



# POLISH HEART JOURNAL

Kardiologia Polska

The Official Peer-reviewed Journal  
of the Polish Cardiac Society  
since 1957

**Online first**

This is a provisional PDF only. Copyedited and fully  
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ISSN 0022-9032

e-ISSN 1897-4279

## **Heart failure epidemiology and outcomes in Poland from 2010 to 2021: A marked decline in HF hospitalization during the COVID-19 pandemic**

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**Article type:** Short communication

**Received:** October 17, 2024

**Accepted:** December 12, 2024

**Early publication date:** December 18, 2024

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# **Heart failure epidemiology and outcomes in Poland from 2010 to 2021: A marked decline in HF hospitalization during the COVID-19 pandemic**

**Short title:** Post-COVID-19 heart failure epidemiology in Poland

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## **INTRODUCTION**

COVID-19 pandemic outbreak affected health care performance. In this nation-wide study trends in heart failure (HF) epidemiology and patient outcomes during the first 2 years of COVID-19 pandemic in Poland were evaluated.

## **METHODS**

This is a retrospective study that covers all adult HF patients from January 1, 2010 to December 31, 2021 in public sector in Poland. Data are based on the Nationwide Polish Ministry of Health

Registry. This cross-sectional investigation included all Polish residents who were recorded with an inpatient or outpatient diagnosis of HF. Co-morbid conditions were based on ICD-10 diagnoses and incorporated into Charlson Comorbidity Index (CCI). Data regarding only unplanned hospitalizations were collected. The investigation conforms to the principles outlined in the Declaration of Helsinki. The Regional Ethical Review Board approved the study.

Data are presented as mean values or percentage. The study did not use a random sample. All patients using the public health sector in Poland participated in the study. Therefore, statistical significance cannot be verified. All analyses and plots were performed using free licence R.

## RESULTS AND DISCUSSION

### Heart failure epidemiology.

Heart failure incidence declined from 0.39% in 2019 to 0.2% in 2020 and 0.3 % in 2021 (Supplementary material, *Table S1*). This reflects absolute decline in new HF cases of 18% and 22% in 2020 and 2021, respectively (**Figure 1A**; Supplementary material, *Table S2*). Given the average yearly drop of 7% in the last decade, this was the greatest decline (**Figure 1A**; Supplementary material, *Table S2*). The change was mainly driven by decline in the number of patients with ischemic HF (**Figure 1A**; Supplementary material, *Table S2*). As a result, 2020 was the first year over a decade when ischemic etiology consisted the minority of incident HF (**Figure 1A**; Supplementary material, *Table S2*). CCI score of incident patients has slightly increased from 1.23 to 1.25 (Supplementary material, *Table S1*).

Prevalence decreased from 3.63% in 2019 to 3.59% in 2020 and 3.48% in 2021 (Supplementary material, *Table S1*). It was the first decline in the last decade (**Figure 1A**; Supplementary material, *Table S2*). This reflected, a drop of 7.6% in the total number of HF patients by the end of 2021 (**Figure 1A**; Supplementary material, *Table S2*). Ischemic HF prevalence decreased from 2.26% down to 2.11% in 2021 and non-ischemic HF remained steady (Supplementary material, *Table S2*).

Mortality increased from 9.92% in 2019 to 11.54% in 2020 and 12.47% in 2021 (Supplementary material, *Table S1*). In comparison to 2019 excess of 20 088 (14.5%) and 27 087 (19.5%) HF patients deaths was recorded in 2020 and 2021, respectively. It was the first time over the last decade that the number of deaths exceeded the number of newly diagnosed HF cases (**Figure 1A**; Supplementary material, *Table S2*). Total mortality among ischemic HF patients increased from 9.13% to 12.18% in 2021, and from 11.26% to 12.93% among non-

ischemic (Supplementary material, *Table S2*). Regardless of etiology, mortality increased remarkably among patients with CCI >5 points (Supplementary material, *Table S1*).

### **Patients presentation and outcomes**

The number of HF patients presented at least once to the public health system in Poland dropped by 10.97% in 2020 and 9.16% in 2021 compared to 2019 (**Figure 1A**; Supplementary material, *Table S2*). Occurrence of patients with ischemic HF dropped over 12.2% in 2020 and 13.3% in 2021, and by 8.8% and 2% with non-ischemic HF (**Figure 1A**).

The decline in patient occurrence to health care system was mainly driven by reduction in hospitalizations (**Figure 1B**). There were 24% and 26% fewer hospitalizations in 2020 and 2021 (**Figure 1B**; Supplementary material, *Table S3*). Admissions to cardiac units declined by 19% and 9%, respectively (Supplementary material, *Table S4*). While admissions to non-cardiac departments plummeted by 23% and 31%. (Supplementary material, *Table S4*). The number of outpatient visits dropped only by 11% in 2020 and 5% in 2021, with significant recovery in cardiac secondary care (Supplementary material, *Table S4*). On monthly basis load of hospitalizations reflected pandemic fluctuation (**Figure 1C**; Supplementary material, *Table S3*).

Number of patients hospitalized at least once dropped from 17.63% (222 426) to just above 14% (172 960 and 169 153) in 2020 and 2021 (**Figure 1B**; Supplementary material, *Table S5*). Patients hospitalized in pandemic years were slightly younger and more often reside in nonurban areas compared to 2019 (Supplementary material, *Table S5*). There was a greater drop in the number of ischemic HF patients being hospitalized towards 2019 (27% vs. 18% for non-ischemic). Comorbidity load (CCI) of hospitalized patients increased from 1.33 to 1.37 in 2021 (Supplementary material, *Table S5*). The mean length of hospital stay was comparable.

In-hospital mortality rose and reached 16% in 2020 and 15.72% in 2021 compared to 14.07% in 2019 (Supplementary material, *Table S5*). On monthly basis percentage of hospital stays that ceased with death varied in parallel with COVID waves (Supplementary material, *Figure S1* and *Table S3*). Additionally, rate of hospitalizations ended with death within the day of admission increased to 1.11% in 2020 compared to 0.93% in 2019 and improved to 0.97% in 2021 (Supplementary material, *Table S3*). In-hospital mortality of ischemic HF patients increased from 11.69% in 2019 to 13.8% in 2021, while non ischemic patients experienced only a transient rise in 2020 (Supplementary material, *Table S5*).

This nationwide study displays challenges met by Polish health system over years 2010–2021. By the end of 2019, there was gradual uptrend in HF prevalence accompanied by

downtrend in incidence and leveled off mortality. During the first 2 years of COVID-19 significant shifts in epidemiology occurred. HF incidence and prevalence decreased for the first time in the decade. This was accompanied by remarkable reduction in HF hospitalizations and incremental increase in total and in-hospital mortality with ischemic HF patients being mostly affected.

Yearly reduction in the total number of hospitalizations exceeded 20%. The drop in non-cardiac units admissions was markedly greater compared to cardiac units. World-wide declines in HF hospitalizations followed by decreased incidence were reported [1]. The outpatient visits were less affected, which could be the result of high Poland tele-visits utilization in Poland [2].

Total and in-hospital mortality in Poland was on rise in the first 2 years of COVID-19 pandemics. Limited access to health service and patients reluctance to seek help could contribute. During COVID-19 pandemic, as many as 28% of Polish residents claimed unmet needs for medical examination or treatment [3]. Access to most effective treatment became available late into pandemics [4]. Kubica et al. [5] reported a significant reduction of self-referrals and increased number of acute HF patients brought by an ambulance. Finally, quick protective measures such as lockdown could limit virus spread in Poland but on the other hand could hold people from seeking help.

The ischemic HF subpopulation experienced profound decline in incidence and prevalence along with mortality increase compared to barely changed epidemiology of nonischemic HF.

Limited data refer to differences in outcomes between HF etiology during COVID-19 pandemics. A significant drop in percutaneous coronary interventions could contribute to unfavourable outcomes in ischemic HF patients. According to Drożdż et al. [6], in Lodz Voivodship by the end of 2020 the number of percutaneous coronary interventions dropped below 85% with reference to 2019. Secondly, it can be assumed ischemic patients were reluctant to seek help or could not receive one early as Hawranek et al. reported decrease in the number of myocardial infarctions along with rise in cardiac arrest prior to admissions [7]. Finally, patients with acute coronary syndromes presented in pandemics, similarly to HF patients of the present study, had a greater comorbidity load [8].

This study has the limitations inherent to a registry of unaudited procedures and the results may not necessarily generalize outside the study period. However, they may indicate changes in HF epidemiology in the coming years. The study is awaiting continuation with an overview of HF population by the end of 2024 to assess if long term effects have occurred.

To sum up during two-year COVID-19 pandemics significant shifts in epidemiology were noted. Interestingly, ischemic HF patients experienced worse outcomes compared to non-ischemic. The pandemics reshaped HF population and at the beginning of 2022 it lessened by 7.7%, became younger with a fewer comorbidities. In the light of above facts and ongoing COVID-19 pandemics beyond 2022 an increase in HF incidence in years following pandemics might be anticipated in Poland as a tidal effect to delay or deferral of care either due to HF or other cardiac symptoms.

### **Supplementary material**

Supplementary material is available at [https://journals.viamedica.pl/polish\\_heart\\_journal](https://journals.viamedica.pl/polish_heart_journal).

### **Article information**

**Conflict of interest:** None declared.

**Funding:** None.

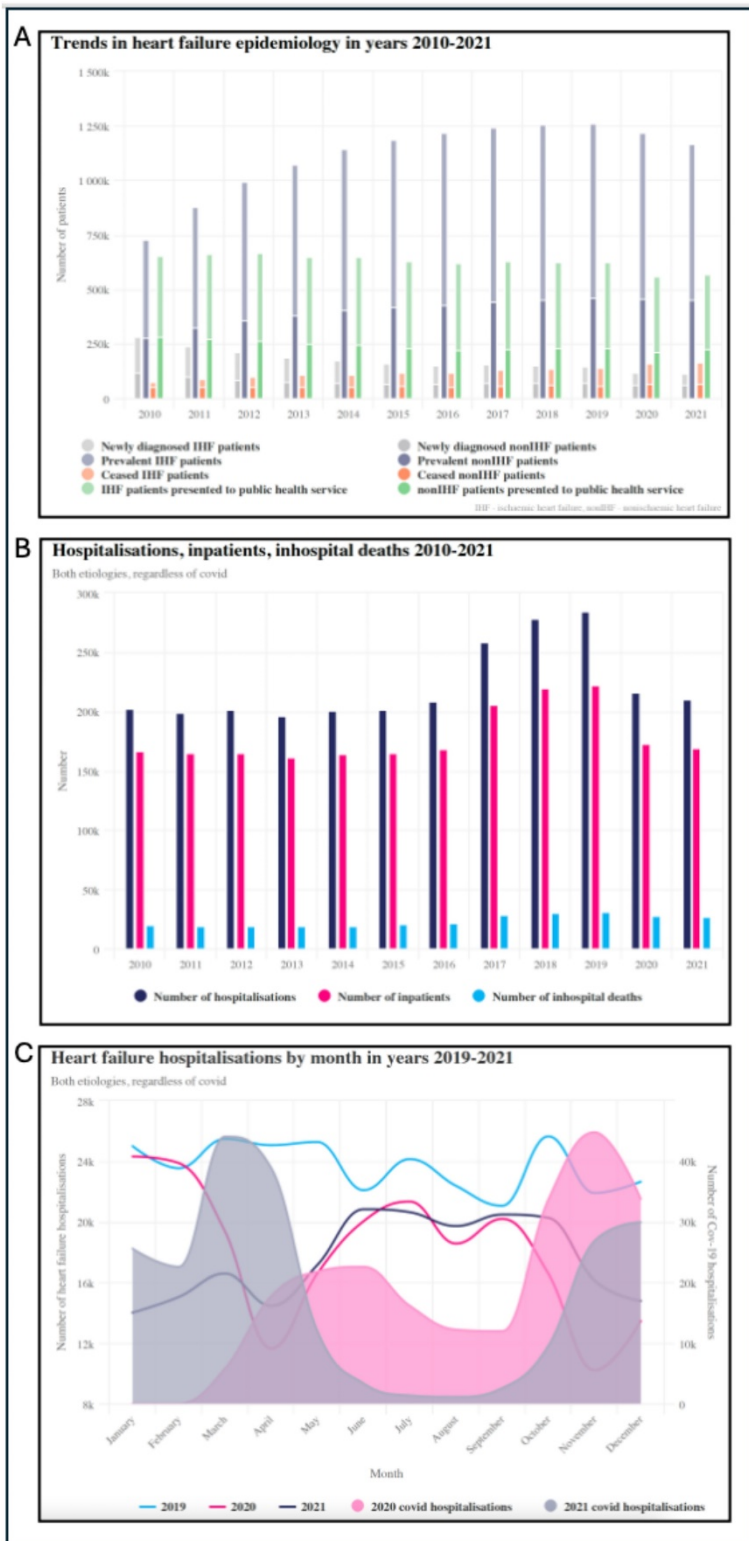
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**Figure 1. A.** Trends in heart failure epidemiology in years 2010–2021. **B.** Hospitalizations, inpatients and in-hospital deaths in years 2010–2021. **C.** Heart failure hospitalizations by month in years 2019–2021