)     38 (64.5		0.65
HR, median (IQR), bpm     77 (70-90)     79 (64-95)       Ischemic etiology, n (%)     10     38 (41.8)       NYHA at admission, n (%)     3 (3.3)       NYHA II     19 (4.3)     3 (3.3)       NYHA II     96 (32.1)     25 (35.2)       NYHA II     96 (32.1)     53 (58.2)       NYHA II     13 (25.5)     15 (16.5)       No data     55 (50-58)     55 (52-60)       NT-proBNP, median (IQR), %     55 (50-58)     55 (52-60)       NT-proBNP, median (IQR), mulkg/1.73 m²     50 (40-61)     2542 (1125-5394)       GFR, median (IQR), mulkg/1.73 m²     52 (50-63)     26 (21.6)       No. of previous HFH     0     21 (23.1)       1     0     21 (23.1)       2     0     21 (23.1)       3     0     47 (51.7)       Hypertipridemia, n (%)     36 (28.15.3)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     46 (25.65.5)     38 (65.2)       Myocardial infarction, n (%)     36 (21.6)     31 (65.2)       Myocardial infarction, n (%)		0.63
ischemic etiology, n (%)     38 (41.8)       NYHA at admission, n (%)     19 (4.3)     33.3       NYHA II     98 (22.1)     20 (22.0)       NYHA III     98 (22.1)     20 (22.0)       NYHA III     15 (5.5.1)     53 (68.2)       NYHA III     55 (50-38)     55 (25-60)       No data     58 (13.1)     0       EF, median (IQR), pg/ml     2027 (956-4791)     252 42 (125-5394)       GFR, median (IQR), ng/ml     2072 (956-4791)     252 42 (125-5394)       Past medical history     2     2     1       Past medical fuluxe, n (%)     279 (62.8)     91 (100)       No.6 tata     0     21 (23.1)       2     0     21 (23.1)       2.3     0     21 (23.1)       2.3     0     21 (23.1)       2.4     0     21 (23.1)       2.5     0     21 (23.1)       2.5     0     21 (23.1)       2.6     0     21 (23.1)       2.6     0     21 (23.1)       2.6     15 (24.6)     31 (35.3)		0.75
NYHA at admission, n (%)     3 (3.3)       NYHA I     19 (4.3)     3 (3.3)       NYHA II     3 (6.2.1)     2 (2.2.0)       NYHA III     15 (5.5.1)     53 (58.2)       NYHA III     15 (5.5.1)     53 (58.2)       NYHA III     55 (50-58)     55 (52-60)       No data     55 (50-58)     55 (52-60)       NT-proBNP, median (IQR), M/s     257 (200-58)     25 (24-67)       Ergen derian (IQR), M/s     257 (200-58)     25 (24-67)       Promotion (IQR), M/s     257 (200-58)     25 (24-67)       Despt of hoopital stay, median (IQR), days     279 (62.8)     91 (100)       No. of previous HFH     0     21 (23.1)       1     0     21 (23.1)       2.3     0     47 (61.7)       Hyperlipidemia, n (%)     36 (21.6)     38 (41.8)       Debety n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     26 (25.9)     99 (9.1)       Stroke, n (%)     210 (47.30)     68 (62.6)       Current     43 (97)     64 (62.6)       Former     15 (34.9)		< 0.001
NYHA II     98 (22.1)     20 (22.0)       NYHA III     156 (35.1)     53 (82.2)       NYHA IV     113 (25.5)     15 (16.5)       No data     58 (13.1)     0       EF, median (IQR), %     55 (50-58)     55 (52-60)       NT-proBNP, median (IQR), gyml     2072 (896-4791)     254 (21125-5394)       GFR, median (IQR), milkg/1.73 m²     55 (40-61)     52 (1125-5394)       Past medical history     Past medical history     91 (100)       No. of previous HFH     0     23 (25.3)       2     0     21 (23.1)       23     0     47 (51.7)       Hypertipricensin, n (%)     162 (36.5)     38 (41.8)       Obabets mellitus, n (%)     162 (36.5)     38 (41.8)       Obaets, n (%)     91 (047.30)     68 (74.7)       Mycardial infarction, n (%)     92 (104.730)     68 (74.7)       Mycardial infarction, n (%)     92 (104.730)     68 (74.7)       Mycardial infarction, n (%)     92 (104.730)     68 (74.7)       Mycardial infarction, n (%)     92 (10.9)     38 (8.0)       Propheral arterial disease, n (%)     62		
NYHA III     53 (58.2)       NYHA IV     113 (25.5)     15 (16.5)       No data     58 (13.1)     0       EF, median ((QR), %     55 (50-58)     55 (52-60)       NT-proBNP, median ((QR), mg/ml     2072 (896-4791)     2542 (1125-5394)       GFR, median ((QR), mg/m2, radian (QR), days     Prior heart failure, n (%)     25 (40-61)     25 (41-67)       Prior heart failure, n (%)     2079 (62.8)     91 (100)     No. 0 for previous HFH     0     23 (25.3)       1     0     23 (25.3)     2     0     21 (23.1)       2     0     21 (23.1)     2     0     21 (23.1)       2.3     0     47 (51.7)     Hyperlipidemia, n (%)     36 (81.5)     78 (85.7)       Hyperlipidemia, n (%)     36 (81.5)     78 (85.7)     38 (41.8)     0       Obesity, n (%)     147 (33.2)     37 (40.7)     6 (6.6)     71.43       Chronic kidney disease, n (%)     26 (5.9)     24 (25.3)     35 (36.8)     22 (24.2)       Never     24 (25.4)     11 (12.2)     86.8)     11 (12.2)     86.8)       P		
NYHA III     53 (58.2)       NYHA IV     113 (25.5)     15 (16.5)       No data     58 (13.1)     0       EF, median ((QR), %     55 (50-58)     55 (52-60)       NT-proBNP, median ((QR), mg/ml     2072 (896-4791)     2542 (1125-5394)       GFR, median ((QR), mg/m2, radian (QR), days     E     E       Prior heart failure, n (%)     2079 (62.8)     91 (100)       No. of previous HFH     0     23 (25.3)       2     0     21 (23.1)       23     0     47 (51.7)       Hypertension, n (%)     36 (81.5)     78 (85.7)       Hypertension, n (%)     36 (81.5)     78 (85.7)       Hypertension, n (%)     36 (21.6)     33 (36.3)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     20 (47.3)     66 (67.7)       Myocardial Infortion, n (%)     26 (59.9)     29 (42.5)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (59.9)     26 (59.2)       Stroke, n (%)     40 (9.0)     8 (8.8)       <		
NYHA IV     113 (25.5)     15 (16.5)       No data     58 (13.1)     0       EF, median (IQR), %     55 (50-58)     55 (50-58)       DyrpoBNP, median (IQR), pg/ml     2072 (896-4791)     2542 (1125-5394)       GFR, median (IQR), mg/kg/1.73 m²     55 (40-61)     52 (41-67)       Length of hospital stay, median (IQR), dkg, dkg     Past medical history     91 (100)       Past medical history     0     23 (25.3)       1     0     23 (25.3)       2     0     21 (23.1)       3     0     47 (51.7)       Hypertension, n (%)     36 (21.5)     78 (65.7)       Hypertipidemia, n (%)     198 (44.6)     65 (71.4)       Dabetes mellitus, n (%)     162 (26.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     66 (21.6)     33 (36.3)       Artal fibrillation, n (%)     210 (47.30)     68 (8.9)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Stroke, n (%)     40 (0.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5		<0.001
No data     58 (13.1)     0       EF, median (QR), %     55 (52–58)     55 (52–60)       NT-proBNP, median (QR), pg/ml     2072 (896–4791)     2542 (1125–5394)       GFR, median (QR), m/kg/1.73 m²     05 (40–61)     2542 (1125–5394)       GFR, median (QR), m/kg/1.73 m²     0     2542 (1125–5394)       Past medical history     Prior heart failure, n (%)     279 (62.8)     9 (100)       No. of previous HFH     0     23 (25.3)     2       1     0     23 (25.3)     2       2     0     21 (23.1)     23       2     0     21 (23.1)     23       1     0     23 (25.3)     78 (85.7)       Hypertension, n (%)     162 (36.5)     38 (41.8)       Diabetes mellisus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     20 (47.30)     68 (74.7)       Myocardial infarction, n (%)     56 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)		
EF, median (IQR), %     55 (50-58)     55 (52-60)       NT-proBNP, median (IQR), mJ/kg/1.73 m²     2072 (896-4791)     2542 (1125-5394)       GFR, median (IQR), mJ/kg/1.73 m²     55 (50-58)     52 (41-67)       Part medical history     Prof heart failure, n (%)     279 (62.8)     91 (100)       No. of previous HFH     0     23 (25.3)     2       1     0     23 (25.3)     2     0     21 (23.1)       2.3     0     47 (51.7)     49 (52.8)     38 (41.8)       Pior heart failure, n (%)     162 (81.5)     38 (41.8)     65 (71.4)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)     66 (71.4)       Diabetes mellitus, n (%)     96 (21.6)     33 (36.3)     33 (36.3)       Atrial fibrillation, n (%)     20 (47.30)     68 (74.7)     40 (9.0)     88 (38.0)     66 (5.7)       Peripheal atrenial disease, n (%)     96 (21.6)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3)     33 (36.3) <t< td=""><td></td><td></td></t<>		
NT-proBNP, median (IQR), pg/ml     2072 (896-4791)     2542 (1125-5394)       GFR, median (IQR), mkg/1.73 m²     55 (40-61)     52 (41-67)       Length of hospital stay, median (IQR), days     Part medical history     91 (100)       Part medical history     0     22 (25.3)       1     0     22 (25.3)       2     0     21 (23.1)       3     0     47 (51.7)       Hyperlipidemia, n(%)     162 (36.5)     38 (41.8)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     210 (47.30)     68 (67.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     20 (047.30)     68 (67.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     20 (047.3)     66.6.5       Former     159 (35.8)     22 (24.2)<		0.008
GFR, median (IQR), ml/kg/1.73 m²     55 (40-61)     52 (41-67)       Length of hospital stay, median (IQR), days     Past medical history     Past medical history       Prior heart failure, n (%)     279 (62.8)     91 (100)       No. of previous HFH     0     23 (2.3)       1     0     21 (2.3)       2     0     47 (51.7)       Hypertension, n (%)     362 (81.5)     78 (85.7)       Hypertipidemia, n (%)     198 (44.6)     65 (71.4)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     28 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     20 (24.73)     66 (6.6)       Former     139 (35.8)     22 (24.21)       Never     242 (54.5)     63 (69.2)       Never     242 (54.5)     63 (69.2)       Never     24 (25.4) </td <td></td> <td>0.27</td>		0.27
Length of hospital stay, median (IQR), days       Past medical history       Prior heart failure, n (%)     279 (62.8)     91 (100)       No. of previous HFH     0     23 (25.3)       2     0     21 (23.1)       3.2     0     47 (51.7)       Hypertinghemia, n (%)     362 (81.5)     38 (87.7)       Hypertinghemia, n (%)     162 (36.5)     38 (41.8)       Obastes mellitus, n (%)     210 (47.30)     68 (7.4)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     88 (8.8)       Peripheral arterial disease, n (%)     25 (3.8)     22 (24.2)       Never     242 (54.5)     63 (66.0)       Former		0.78
Past medical history     Prior heart failure, n (%)     279 (62.8)     91 (100)       No. of previous HFH     0     23 (25.3)     2       2     0     21 (23.1)       a.3     0     47 (51.7)       Hypertension, n (%)     362 (81.5)     78 (85.7)       Hypertension, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (32.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     20 (47.3)     66.6       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       CUPCh, n (%)     8 (18.2)     9 (31.9)       History of SAR5-CoV-2, n (%)     81 (18.2)     9 (31.9)       History of SAR5-CoV-2, n (%)     15 (3.4)     4 (4.4)       Implanted Dacemaker, n (%)     15 (3.4)     4 (4.4)       Introl of SAR5-CoV-2, n (%)     71 (16.0)     17 (18.7)       History of SAR5-CoV-2, n (%)<		0.70
Prior heart failure, n(%)     279 (62.8)     91 (100)       No. of previous HFH     0     23 (25.3)       1     0     23 (25.3)       2     0     21 (23.1)       3     0     47 (61.7)       Hypertension, n(%)     362 (81.5)     78 (85.7)       Hyperfipidemia, n(%)     162 (36.5)     38 (41.8)       Diabetes mellitus, n(%)     162 (36.5)     38 (41.8)       Obesity, n(%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n(%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n(%)     210 (47.30)     68 (74.7)       Myocardial infarction, n(%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral atterial disease, n (%)     26 (5.5)     9 (9.9)       Smoking, n (%)     22 (24.2)     8 (8.8)       Current     43 (9.7)     6 (6.6)       Former     159 (35.6)     22 (24.2)       Never     24 (24.55.5)     63 (69.2)       COPD, n(%)     81 (18.2)     8 (8.8)       History of CABG, n (%) <td< td=""><td></td><td></td></td<>		
No. of previous HFH     0     23 (25.3)       1     0     23 (25.3)       2     0     21 (21.1)       23     0     47 (51.7)       Hypertension, n (%)     362 (81.5)     78 (85.7)       Hypertipidemia, n (%)     198 (44.6)     65 (71.4)       Diabetes mellitus, n (%)     162 (35.5)     38 (41.8)       Obesity, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral atterial disease, n (%)     25 (5.9)     9 (9.9)       Smoking, n (%)     210 (47.30)     6 (6.6)       Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)		<0.001
1     0     23 (25.3)       2     0     21 (23.1)       =3     0     47 (51.7)       Hypertension, n (%)     362 (81.5)     78 (85.7)       Hypertipidemia, n (%)     189 (44.6)     65 (71.4)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     28 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     21 (24.2)     66.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of PCI, n (%)     81 (18.2)     29 (31.9)       History of CABG, n (%)     11 (12.1)     11 (12.1)       History of CABG, n (%)     71 (16.0)     17 (18.7)       Implanted		<0.001
2   0   21 (23.1)     ≥3   0   47 (51.7)     Hypertension, n (%)   362 (81.5)   78 (85.7)     Hyperlipidemia, n (%)   198 (44.6)   65 (71.4)     Diabetes mellitus, n (%)   162 (36.5)   38 (41.8)     Obesity, n (%)   147 (33.2)   37 (40.7)     Chronic kidney disease, n (%)   96 (21.6)   33 (36.3)     Atrial fibrillation, n (%)   210 (47.30)   68 (74.7)     Myocardial infarction, n (%)   58 (12.9)   24 (25.3)     Stroke, n (%)   40 (9.0)   8 (8.8)     Peripheral aterial disease, n (%)   26 (5.9)   9 (9.9)     Smoking, n (%)   11 (8.2)   22 (24.2)     Never   242 (54.5)   63 (69.2)     COPD, n (%)   81 (18.2)   29 (31.9)     History of SARS-CoV-2, n (%)   81 (18.2)   29 (31.9)     History of CARG, n (%)   34 (1.8)   41 (4.3)     Implanted pacemaker, n (%)   71 (16.0)   17 (18.7)     Implanted pacemaker, n (%)   9 (2.0)   0     Clinical presentation of HF at hospital admission   24 (45.5)   64 (59.3)     Peripheral oedema, n (%)		
≥3     0     47 (51.7)       Hyperlipidemia, n (%)     362 (81.5)     78 (85.7)       Hyperlipidemia, n (%)     198 (44.6)     65 (71.4)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     66 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Stroke, n (%)     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     61 (14.2)     3(14.3)       History of CABG, n (%)     31 (14.3)     29 (31.9)       History of CABG, n (%)     32 (4.6.4)     11 (12.1)       History of CABG, n (%)     32 (4.6.4)     11 (12.1)       History of CABG, n (%)     32 (4.5.9) <td></td> <td></td>		
Hypertension, n (%)     362 (81.5)     76 (85.7)       Hyperlipidemia, n (%)     198 (44.6)     65 (71.4)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     24 (25.3)     66.60.       Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (25.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     11 (12.1)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of CABG, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted pacemaker, n (%)		-
Hyperlipidemia, n (%)     198 (44.6)     65 (71.4)       Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     26 (5.9)     9 (9.9)       Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     81 (18.2)     29 (31.9)       History of CABG, n (%)     11 (10.1)     11 (11.21)       History of CABG, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     17 (16.0)     17 (18.7)       Implanted pacemaker, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admissio		0.24
Diabetes mellitus, n (%)     162 (36.5)     38 (41.8)       Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     81 (18.2)     29 (31.9)       History of CABG, n (%)     24 (54.4)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of CABG, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     17 (16.0)     17 (18.7)       Implanted pacemaker, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     44 (59.3)       Pulm		0.34
Obesity, n (%)     147 (33.2)     37 (40.7)       Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     22 (24.2)     8       Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     11 (12.1)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     15 (3.4)     4 (4.4)       Implanted ICD/CRT-P/CRT-D, n (%)     24 (55.9)     54 (59.3)       Clinical presentation of HF at hospital admission     22 (46.2)     12 (46.2)       P		<0.001
Chronic kidney disease, n (%)     96 (21.6)     33 (36.3)       Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     22 (24.2)     V       Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     29 (31.9)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     15 (3.4)     4 (4.4)       Implanted ICD/CRT-P/CRT-D, n (%)     248 (55.9)     24 (59.3)       Clinical presentation of HF at hospital admission     24 (26.2)     24 (26.2)       Pleural effusion, n (%)     158 (35.6)     24 (46.2)		0.34
Atrial fibrillation, n (%)     210 (47.30)     68 (74.7)       Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)     210 (47.30)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     61 (14.3)     10 (17.7)       Procedures before admission     71 (16.0)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of CABG, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     94 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)		0.17
Myocardial infarction, n (%)     58 (12.9)     24 (25.3)       Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)         Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     29 (31.9)     14 (4.4)       Implanted pacemaker, n (%)     24 (55.4)     11 (12.1)       History of CABG, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     0       Clinical presentation of HF at hospital admission     0     0       Clinical presentation of HF at hospital admission     27 (29.7)     44 (4.2)       Peripheral ocedema, n (%)     268 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)		0.027
Stroke, n (%)     40 (9.0)     8 (8.8)       Peripheral arterial disease, n (%)     26 (5.9)     9 (9.9)       Smoking, n (%)         Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     29 (31.9)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     24 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n		<0.001
Peripheral atterial disease, n (%)   26 (5.9)   9 (9.9)     Smoking, n (%)   43 (9.7)   6 (6.6)     Current   43 (9.7)   6 (6.6)     Former   159 (35.8)   22 (24.2)     Never   242 (54.5)   63 (69.2)     COPD, n (%)   81 (18.2)   8 (8.8)     History of SARS-CoV-2, n (%)   65 (14.6)   17 (18.7)     Procedures before admission   24 (5.4)   11 (12.1)     History of PCI, n (%)   81 (18.2)   29 (31.9)     History of CABG, n (%)   24 (5.4)   11 (12.1)     History of CABG, n (%)   15 (3.4)   4 (4.4)     Implanted pacemaker, n (%)   71 (16.0)   17 (18.7)     Implanted pacemaker, n (%)   9 (2.0)   0     Clinical presentation of HF at hospital admission   248 (55.9)   54 (59.3)     Pulmonary congestion, n (%)   248 (55.9)   54 (59.3)     Pulmonary congestion, n (%)   158 (35.6)   27 (29.7)     Hepatomegaly, n (%)   48 (10.8)   13 (14.3)     Jugular vein distention, n (%)   33 (7.4)   6 (6.6)		0.001
Smoking, n (%)     6 (6.6)       Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     24 (54.4)     11 (12.1)       History of PCI, n (%)     81 (18.2)     29 (31.9)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     24 (55.9)     54 (59.3)       Peripheral oedema, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     33 (7.4)     6 (6.6)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)		0.95
Current     43 (9.7)     6 (6.6)       Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     56 (14.6)     17 (18.7)       Procedures before admission     24 (5.4)     11 (12.1)       History of PCI, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     71 (16.0)     17 (18.7)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     33 (7.4)     6 (6.6)		0.16
Former     159 (35.8)     22 (24.2)       Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     24 (54.4)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     33 (7.4)     6 (6.6)		
Never     242 (54.5)     63 (69.2)       COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     24 (54.4)     11 (12.1)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     33 (7.4)     6 (6.6)		
COPD, n (%)     81 (18.2)     8 (8.8)       History of SARS-CoV-2, n (%)     65 (14.6)     17 (18.7)       Procedures before admission     2     17 (18.7)       History of PCI, n (%)     81 (18.2)     29 (31.9)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     9 (2.0)     0       Peripheral oedema, n (%)     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     33 (7.4)     6 (6.6)		0.035
History of SARS-CoV-2, n (%)   65 (14.6)   17 (18.7)     Procedures before admission   1     History of PCI, n (%)   81 (18.2)   29 (31.9)     History of CABG, n (%)   24 (5.4)   11 (12.1)     History of cardiac ablation, n (%)   15 (3.4)   4 (4.4)     Implanted pacemaker, n (%)   71 (16.0)   17 (18.7)     Implanted ICD/CRT-P/CRT-D, n (%)   9 (2.0)   0     Clinical presentation of HF at hospital admission   7   7     Peripheral oedema, n (%)   248 (55.9)   54 (59.3)     Pulmonary congestion, n (%)   158 (35.6)   42 (46.2)     Pleural effusion, n (%)   96 (21.6)   27 (29.7)     Hepatomegaly, n (%)   33 (7.4)   6 (6.6)     Clinical profile (the Forrester classification), n (%)   33 (7.4)   6 (6.6)		
Procedures before admission     History of PCI, n (%)   81 (18.2)   29 (31.9)     History of CABG, n (%)   24 (5.4)   11 (12.1)     History of cardiac ablation, n (%)   15 (3.4)   4 (4.4)     Implanted pacemaker, n (%)   71 (16.0)   17 (18.7)     Implanted ICD/CRT-P/CRT-D, n (%)   9 (2.0)   0     Clinical presentation of HF at hospital admission   7   7     Peripheral oedema, n (%)   248 (55.9)   54 (59.3)     Pulmonary congestion, n (%)   158 (35.6)   42 (46.2)     Pleural effusion, n (%)   96 (21.6)   27 (29.7)     Hepatomegaly, n (%)   33 (7.4)   6 (6.6)     Clinical profile (the Forrester classification), n (%)   33 (7.4)   6 (6.6)		0.027
History of PCI, n (%)     81 (18.2)     29 (31.9)       History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     7     7       Peripheral oedema, n (%)     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     33 (7.4)     6 (6.6)		0.33
History of CABG, n (%)     24 (5.4)     11 (12.1)       History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)		
History of cardiac ablation, n (%)     15 (3.4)     4 (4.4)       Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Peripheral oedema, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)		0.003
Implanted pacemaker, n (%)     71 (16.0)     17 (18.7)       Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     7     100       Peripheral oedema, n (%)     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)		0.019
Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Peripheral oedema, n (%)     248 (55.9)     54 (26.2)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     53 (7.4)     50 (6.6)		0.78
Implanted ICD/CRT-P/CRT-D, n (%)     9 (2.0)     0       Clinical presentation of HF at hospital admission     248 (55.9)     54 (59.3)       Peripheral oedema, n (%)     248 (55.9)     54 (26.2)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     53 (7.4)     50 (6.6)		0.53
Clinical presentation of HF at hospital admission       Peripheral oedema, n (%)     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)		-
Peripheral oedema, n (%)     248 (55.9)     54 (59.3)       Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)		
Pulmonary congestion, n (%)     158 (35.6)     42 (46.2)       Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)		0.54
Pleural effusion, n (%)     96 (21.6)     27 (29.7)       Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     33 (7.4)     6 (6.6)		0.06
Hepatomegaly, n (%)     48 (10.8)     13 (14.3)       Jugular vein distention, n (%)     33 (7.4)     6 (6.6)       Clinical profile (the Forrester classification), n (%)     6 (6.6)     6 (6.6)		0.1
Jugular vein distention, n (%)33 (7.4)6 (6.6)Clinical profile (the Forrester classification), n (%)		0.34
Clinical profile (the Forrester classification), n (%)		0.34
		0.70
Warm-wet     321 (72.3)     52 (57.1)       Cold drive     0 (2.0)     2 (2.2)		<0.001
Cold-dry     9 (2.0)     2 (2.2)       Cold-wet     34 (7.7)     0		

Table 1. (cont.) Baseline characteristics and clinical pathways of patients with heart failure with preserved ejection fraction with and without
previous heart failure hospitalization (HFH)

Medications during hospitalization				
	Without previous HFH n = 444	With at least 1 previous HFH n = 91	P-value	
Inotropes, n (%)	59 (13.3)	5 (5.5)	0.037	
Intravenous diuretics, n (%)	409 (92.1)	62 (68.1)	<0.001	
Intravenous nitrates, n (%)	178 (40.1)	30 (33.0)	0.2	
ACEi, n (%)	237 (53.4)	48 (52.8)	0.91	
ARB, n (%)	59 (13.3)	22 (24.2)	0.008	
Beta-blockers, n (%)	355 (80.0)	84 (92.3)	0.005	
MRA, n (%)	217 (48.9)	40 (44.0)	0.39	
SGLT-2i, n (%)	46 (10.4)	23 (25.3)	<0.001	
Outpatient clinic visits before admission				
Cardiologist, n (%)	150 (33.8)	81 (89.0)	<0.001	
Internal medicine, n (%)	126 28.4)	55 (60.4)	<0.001	
Diabetologist, n (%)	37 (8.3)	21 (23.1)	<0.001	
Pneumologist, n (%)	22 (5.0)	10 (11.0)	0.027	
Nephrologist, n (%)	16 (3.6)	9 (9.9)	0.01	
Department of hospitalization				
Internal medicine, n (%)	226 (50.9)	1 (1.1)		
Cardiology, n (%)	216 (48.7)	90 (98.9)	<0.001	
ER with no data on admission, n (%)	2 (0.4)	0		
Where patients were referred form				
General practitioner, n (%)	108 (24.5)	27 (29.7)		
Ambulance service, n (%)	146 (33.1)	7 (7.7)		
Emergency department, n (%)	139 (31.5)	34 (37.4)		
Outpatient clinic, n (%)	48 (10.9)	23 (25.3)	<0.001	
Where patients were discharged to				
Home, n (%)	189 (42.6)	72 (79.2)		
Another hospital, n (%)	14 (3.1)	5 (5.5)		
Social welfare home, n (%)	2 (0.5)	1 (1.1)	<0.001	
No data, n (%)	239 (53.8)	13 (14.3)		

Abbreviations: ACEi, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers; BMI, body mass index; CABG, coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease; CRT-D, cardiac resynchronization therapy defibrillator; CRT-P, cardiac resynchronization therapy pacemaker; DBP, diastolic blood pressure; EF, ejection fraction; GFR, glomerular filtration rate; HF, heart failure; HFH, heart failure hospitalization; HR, heart rate; ICD, implantable cardioverter-defibrillator; IQR, interquartile range; MRA, mineralocorticoid receptor blocker; NT-ProBNP, N-terminal pro-B-type natriuretic peptide; NYHA, New York Heart Association; PCL, percutaneous coronary intervention; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; SBP, systolic blood pressure; SGLT2i, sodium-glucose co-transporter 2 inhibitors

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