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Survival benefits of specialized heart failure clinics: Czech real-world evidence

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SOUHRN

Úvod: Srdeční selhání zůstává navzdory významnému pokroku ve farmakologické a přístrojové léčbě jednou z hlavních příčin morbidity a mortality celosvětově. Optimalizovaná farmakoterapie vedená doporučenými postupy (guideline-directed medical therapy, GDMT) a dostupnost specializované péče jsou zásadní pro zlepšení dlouhodobé prognózy pacientů. Vliv specializovaných ambulancí srdečního selhání na přežití pacientů v reálné klinické praxi však zůstává ve střední a východní Evropě nedostatečně zdokumentován.
Metody: Tato retrospektivní observační studie porovnávala dva vzájemně se doplňující soubory pacientů se srdečním selháním v České republice. Celostátní data byla získána z Národního registru hrazených zdravotních služeb (NRHZS) za období 2015–2023. Tato data byla porovnána se souborem 217 pacientů sledovaných ve specializované ambulanci srdečního selhání Ústřední vojenské nemocnice v Praze v letech 2017–2024. Pomocí deskriptivní statistiky a analýzy přežití byly hodnoceny farmakoterapie, dosažení cílových dávek doporučených guidelines, využití přístrojové léčby (ICD, CRT) a celková mortalita.
Výsledky: Pacienti sledovaní ve specializované ambulanci srdečního selhání byli častěji léčeni moderními prognosticky příznivými léčivy než pacienti v celostátním souboru. Výrazně častější bylo užívání inhibitorů angiotenzinového receptoru a neprilysinu (ARNI) a inhibitorů sodíko-glukózového kotransportéru 2 (SGLT2), stejně jako dodržování doporučených kombinací GDMT. Během dlouhodobého sledování činila celková mortalita v souboru specializované ambulance 10,6 %, přičemž odhadovaná míra přežití dosahovala 90,1 % ve 2 letech a 78,3 % v 7 letech. Léčba inhibitory SGLT2 a vyšší počet užívaných tříd prognosticky příznivé farmakoterapie byly spojeny s nižší mortalitou.
Závěr: Péče ve specializované ambulanci srdečního selhání byla spojena s vysokou mírou využití farmakoterapie vedené doporučenými postupy a numericky příznivějším přežitím ve srovnání s celostátními daty.

Keywords:
Guideline-directed medical therapy
Heart failure
Pharmacotherapy
Specialized clinics

ABSTRACT

Background: Heart failure (HF) remains a leading cause of morbidity and mortality worldwide despite major advances in pharmacological and device therapy. Optimized guideline-directed medical therapy (GDMT) and access to specialized care are crucial for improving long-term outcomes. The impact of specialized heart failure clinics on survival in real-world clinical practice remains insufficiently documented in Central and Eastern Europe.
Methods: This retrospective observational study compared two complementary datasets of HF patients in the Czech Republic. Nationwide data were obtained from the National Reimbursement of Healthcare Services Database (NRHZS) covering the period 2015–2023. These data were compared with a cohort of 217 patients followed at a specialized outpatient heart failure clinic at the Military University Hospital in Prague between 2017 and 2024. Pharmacotherapy patterns, achievement of guideline-recommended target doses, use of device therapy (ICD, CRT), and all-cause mortality were analyzed using descriptive statistics and survival analysis.
Results: Patients managed in the specialized heart failure clinic received modern disease-modifying therapies more frequently than patients in nationwide care. Use of angiotensin receptor–neprilysin inhibitors and SGLT2 inhibitors was markedly higher, as was adherence to recommended combinations of GDMT. During long-term follow-up, all-cause mortality in the specialized-clinic cohort was 10.6%, with estimated survival rates of 90.1% at 2 years and 78.3% at 7 years. Treatment with SGLT2 inhibitors and a higher number of prognostic drug classes were associated with lower mortality.
Conclusions: Management in a specialized outpatient clinic was associated with high uptake of guideline-directed medical therapy and numerically favorable survival compared with nationwide data.

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Introduction

Heart failure (HF) represents one of the most prevalent and challenging cardiovascular syndromes worldwide and remains a leading cause of morbidity, mortality, and healthcare expenditure. Despite substantial advances in pharmacological and device-based therapies over the past two decades, long-term prognosis of HF patients remains poor, particularly in elderly and multimorbid populations. The increasing prevalence of HF is largely driven by population ageing, improved survival after acute cardiovascular events, and broader recognition of the syndrome across healthcare systems.

Contemporary guideline-directed medical therapy (GDMT), including beta-blockers, renin–angiotensin system inhibitors, mineralocorticoid receptor antagonists, angiotensin receptor–neprilysin inhibitors (ARNI), and sodium–glucose cotransporter 2 (SGLT2) inhibitors, has been shown to significantly reduce mortality and hospitalization rates in randomized clinical trials. However, real-world implementation of these therapies remains suboptimal. Underutilization of novel agents, insufficient dose titration, and fragmented follow-up continue to limit the potential benefits of modern HF treatment, particularly outside specialized care settings.

Several observational studies and registries have demonstrated that structured management within specialized heart failure clinics is associated with improved adherence to guideline-recommended therapies, higher achievement of target drug doses, and better clinical outcomes. Multidisciplinary HF clinics typically provide protocol-driven pharmacotherapy titration, closer follow-up, patient education, and timely access to device therapy. Nevertheless, data directly comparing outcomes of patients treated in specialized HF clinics with nationwide real-world populations remain limited, particularly in the Central and Eastern Europe.

In the Czech Republic, previous nationwide analyses based on administrative healthcare databases have described trends in HF prevalence, incidence, and survival, revealing a persistently high disease burden and substantial gaps in GDMT implementation. At the same time, the role and impact of specialized HF outpatient clinics on patient outcomes at the population level have not been systematically evaluated.

Therefore, the aim of this study was to compare treatment patterns and survival outcomes between heart failure patients managed within a specialized outpatient HF clinic and patients captured in nationwide real-world data from the Czech Republic. By integrating data from the National Reimbursement of Healthcare Services Database with a well-characterized cohort from a specialized HF clinic, we sought to assess whether structured multidisciplinary care translates into measurable survival benefits in routine clinical practice.

Methods

Study design

This study was designed as a retrospective observational analysis comparing two complementary datasets of patients with heart failure (HF) in the Czech Republic. Nationwide administrative data were contrasted with a well-defined cohort of patients followed in a specialized outpatient heart failure clinic. The primary objective was to evaluate differences in treatment patterns, adherence to guideline-directed medical therapy (GDMT), and survival outcomes between routine nationwide care and structured specialized management.

Data sources

Nationwide data were obtained from the National Reimbursement of Healthcare Services Database (NRHZS), which captures comprehensive information on healthcare utilization reimbursed by the public health insurance system in the Czech Republic. The database includes diagnostic codes, hospitalizations, outpatient visits, prescribed pharmacotherapy, and device-based interventions. For the purpose of this study, data covering the period from January 1, 2015 to December 31, 2023 were analyzed.

The specialized cohort consisted of patients followed at the outpatient heart failure clinic within the Department of Internal Medicine of the Military University Hospital Prague. This clinic provides structured, guideline-based care with regular follow-up, protocol-driven pharmacotherapy titration, and access to advanced heart failure therapies. Patients were enrolled consecutively between January 2017 and December 2024.

Patient population and inclusion criteria

In the nationwide cohort, patients were identified based on the presence of a diagnosis of heart failure recorded as either a primary or secondary diagnosis using International Classification of Diseases, 10th Revision (ICD-10) codes I50.0, I50.1, or I50.9. Inclusion required at least one recorded hospitalization or outpatient encounter associated with HF during the study period.

In the specialized outpatient cohort, all consecutive adult patients with a confirmed clinical diagnosis of chronic heart failure managed in the specialized HF clinic were included. Diagnosis was established by the treating cardiologist or internist based on clinical presentation, imaging findings, and laboratory data in accordance with contemporary guideline recommendations.

Pharmacotherapy and device therapy assessment

Pharmacological treatment was assessed in both cohorts with a focus on guideline-directed medical therapy. The following drug classes were evaluated: beta-blockers, angiotensin-converting enzyme inhibitors (ACEi), angiotensin II receptor blockers (ARB), angiotensin receptor–neprilysin inhibitors (ARNI), mineralocorticoid receptor antagonists (MRA), and sodium–glucose cotransporter 2 (SGLT2) inhibitors. In the specialized cohort, achievement of guideline-recommended target doses was systematically documented as part of routine clinical care.

Device therapy, including implantable cardioverter-defibrillators (ICD) and cardiac resynchronization therapy (CRT), was recorded in both datasets where applicable. The presence of device therapy was identified using reimbursement and procedural codes in the nationwide database and clinical records in the specialized cohort.

Outcome measures

The primary outcome of interest was all-cause mortality. In the nationwide cohort, mortality was assessed using linked administrative records capturing death during hospitalization or documented termination of healthcare reimbursement. In the specialized cohort, survival status was obtained from clinical follow-up records and hospital information systems.

Secondary outcomes included patterns of pharmacotherapy use, adherence to GDMT, achievement of target doses, and utilization of device therapy. Comparisons between cohorts focused on differences in treatment intensity and their association with observed survival outcomes.

Statistical analysis

Descriptive statistics were used to summarize baseline characteristics, pharmacotherapy patterns, and device utilization in both cohorts. Continuous variables are presented as mean ± standard deviation or median with interquartile range, as appropriate. Categorical variables are expressed as absolute numbers and percentages. Survival within the specialized outpatient cohort was assessed using Kaplan–Meier estimates. Comparisons between subgroups of patients within the cohort were performed using the log-rank test. Formal statistical comparison with nationwide registry data was not feasible due to the absence of patient-level data. Statistical analyses were performed using SPSS (version 25.0, IBM Corp., Armonk, NY, USA) and R statistical software. A two-sided *p*-value of less than 0.05 was considered statistically significant.

Ethical considerations

The study was conducted in accordance with Czech legislation governing the use of anonymized healthcare data and in compliance with the Declaration of Helsinki. Given the retrospective design and full anonymization of the data, individual informed consent was not required.

Results

Study population

The specialized outpatient cohort consisted of 217 patients followed at the heart failure clinic of the Department of Internal Medicine, Military University Hospital Prague. The clinic has provided continuous specialized care since 2017, with a primary focus on patients mainly with reduced left ventricular ejection fraction. Patients were followed between 2017 and early 2024, and data were obtained retrospectively from outpatient records and the electronic hospital information system.

Patient age ranged from 18 to 71 years. The mean age was 55.2 years, with a median of 58 years. Male patients predominated (165 patients, 76.0%), while 52 patients (24.0%) were female.

Baseline left ventricular ejection fraction (LVEF) ranged from 15% to 60%, with a mean value of 31.5% and a median of 30%. The majority of patients were classified as having heart failure with reduced ejection fraction (HFrEF, LVEF ≤40%), accounting for 192 patients (88.5%).

Table 1 – Baseline characteristics of the specialized heart failure clinic cohort

Characteristic	Value
Number of patients	217
Age, years (mean/median)	55.2/58
Male sex, n (%)	165 (76.0)
Female sex, n (%)	52 (24.0)
Left ventricular ejection fraction, % (mean/median)	31.5 / 30
HFrEF (LVEF ≤40%), n (%)	192 (88.5)
HFmrEF (LVEF 41–49%), n (%)	6 (2.8)
HFpEF (LVEF ≥50%), n (%)	19 (8.8)

HFmrEF – heart failure with mildly reduced ejection fraction; HFpEF – heart failure with preserved ejection fraction; HFrEF – heart failure with reduced ejection fraction; LVEF – left ventricular ejection fraction.
Values are presented as absolute numbers and percentages unless otherwise stated.

Heart failure with mildly reduced ejection fraction (HFmrEF, LVEF 41–49%) was present in 6 patients (2.8%), and heart failure with preserved ejection fraction (HFpEF, LVEF ≥ 50%) in 19 patients (8.8%) (**Table 1**).

Pharmacotherapy utilization

Pharmacological treatment at the time of the most recent outpatient visit reflected a high uptake of guideline-directed medical therapy. Beta-blockers were prescribed in

Table 2 – Distribution of heart failure-related pharmacotherapy in patients followed at the specialized outpatient heart failure clinic

Drug class	Number of patients	% of total
Beta-blockers	195	89.9
Angiotensin receptor–neprilysin inhibitors (ARNI)	175	80.6
Angiotensin-converting enzyme inhibitors (ACEi)	29	13.4
Angiotensin II receptor blockers (ARB)	9	4.1
Sodium–glucose cotransporter 2 inhibitors (SGLT2i)	171	78.8
Ivabradine	15	6.9
Furosemide	145	66.8
Mineralocorticoid receptor antagonists (MRA)	155	71.4
Indapamide	6	2.8
Hydrochlorothiazide	14	6.5
Vericiguat	16	7.4
Digoxin	3	1.4

Values are presented as absolute numbers and percentages of the total cohort.

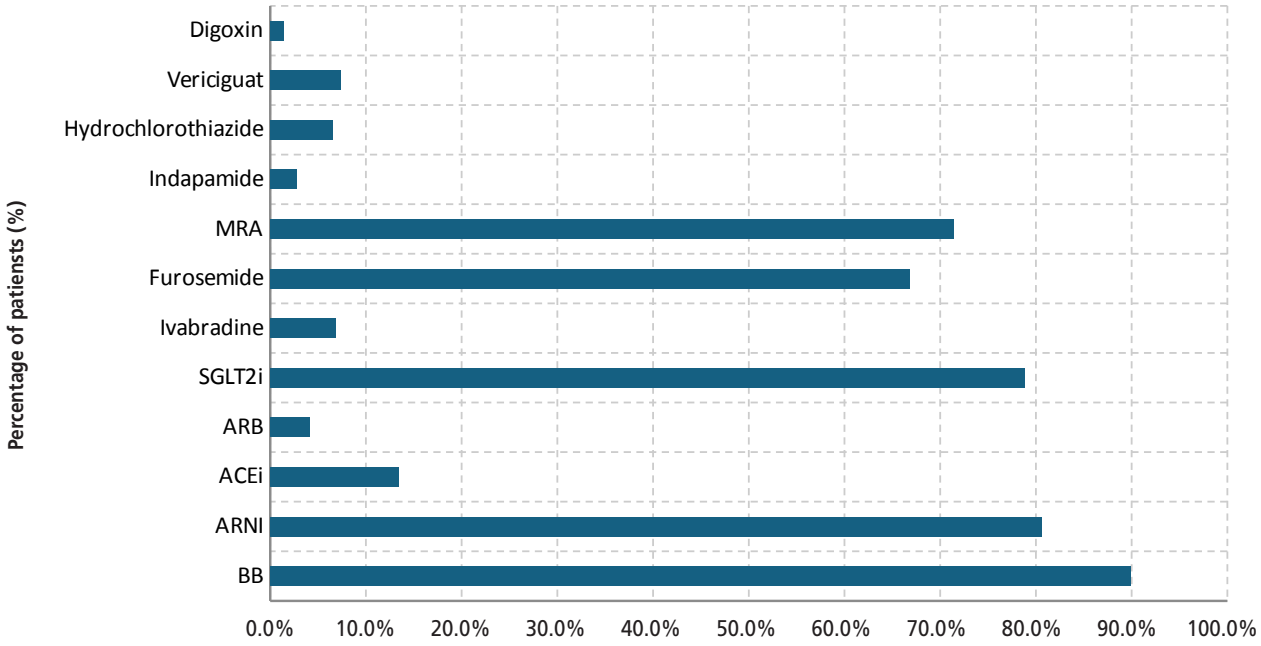

Fig. 1 Pharmacotherapy in the specialized heart failure clinic.

195 patients (89.9%), mineralocorticoid receptor antagonists in 155 patients (71.4%), and sodium–glucose cotransporter 2 inhibitors (SGLT2i) in 171 patients (78.8%). Loop diuretic therapy with furosemide was recorded in 145 patients (66.8%).

Angiotensin receptor–neprilysin inhibitors (ARNI) were used in 175 patients (80.6%). Angiotensin-converting enzyme inhibitors (ACEi) were prescribed in 29 patients (13.4%), and angiotensin receptor blockers (ARB) in 9 patients (4.1%), predominantly in patients not receiving ARNI therapy. Additional heart failure–related pharmacotherapy included ivabradine in 15 patients (6.9%), vericiguat in 16 patients (7.4%), digoxin in 3 patients (1.4%), hydrochlorothiazide in 14 patients (6.5%), and indapamide in 6 patients (2.8%) (**Table 2**, **Fig. 1**).

Among patients with heart failure with reduced ejection fraction (HFrEF; n = 192), ARNI therapy was prescribed in 175 patients (91.1%).

Compared with published nationwide Czech data, uptake of contemporary guideline-directed medical therapy was higher in the present cohort. In the nationwide analysis, ARNI and SGLT2 inhibitors were prescribed in 7.8% and 16.1% of patients, respectively, whereas in the present cohort these proportions reached 80.6% and 78.8% at the most recent outpatient visit. Similarly, beta-blockers were more frequently used (89.9% vs. 62.6%), while ACE inhibitors and ARBs were less common (13.4% and 4.1% vs. 42.1% and 16.5%, respectively).[1] Nationwide data did not allow stratification according to ejection fraction.

Target dose achievement

Achievement of guideline-recommended target doses was evaluated for key disease-modifying drug classes. Among patients treated with ARNI, target doses were achieved in 48 of 175 patients (27.4%). In patients receiving ACE inhibitors, target doses were achieved in 6 of 30 patients (20.0%). Due to the small number of patients treated with ARB (9 patients, 4.1%), further analysis of dose attainment in this subgroup was not performed. For beta-blockers, achievement of guideline-recommended target doses was observed in 20 of 195 treated patients (10.3%).

Device therapy utilization

Non-pharmacological treatment included device-based therapy in a substantial proportion of patients. Overall, implantable cardioverter-defibrillators were present in 69 patients (31.7%), and cardiac resynchronization therapy was utilized in 36 patients (16.5%). When restricted to patients with heart failure with reduced ejection fraction, device therapy utilization increased to 69 patients (35.9%) for implantable cardioverter-defibrillators and 36 patients (18.8%) for cardiac resynchronization therapy.

Survival and mortality outcomes

During the observation period from 2017 to 2024, a total of 23 deaths were recorded among 217 patients, corresponding to an all-cause mortality of 10.6%. Kaplan–Meier analysis demonstrated a gradual decline in cumulative survival over time; median survival was not reached. Estimated survival probability was 90.1% at 2 years, 84.7% at 4 years, and 78.3% at 7 years of follow-up.

Survival in the context of nationwide data

Survival outcomes of patients followed in the specialized heart failure outpatient clinic were interpreted in the context of previously published nationwide data. In a nationwide population-based study using the Czech National Healthcare Reimbursement Database, Táborský et al. reported an annual all-cause mortality rate of 15.9%

among heart failure patients in 2018, despite a gradual improvement over time. Mortality remained strongly age-dependent, reaching 17.7% in patients aged ≥65 years.[2] When contrasted with these population-level data, patients followed in the specialized heart failure outpatient clinic demonstrated favorable long-term cumulative survival within the observed follow-up period. Direct statistical comparison between cohorts was not performed due to the use of aggregated nationwide data and differences in age distribution and heart failure phenotype. It should be noted that nationwide mortality rates represent annual population-based estimates and are not directly comparable to cumulative Kaplan–Meier survival estimates.

Causes of death

Among the 23 deaths, 16 (69.6%) were classified as cardiac, 6 (26.1%) as non-cardiac, and 1 (4.3%) as unknown. Heart failure was the leading cardiac cause (12 cases, 52.2%), followed by ischemic heart disease including myocardial infarction (2 cases, 8.7%) and arrhythmogenic causes (2 cases, 8.7%). Non-cardiac causes included malignancy (2 cases, 8.7%), renal failure (2 cases, 8.7%), hemorrhagic shock (1 case, 4.3%), and infection (pneumonia; 1 case, 4.3%).

Treatment and age differences between survivors and non-survivors

Use of SGLT2 inhibitors differed between survivors and non-survivors (81.4% vs. 56.5%, respectively; p <0.05). The mean number of prognostic drug classes (ARNI or ACEi/ARB, beta-blocker, MRA, SGLT2 inhibitor) was 3.1 ± 0.8 among survivors and 2.5 ± 1.0 among non-survivors (p <0.05).

In unadjusted analysis, SGLT2 inhibitor therapy was associated with lower mortality (OR 0.41; 95% CI 0.18–0.93; p <0.05). No statistically significant associations with mortality were observed for ARNI (OR 0.71; 95% CI 0.29–1.72), MRA (OR 0.76; 95% CI 0.32–1.83), or beta-blockers (OR 0.81; 95% CI 0.29–2.25).

Non-survivors were older than survivors (77.4 ± 6.1 vs. 69.1 ± 9.7 years; p <0.001). Regarding device therapy, ICD was present in 6 non-survivors (26.1%) and CRT in 5 non-survivors (21.7%); differences in ICD and CRT prevalence between survivors and non-survivors were not statistically significant (ICD p = 0.489; CRT p = 0.618).

Discussion

Principal findings

To our knowledge, this study represents the first direct real-world comparison between a structured specialized heart failure outpatient clinic and nationwide administrative data in the Czech Republic. It provides real-world evidence demonstrating that management of heart failure patients within a specialized outpatient clinic is associated with a high level of adherence to guideline-directed medical therapy and favorable survival outcomes. Patients followed in the specialized heart failure clinic were predominantly characterized by a reduced ejection fraction phenotype, received modern disease-modifying pharmacotherapy at high rates, and exhibited lower all-cause mortality compared with nationwide data.[2]

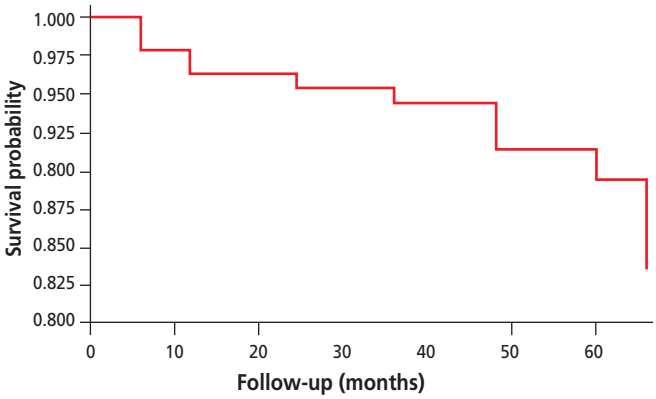

Fig. 2 – Kaplan–Meier overall survival curve.

The specialized outpatient cohort was highly enriched with patients with heart failure with reduced ejection fraction, accounting for nearly 90% of the population. This reflects targeted referral and selection of patients most likely to benefit from evidence-based pharmacological and device-based therapies, for which the strongest prognostic benefit has been demonstrated in randomized trials and contemporary guidelines.[3] Utilization of modern pharmacotherapy, particularly angiotensin receptor–neprilysin inhibitors and sodium–glucose cotransporter 2 inhibitors, was markedly higher than reported in nationwide Czech data.[1,2]

Despite high prescription rates, achievement of guideline-recommended target doses remained limited, particularly for beta-blockers. Even in a specialized setting, achievement of full target doses remains challenging in routine practice, reflecting patient tolerance and clinical complexity rather than insufficient therapeutic intent. This finding is consistent with previous real-world studies showing that dose optimization represents a major unmet need in heart failure management, even in specialized care settings.[4] Nevertheless, the observed association between more comprehensive pharmacotherapy and improved survival supports the concept of cumulative benefit from combination therapy.

Lower all-cause mortality was observed when survival outcomes were interpreted in the context of previously published nationwide data.[2] Kaplan–Meier analysis demonstrated high cumulative survival over long-term follow-up. Although differences in patient selection must be considered, these findings support the concept that specialized outpatient care may contribute to improved outcomes in patients with chronic heart failure. Overall survival of patients followed at the specialized heart failure clinic is shown in **Figure 2**. These observations should be viewed in light of substantial differences in patient selection and age distribution between specialized outpatient cohorts and unselected nationwide populations.

Patient selection and phenotype

Interpretation of the present findings must take into account the specific patient selection and phenotype of the specialized outpatient cohort. Patients followed in

the specialized heart failure clinic were younger than those typically reported in nationwide registries, where the mean age of heart failure patients commonly exceeds 70–75 years.[1,5] Age is a major determinant of prognosis in heart failure and represents an important confounder when comparing outcomes between specialized and unselected populations.

Nearly 90% of patients in the specialized cohort had heart failure with reduced ejection fraction, whereas population-based datasets report a substantially higher proportion of patients with preserved or mildly reduced ejection fraction.[2,6] This predominance of HFrEF reflects both the clinical focus of the specialized clinic and the fact that patients with reduced ejection fraction derive the greatest benefit from contemporary disease-modifying therapy.[1]

The predominance of male patients is consistent with registry data demonstrating higher prevalence of HFrEF among men, while women are more frequently represented in HFpEF populations.[6] Taken together, these characteristics indicate that patients followed in the specialized clinic constitute a prognostically more favorable subgroup. However, this selection reflects the real-world role of specialized heart failure clinics as referral centers for patients most likely to benefit from intensive, guideline-directed management.

Impact of optimized pharmacotherapy

Optimized pharmacotherapy represents the cornerstone of contemporary heart failure management and a central component of care delivered in specialized heart failure clinics. In the present study, uptake of angiotensin receptor–neprilysin inhibitors and sodium–glucose cotransporter 2 inhibitors substantially exceeded rates reported in nationwide Czech analyses as well as in other contemporary European and international real-world registries, where implementation gaps in guideline-directed medical therapy remain evident.[1,2,7]

Despite high prescription rates, achievement of guideline-recommended target doses remained limited across all major drug classes. This observation is consistent with prior real-world studies demonstrating that dose escalation is frequently constrained by hypotension, renal dysfunction, bradycardia, and drug intolerance.[4] Importantly, evidence suggests that even submaximal doses confer prognostic benefit compared with non-use, supporting early initiation and gradual titration whenever feasible.[8]

A key finding of the present analysis is the association between overall pharmacotherapy intensity and survival. Survivors received a significantly higher number of prognostically relevant drug classes compared with non-survivors, supporting the concept of comprehensive guideline-directed medical therapy.

Treatment with SGLT2 inhibitors was associated with a statistically significant reduction in mortality, consistent with findings from randomized trials and meta-analyses demonstrating early and robust benefits of this drug class across a broad spectrum of heart failure patients.[8] However, this observation should not be interpreted as evidence of superiority of SGLT2 inhibitors over other foundational therapies. In our cohort, angiotensin receptor–neprilysin inhibitors, beta-blockers, and mineralocorticoid receptor antagonists were prescribed in a very high proportion of patients, resulting in limited exposure variability and reduced statistical power to detect between-group differences.

By contrast, SGLT2 inhibitors were introduced later during the study period and showed greater prescription heterogeneity, which may have facilitated detection of their protective association in a simple univariable model. Given the limited number of events and the absence of multivariable adjustment, these findings should be interpreted as supportive of the four-pillar therapeutic strategy as a whole rather than as evidence favoring any single drug class.

Role of device therapy

Device-based therapy represents an important component of comprehensive heart failure management, particularly in patients with reduced ejection fraction at increased risk of sudden cardiac death or ventricular dyssynchrony. In the present study, the prevalence of implantable cardioverter-defibrillators and cardiac resynchronization therapy was comparable to that reported in the Czech and international registries focusing on advanced heart failure populations.[6,9,10]

No statistically significant association between device therapy and mortality was observed. This finding should be interpreted in the context of indication bias, as device therapy is typically indicated in patients with more advanced disease and higher baseline risk. Similar observations have been reported in other observational studies, where the survival benefit demonstrated in randomized trials is attenuated in real-world analyses due to confounding by indication and limited statistical power.[6] Importantly, the clinical benefits of implantable cardioverter-defibrillators extend beyond all-cause mortality and primarily involve prevention of sudden cardiac death, as demonstrated in landmark randomized trials.[11,12] Cardiac resynchronization therapy has been shown to improve symptoms, reduce heart failure hospitalizations, and induce reverse ventricular remodeling.[13–15] Therefore, assessment based solely on all-cause mortality may underestimate the overall clinical impact of device therapy in specialized outpatient settings.[3]

Survival benefit of specialized heart failure clinics

The favorable survival observed in the present specialized outpatient cohort may reflect both patient characteristics and organizational aspects of care delivery. Although differences in age distribution and heart failure phenotype must be acknowledged, structured management within a dedicated heart failure clinic likely contributes to optimized implementation of guideline-directed medical therapy.

Specialized clinics enable rapid initiation of novel pharmacological agents, structured up-titration protocols, close monitoring of treatment tolerance, and timely referral for device therapy when indicated. Continuity of care, regular follow-up, and management by experienced clinicians may facilitate early recognition of clinical deterioration and prevention of adverse outcomes.

Observational studies from Western and Northern Europe have reported improved outcomes in patients managed

within structured heart failure programs or multidisciplinary disease management systems.[16–18] Similarly, registry-based analyses suggest that earlier initiation and sustained implementation of comprehensive pharmacotherapy are associated with more favorable survival trajectories.[5,8]

Recent prospective evidence further highlights the importance of intensive outpatient management. The STRONG-HF trial demonstrated that rapid initiation and up-titration of guideline-directed medical therapy combined with close post-discharge follow-up significantly reduced 180-day heart failure readmission and all-cause mortality.[19] These findings emphasize the clinical relevance of early treatment optimization and structured patient contact during follow-up.

Data from the ESC Heart Failure Long-Term Registry provide additional context. In that large contemporary European cohort, patients were generally older, more heterogeneous with respect to ejection fraction, and characterized by substantial comorbidity burden. Despite widespread use of evidence-based therapies, 1-year mortality remained considerable.[5] In comparison, patients followed in our specialized outpatient clinic were younger, predominantly had heart failure with reduced ejection fraction, and demonstrated higher uptake of contemporary disease-modifying therapies, which may partly explain the more favorable survival observed in our cohort.

Clinical implications

The present results have several important implications for clinical practice and healthcare organization. They support early referral of eligible patients to specialized heart failure services, particularly those with reduced ejection fraction who stand to benefit most from optimized therapy. Dedicated heart failure clinics are uniquely positioned to initiate combination therapy early, manage side effects, and pursue dose optimization through structured follow-up.

At the healthcare system level, expansion of specialized heart failure clinics and regional care networks may represent an effective strategy to improve outcomes and reduce the burden of heart failure. Although such models require investment, their potential to improve survival and reduce hospitalizations suggests favorable cost-effectiveness in the long term.

Our findings from routine clinical practice are consistent with these results and suggest that specialized heart failure outpatient clinics may provide an effective framework for treatment optimization, monitoring, and patient education in routine clinical practice. In contrast to randomized clinical trials, our study reflects everyday care in a specialized setting and demonstrates that high uptake of modern disease-modifying therapies and favorable long-term survival can be achieved in a real-world population. This supports the role of structured multidisciplinary care as an important component of contemporary heart failure management.

Study limitations

Several limitations should be acknowledged. The retrospective observational design precludes causal inference, and residual confounding cannot be excluded. The specialized cohort represents a selected population that was younger and predominantly affected by heart failure with reduced ejection fraction, limiting direct comparability with nationwide populations. In addition, the relatively small sample size and limited number of deaths restrict statistical power, particularly for subgroup analyses.

Pharmacotherapy data reflect treatment at the most recent outpatient visit and do not fully capture longitudinal treatment changes, adherence, or reasons for dose reduction. Furthermore, nationwide data used for contextual comparison rely on administrative coding and lack detailed clinical parameters.

Although the majority of patients had heart failure with reduced ejection fraction, a smaller proportion of patients with heart failure with mildly reduced or preserved ejection fraction was also included. As several disease-modifying pharmacological therapies and device-based interventions are primarily indicated for patients with heart failure with reduced ejection fraction, their overall utilization rates may appear lower when calculated for the entire cohort. This should be taken into account when interpreting the presented treatment data.

Finally, data on heart failure-related rehospitalizations were not available in the analyzed dataset and therefore could not be evaluated. Rehospitalization rates nevertheless represent an important clinical outcome and should be addressed in future studies assessing the impact of specialized heart failure outpatient care.

Nationwide data used for contextual comparison were available only in aggregated form and did not allow patient-level matching with respect to age, comorbidities, or heart failure phenotype. Therefore, formal statistical comparison of survival between the cohorts was not performed.

Despite these limitations, the study provides valuable real-world insight into the impact of specialized outpatient care on heart failure management and outcomes.

Conflict of interest

The authors declare that they have no conflicts of interest related to this manuscript.

Funding

This research received no external funding.

Ethical statement

The study was conducted in accordance with Czech legislation governing the use of anonymized healthcare data and in compliance with the principles of the Declaration of Helsinki.

Informed consent

Given the retrospective design of the study and the use of fully anonymized data, individual informed consent was not required.

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