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ORIGINAL RESEARCH

Trends in Healthcare Costs in Heart Failure and Its Clinical Phenotypes During the Implementation of SGLT2 Inhibitors: A Finnish Registry Study

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Purpose: Real-world data on healthcare costs associated with SGLT2 inhibitor use during its early adoption remains limited, particularly across heart failure (HF) phenotypes. This study assessed trends in healthcare resource utilization (HCRU) and costs among HF patients, stratified by SGLT2 inhibitor use and left ventricular ejection fraction (LVEF).

Patients and methods: Using Finnish specialty care registry data, adults with a first HF diagnosis between January 1, 2016, and June 30, 2022 were identified and categorized by LVEF as reduced (HFrEF), mildly reduced (HFmrEF), and preserved (HFpEF) LVEF. Annual SGLT2 inhibitor uptake (2016–2022) was assessed. Patients were stratified by SGLT2 inhibitor use within 365 days of HF diagnosis to assess HCRU and costs trends (2016–2021).

Results: Among 119,314 patients, 7,626 (6.4%) initiated SGLT2 inhibitors within a year. Among those with LVEF data (n=16,312/119,314 [13.7%]), HFpEF predominated (58%). SGLT2 inhibitor use in HFrEF increased from 14.4% (2020) to 50.1% (2022). Patients receiving SGLT2 inhibitors were younger (70.8 vs 78.6 years), more often male (65.0% vs 47.2%), and had higher prevalence of type 2 diabetes (72.4% vs 28.5%) compared with those without SGLT2 inhibitor use. From 2016 to 2021, inpatient admissions declined modestly across all groups, with consistently shorter stays among patients with SGLT2 inhibitors compared with those not using them (mean: 20.0 vs 26.3 days [2016]; 17.2 vs 21.7 days [2021]). Outpatient visits and drug dispensations were higher in the SGLT2 inhibitor group. Total annual HCRU costs declined over time, remaining lower for SGLT2 inhibitor users (€30,742 vs €34,235 in 2021), driven by reduced inpatient admission costs.

Conclusion: SGLT2 inhibitor uptake increased notably following regulatory approvals. Patients who received SGLT2 inhibitors had lower healthcare costs driven by reduced hospitalization costs, suggesting economic benefits of early SGLT2 inhibitor initiation in HF management and supporting further research evaluation of long-term cost-effectiveness.

Keywords: Finland, heart failure, heart failure phenotypes, real-world evidence, resource use and costs, SGLT2 inhibitors

Introduction

Heart failure (HF) has emerged as a major global public health concern, with prevalence more than doubling over the past three decades. In 2021, an estimated 55.5 million people worldwide were living with HF, compared to 25.4 million in 1990, reflecting a continuing increase in disease burden.[1]

In Finland, the burden of HF is substantial; in 2013, the incidence was reported as 320 per 100,000 inhabitants, and the prevalence as 1,390 per 100,000 inhabitants.[2] HF also imposes a substantial economic burden on healthcare systems across Europe.[3] As an example, the annual direct healthcare cost of HF in Finland was estimated at approximately $314 million in 2012.[4]

Sodium-glucose co-transporter 2 (SGLT2) inhibitors are an important treatment option in HF across the spectrum of left ventricular ejection fraction (LVEF).[5] The first SGLT2 inhibitor for HF with reduced ejection fraction (HFrEF) was

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approved by the European Medicines Agency (EMA) in November 2020,[6,7] followed by expanded approval for HF with preserved ejection fraction (HFpEF) and with mid-range ejection fraction (HFmrEF) in March 2022.[8] Based on compelling clinical evidence, SGLT2 inhibitors were first recommended for HFrEF in the 2021 European Society of Cardiology (ESC) guidelines with a Class I, Level A recommendation,[9] and in 2023, these guidelines extended these recommendations to include patients with HFmrEF and HFpEF.[10] The 2022 American Heart Association / American College of Cardiology / Heart Failure Society of America (AHA/ACC/HFSA) guidelines also support SGLT2 inhibitors use across the HF spectrum.[11]

After these guideline updates, SGLT2 inhibitors have been rapidly integrated in routine clinical care.[12,13] In a European survey, cardiologists in Finland were among those who most closely followed the ESC HF guidelines historically.[14] Reflecting this alignment, the Finnish Current Care Guideline for HF, when updated in December 2023, incorporated SGLT2 inhibitors as a core component of treatment across the HF spectrum, consistent with the 2023 ESC focused update.[15] Finnish reimbursement policies have evolved in parallel. For HFrEF, special reimbursement was granted for dapagliflozin on June 1, 2021, and for empagliflozin on January 1, 2022. For HFpEF, empagliflozin was reimbursed from December 1, 2022, and dapagliflozin from July 1, 2023.

Health economic analyses, including evaluations of healthcare resource utilization (HCRU), are essential for assessing the value for money of interventions and for informing efficient allocation of limited healthcare resources. Real-world data on costs during the early adoption of SGLT2 inhibitors in clinical practice remain limited, particularly when stratified by HF phenotypes and SGLT2 inhibitor use. Most available evidence is derived from clinical trials, which may not reflect routine care settings. This gap underscores the need for real-world data to better inform policy and clinical decision-making. Finnish health data are well-suited for this type of analysis due to their comprehensive nationwide and regional coverage, as well as the ability to link information across multiple data sources.[16]

This registry-based study aimed to describe time trends in HCRU and associated costs among patients with HF, stratified by SGLT2 inhibitors treatment status and LVEF subgroups.

Methods

Study Design and Study Population

A non-interventional observational study using specialty care registry data in Finland was conducted to include adult patients (≥18 years of age) with the diagnosis of HF (ICD-10: I50) recorded for the first time in the Finnish specialty care register during the inclusion period (1 January 2016 to 30 June 2022). See Table S1 for more details on data sources.

Time Periods

The study period spanned from 1 January 2005 to 31 December 2022. The inclusion period (1 January 2016 to 30 June 2022) was set to ensure that patients' first HF diagnosis was captured and that patients were followed for at least six months after their first HF diagnosis. The date of the first HF diagnosis registered in the specialty care register was the index date starting the follow-up. Figure S1 provides a visual illustration of the study design.

Study Outcomes

In a regional subset of patients with available LVEF data, HF phenotypes were classified based on the LVEF value closest to the index date. These values were extracted from echocardiograms identified from the data lakes of Helsinki and Uusimaa (HUS) and County of Southwest Finland (Auria Biobank) biobanks using a text-mining algorithm previously applied in published studies.[2,17,18]

Using the latest guidelines on HF, published by the ESC,[9] patients were stratified based on LVEF as HFrEF (LVEF ≤40%), HFmrEF (LVEF 41–49%), and HFpEF (LVEF ≥50%). Uptake of SGLT2 inhibitors was assessed each year from 2016 to mid-way of 2022 among the full study population and the HF subgroups (HFrEF, HFmrEF, and HFpEF).

To describe resource use and costs depending on use of SGLT2 inhibitors, patients were classified as users of SGLT2 inhibitors if they dispensed at least one SGLT2 inhibitor dispensation within 365 days following the index date; all other patients were classified as non-users.

Healthcare Resource Utilization

HCRU, including inpatient admissions, outpatient specialist visits, primary care visits and dispensed outpatient pharmaceuticals, was assessed during the first year of follow-up period after the patient's first HF diagnosis (see exact definitions of pharmaceuticals in Table S2). Patients diagnosed in year 2022 were excluded from this analysis to ensure a minimum of 365 days of potential follow-up for all included individuals. End of follow-up was 365 days after the index date.

For the entire nationwide population, information related to visits in inpatient and outpatient specialist care and primary care was extracted from the Specialty care register and Primary care register, respectively, and information on dispensed medications was retrieved from the Prescribed Drug Register. Data from the Cause of death register was used to be able to censor patients at date of death.

Healthcare Costs

Total healthcare costs during the first year following index date were calculated as the sum of costs for all-cause inpatient care admissions, outpatient specialist care visits, primary care visits and dispensed pharmaceuticals (Table S2). Specialty care costs were based on the cost of service directly available in the Specialty care register. Inpatient and outpatient specialist costs were calculated using the total cost recorded for each visit or admission. Primary care visits were assigned unit costs based on contact type (eg, physician vs others). Drug costs were based on pharmacy list prices from the Prescription register. Missing specialty care costs were imputed using average inpatient (€1,184/day) or outpatient (€397/visit) costs, based on the mean cost calculated from the total HF population with complete data. All costs were adjusted to 2023 EUR.

Patient characteristics at index were assessed based on diagnoses and dispensed medication during the five-year period preceding the index date (Table S2).

Statistical Analysis

This was a descriptive study with no formal hypothesis testing. Continuous variables were reported as the number of observations and mean, while categorical variables were summarized using counts and percentages. The mean HCRU cost per patient was calculated on an annual basis. All statistical analyses were performed using R version 4.3.1.

Ethical Statement

Permission to perform this study was granted under the Secondary Use Act by Findata (Diary number THL/2425/14.02.00/2022 and THL/4559/14.06.00/2024).

Results

Study Population

In total 365,474 patients with a recorded diagnosis of HF in Finland were identified between 2005 and 2022. Of these, 119,314 patients fulfilled the inclusion criteria (aged 18 years or older at the time of index and had their first HF diagnosis during the period 2016–2022). Within this population, 7,626 (6.4%) patients received a dispensation of a SGLT2 inhibitor within one year following their index.

A regional subset of this cohort (n=16,312/119,314 [13.7%]) had available data on LVEF, enabling further stratification into HF phenotypes. Among these, 4,822 patients were classified as having HFrEF, of whom 714 (14.8%) received an SGLT2 inhibitor. In the group with HFmrEF (n=2,039), 180 (8.8%) received an SGLT2 inhibitor. Finally, 9,451 patients were classified as having HFpEF, with 565 (6.0%) receiving an SGLT2 inhibitor (Figure 1). Table S3 shows the annual number of patients diagnosed with HF from 2016 to 2022, with stable counts through 2021 and a decline in 2022 due to data availability only until June 2022. HFpEF consistently accounted for the highest number of cases, followed by HFrEF and HFmrEF, reflecting the predominance of HFpEF across the study period.

Patient Characteristics

In the overall study population, patients who received SGLT2 inhibitors were younger, more likely to be male, and had a lower prevalence of comorbidities, such as atrial fibrillation and chronic kidney disease, but a higher prevalence of

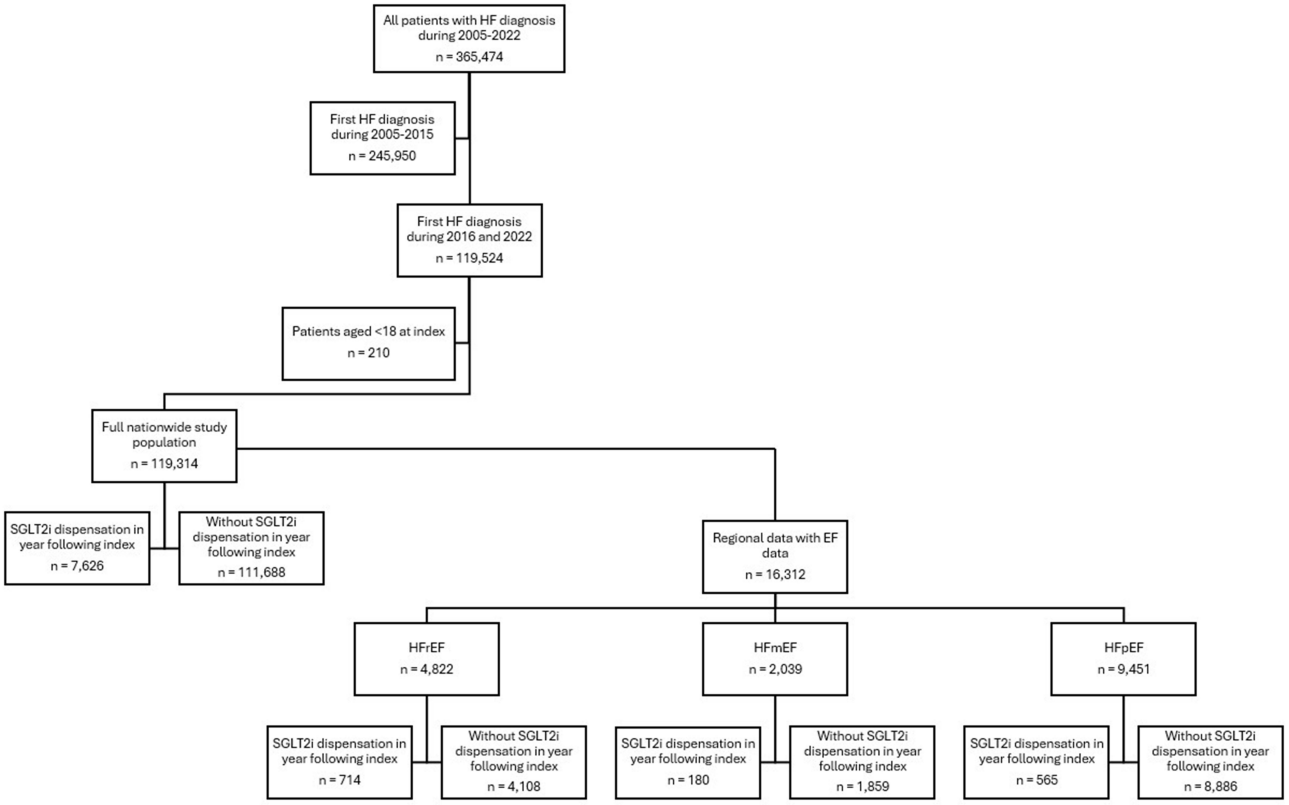

Figure 1 Patient flow chart Italicized text represent excluded patients.
Abbreviations: EF, ejection fraction; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFmrEF, heart failure with mildly reduced ejection fraction; HFrEF, heart failure with reduced ejection fraction; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

T2DM, compared to those without SGLT2 inhibitor use. Use of pre-index therapies including angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs), and mineralocorticoid receptor antagonists (MRAs) was also more common among SGLT2 inhibitors users. Across all HF subgroups, HFrEF, HFmrEF, and HFpEF, similar trends were observed (Table 1). Patient characteristics remained largely consistent across index calendar years, with a few exceptions—most notably age (Table S4).

Use of SGLT2 inhibitors increased substantially in the full study population throughout the study period, with earlier initiation after diagnosis observed in more recent years (2020–2022), when initiation rates ranged from 6.5% to 22.1%, compared to 1.4% to 4.1% in 2016–2019. A similar increasing trend was observed across all three subgroups (Figure 2). The increase was most notable in the HFrEF subgroup where the proportion of patients dispensing an SGLT2 inhibitor within one year from diagnosis rose from 14.4% in 2020 to 50.1% in 2022.

Healthcare Resource Utilization

From 2016 to 2021, HCRU trends differed between patients treated with SGLT2 inhibitors and the rest of the HF patients (Figure 3). Number of inpatient admissions declined modestly in both groups but were generally similar overall, though subgroup trends varied (Figure S2). However, total length of stay for inpatient admissions was (consistently) lower in the SGLT2 inhibitors group during the study period, including among patients with HFpEF, HFmrEF (except in 2019), and HFrEF (except in 2019–2021). Outpatients visit rates were consistently higher in the SGLT2 inhibitors group. Primary care visits increased sharply in both groups between 2016 and 2021 but were higher in the non-SGLT2 inhibitors group. The SGLT2 inhibitors group also had a higher number of dispensed drugs each year.

Table 1 Patient Characteristics of the Entire Study Population and in the Subpopulation with Information on Left Ventricular Ejection Fraction

	Full Study Population		HFrEF		HFmrEF		HFpEF	
	With SGLT2i	Without SGLT2i	With SGLT2i	Without SGLT2i	With SGLT2i	Without SGLT2i	With SGLT2i	Without SGLT2i
Number of patients	7,626	111,688	714	4,108	180	1,859	565	8,886
Males	4,955 (65.0%)	52,761 (47.2%)	519 (72.7%)	2,924 (71.2%)	130 (72.2%)	1,162 (62.5%)	331 (58.6%)	4,147 (46.7%)
Age (years)	70.8 (11.5)	78.6 (11.6)	65.8 (12.4)	69.2 (13.4)	67.4 (12.)	72.7 (12.4)	71.8 (10.9)	76.4 (11.5)
Charlson comorbidity index	3.2 (1.9)	3. (2.)	2.7 (1.7)	2.7 (1.9)	3.1 (2.1)	2.9 (1.9)	3.4 (2.)	3.1 (2.)
Comorbidities								
Atrial fibrillation	3,573 (46.9%)	57,806 (51.8%)	279 (39.1%)	1,823 (44.4%)	76 (42.2%)	959 (51.6%)	299 (52.9%)	4,977 (56.0%)
Chronic kidney disease	296 (3.9%)	8,382 (7.5%)	19 (2.7%)	224 (5.5%)	5 (2.8%)	140 (7.5%)	33 (5.8%)	797 (9.0%)
Myocardial infarction	1,806 (23.7%)	19,494 (17.5%)	199 (27.9%)	1,111 (27.0%)	52 (28.9%)	497 (26.7%)	90 (15.9%)	1,387 (15.6%)
Type 2 diabetes	5,523 (72.4%)	31,819 (28.5%)	409 (57.3%)	1,007 (24.5%)	127 (70.6%)	531 (28.6%)	450 (79.6%)	2,566 (28.9%)
Treatment history								
ACEi/ARBs	4,977 (65.3%)	63,551 (56.9%)	427 (59.8%)	2,220 (54.0%)	120 (66.7%)	1,146 (61.6%)	409 (72.4%)	5,493 (61.8%)
Beta-blockers	4,668 (61.2%)	69,438 (62.2%)	371 (52.0%)	2,176 (53.0%)	112 (62.2%)	1,223 (65.8%)	391 (69.2%)	6,014 (67.7%)
MRA	611 (8.0%)	5,952 (5.3%)	111 (15.5%)	429 (10.4%)	31 (17.2%)	148 (8.0%)	55 (9.7%)	669 (7.5%)
ARNi	54 (0.7%)	121 (0.1%)	13 (1.8%)	35 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
SGLT2i	1,951 (25.6%)	745 (0.7%)	141 (19.7%)	30 (0.7%)	50 (27.8%)	17 (0.9%)	162 (28.7%)	74 (0.8%)

Notes: Continuous variable, presented with mean and SD; categorical variable, presented with n and %.
Abbreviations: ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; ARNi, angiotensin receptor-neprilysin inhibitor; HFpEF, heart failure with preserved ejection fraction; HFmrEF, heart failure with mildly reduced ejection fraction; HFrEF, heart failure with reduced ejection fraction; MRA, mineralocorticoid receptor antagonist; SD, standard deviation; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

Healthcare Costs

From 2016 to 2021, total HCRU costs showed a slight downward trend in both SGLT2 inhibitors and non-SGLT2 inhibitors groups, with consistently lower costs observed in the SGLT2 inhibitors group throughout the period. In 2016, the total cost difference between the two groups was €4,091 (€31,949 vs €36,040) and in 2021 the cost difference was €3,493 (€30,742 vs €34,235). Inpatient admission costs declined in both groups and the reduction was more pronounced among users of SGLT2 inhibitors (from 2016 to 2021: €23,815 to €20,016 in SGLT2 inhibitors group and €30,679 to €24,023 in those not using SGLT2 inhibitors).The cost of outpatient services and drug-related costs remained higher in the SGLT2 inhibitors group across all years, reflecting greater utilization of healthcare services and medications (Figure 4). Outpatient costs in 2016 were €4,114 in the SGLT2 inhibitor group compared to €3,085 in those without use of SGLT2 inhibitors and increased to €4,615 and €3,555 in 2021, respectively. Prescription drug costs were €3,136 and €1,581 in 2016, and €2,839 and €1,656 in 2021 in those with and without SGLT2 inhibitor use, respectively. Subgroup trends in HCRU costs were generally consistent with those observed in the overall population (Figure S3). However, deviations were observed for the HFrEF group in 2019–2021, where those with SGLT2 inhibitor use had higher costs on average than those without SGLT2 inhibitor use.

Discussion

SGLT2 inhibitors play an important role in the management of HF across all ranges of LVEF, with the potential to significantly reduce the clinical burden.[5] Initially developed for glycaemic control in type 2 diabetes mellitus, these agents have shown robust cardiovascular benefits in both diabetic and non-diabetic HF populations. Randomized

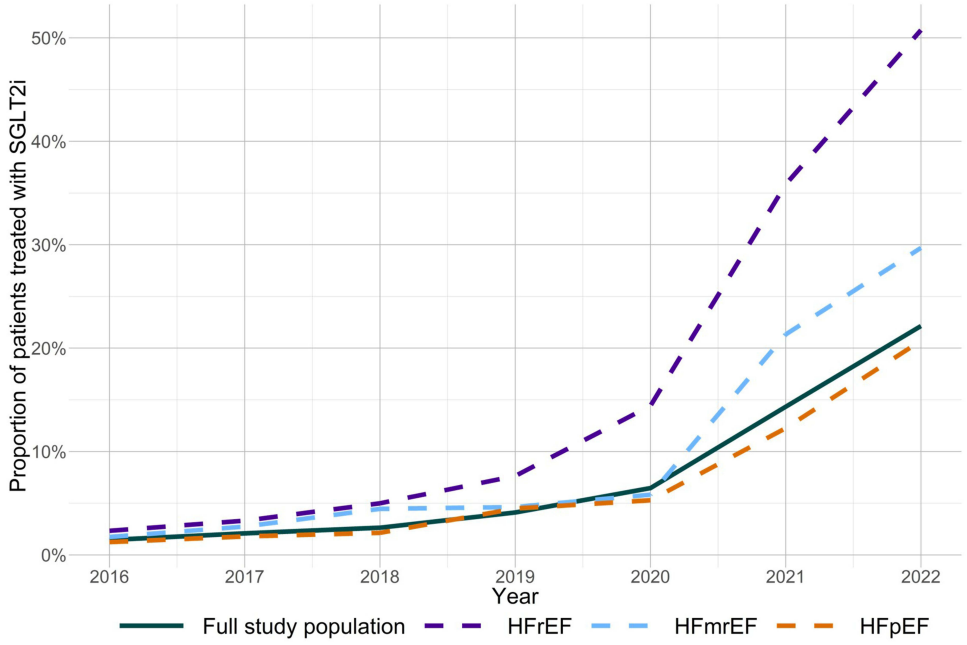

Figure 2 SGLT2 inhibitor treatment uptake over time in full study population and in patients with HFrEF, HFmrEF and HFpEF.
Notes: The first SGLT2 inhibitor for HFrEF was approved by the EMA in November 2020 followed by expanded approval for HFpEF and HFmrEF in March 2022.
Abbreviations: HFmrEF, heart failure with mildly reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

controlled trials and meta-analyses have consistently shown reductions in cardiovascular death and hospitalization for HF across HFrEF, HFmrEF, and HFpEF populations.[19]

This study, based on nationwide data, shows the real-world uptake of SGLT2 inhibitors in Finland during a period when regulatory approvals and reimbursement policies were evolving. Following EMA approval for HFrEF in November 2020 and the Finnish decision to reimburse SGLT2 inhibitors for this indication in June 2021, access and clinician confidence in prescribing SGLT2 inhibitors increased. SGLT2 inhibitors use rapidly rose during 2020 and 2021, especially in the HFrEF group (Figure 2). However, despite this increase, approximately 50% of patients with HFrEF were not treated with SGLT2 inhibitors within one year after diagnosis. This incomplete uptake likely reflects real-world implementation factors, including gradual dissemination of new evidence, patient eligibility, contraindications, and comorbidity burden. At that time, ESC guidelines or national guidelines had not yet issued recommendations for SGLT2 inhibitor use in HF, highlighting that SGLT2 inhibitors were adopted early in practice relative to guideline endorsement.

Patients who were prescribed SGLT2 inhibitors during the first year after HF diagnosis were younger and less comorbid than non-SGLT2 inhibitor users. However, the difference in age and comorbidities decreased over the course of the study period together with the increase in the SGLT2 inhibitor use. A higher proportion of patients were male in the SGLT2 inhibitors group during the whole study period.

Our finding that healthcare costs were mainly driven by hospitalizations are in line with earlier studies. In Denmark, the annual direct healthcare cost for patients with HF was estimated at approximately €12,000, peaking at the year of diagnosis with the majority of costs driven by hospitalizations.[20] Similarly, a study from Sweden reported that the mean HF-related secondary care cost during the first-year post-diagnosis was approximately €8920 per HF patient, mainly driven by high hospitalization rates.[21] While the total costs in Finland may appear high in the present study (perhaps due to underlying cost items included in the unit costs), the overall cost patterns in Nordic countries are consistent, with hospitalizations being the predominant driver across settings.

In the present study, costs of HF treatment decreased during the study period, driven by lower hospitalization costs, potentially reflecting better management of this patient population. Due to lower inpatient costs, users of SGLT2

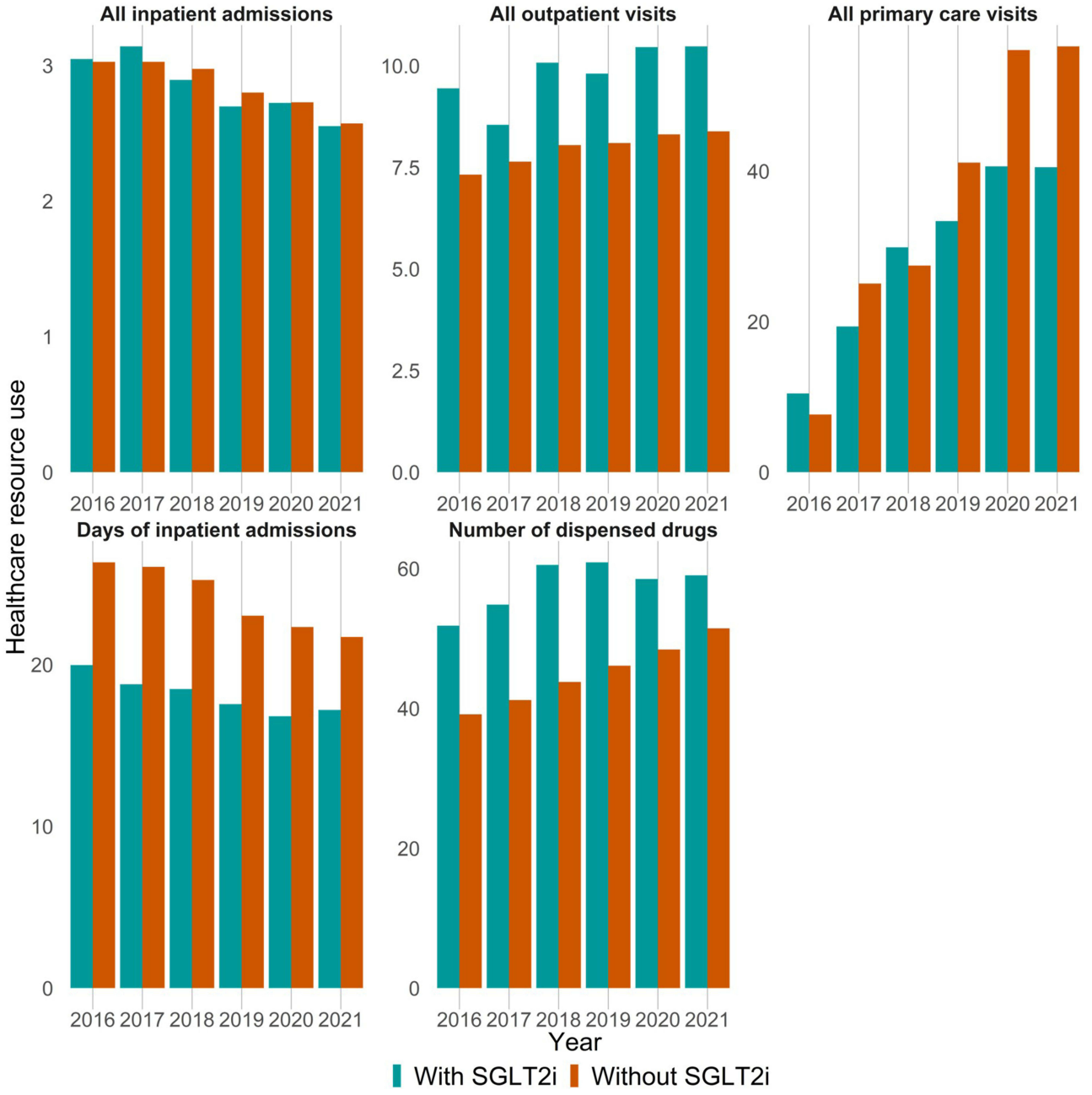

Figure 3 Time trends in healthcare resource use in total study population from 2016 to 2021, stratified by SGLT2 inhibitor use.
Abbreviation: SGLT2i, sodium-glucose cotransporter-2 inhibitor.

inhibitors had consistently lower total healthcare costs than those not using SGLT2 inhibitors. This is likely a combination of selection of patients and treatment effectiveness. In concordance with the present descriptive analysis, randomized clinical trials have shown lower resource use in SGLT2 inhibitor treated patients compared to placebo, driven by lower hospitalization rates.[22–25] However, the present study was descriptive in nature and not designed to provide causal evidence on the effectiveness of SGLT2 inhibitors. The groups were observed to differ in patient characteristics and any differences described need to be interpreted with caution. Assessing the real-world effectiveness of SGLT2 inhibitors and their impact on total healthcare costs would be a highly relevant topic for future research.

In the present study, follow-up was up to a maximum of one year after the first diagnosis of HF in specialty care. However, prior randomized controlled trials in HF populations — including DAPA-HF,[22] EMPEROR-Reduced,[23,24]

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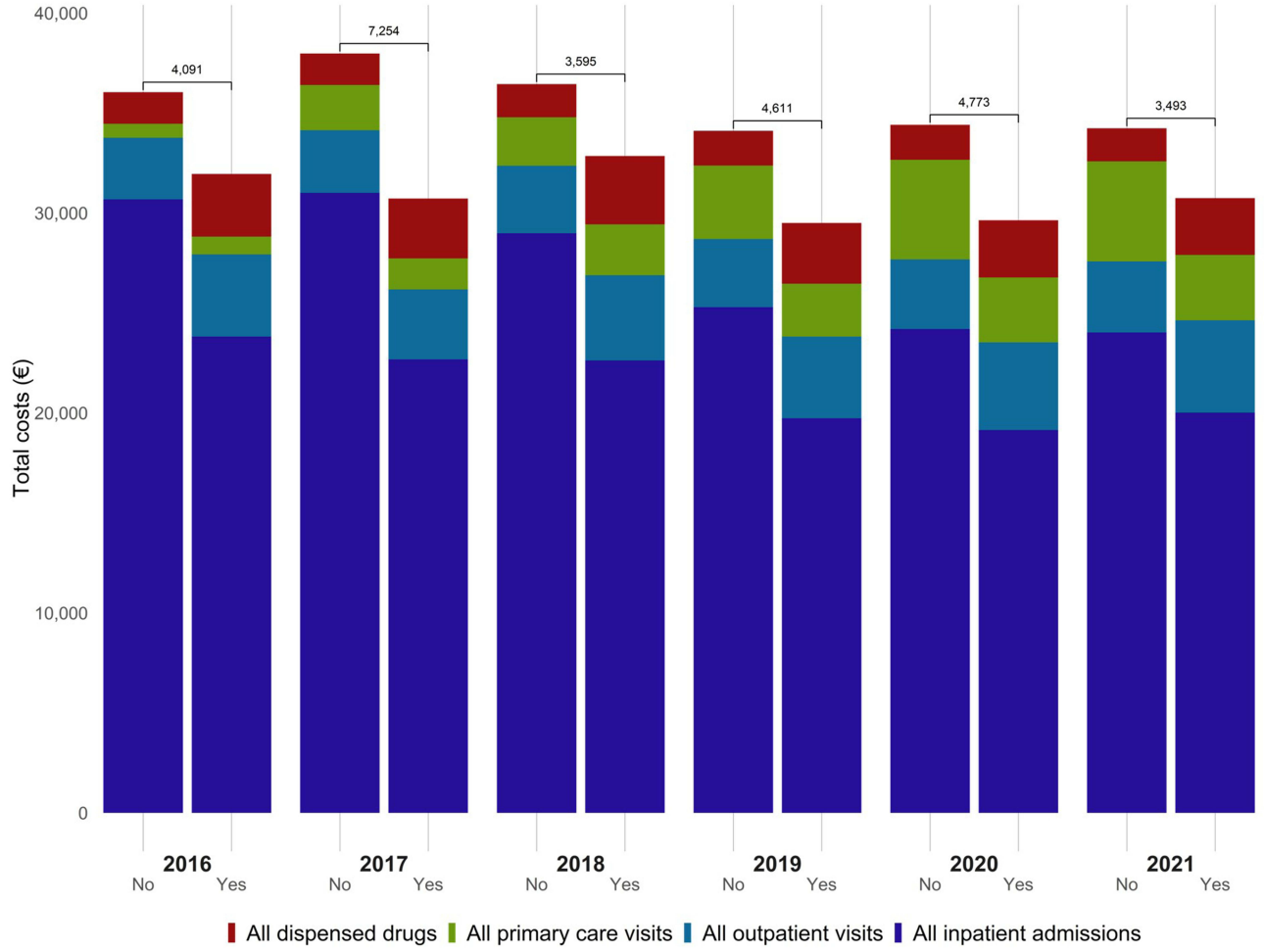

Figure 4 Time trends in healthcare costs in total study population from 2016 to 2021, stratified by SGLT2 inhibitor use. The costs on top of the bars refer to the total cost difference between those with and without SGLT2i use.
Abbreviation: SGLT2i, sodium-glucose cotransporter-2 inhibitor.

EMPEROR-Preserved,[24] and DELIVER[23,25] — have shown reductions in hospitalization for HF with SGLT2 inhibitors over a longer period of time, with median follow-up durations ranging from approximately 1.3 to 2.3 years across these trials. Given this consistent pattern of increasing benefit over time, it is reasonable to expect that a longer follow-up may reveal greater clinical and economic advantages associated with SGLT2 inhibitor use.

Patients using SGLT2 inhibitors had a high prevalence of T2DM (72.4%) compared to non-users (28.5%), consistent with their initial approval for glycaemic control. SGLT2 inhibitors were approved for T2DM nearly a decade before their formal indication for HF.[26] It is worth noting that indication for prescription is not available in the data used in this study, so it is not possible to determine whether the prescriptions were issued specifically for HF or T2DM or their combination. Consequently, it remains unclear whether the observed differences in healthcare costs between those with and without SGLT2 inhibitors use are attributable to the management of T2DM, HF, or a combination of both. This highlights the need for further research to better understand the impact of SGLT2 inhibitor use in routine clinical practice.

A key strength of this study is that it is based on nationwide comprehensive data over a long time period for the entire HF population in Finland, thereby allowing for a unique assessment of how treatment and healthcare costs in incident HF patients have evolved during a time when guidelines were changing significantly. Moreover, LVEF data were available for a subgroup of the patient population, enabling analysis of treatment and costs over time in HF patients with different clinical phenotypes. The assessment of healthcare costs was comprehensive, as it captures use of inpatient and outpatient specialty care, primary care and pharmaceuticals.

A limitation of the study is that LVEF data were not available for the entire study population. The data was retrieved only from two large urban areas. Consequently, the population for which stratification on clinical phenotype was conducted, may differ from the total HF population. LVEF data was largely based on unstructured data which may introduce uncertainties in interpretation. However, the reliability of this data has been shown in previous studies.[2,17,18,27] It is worth noting that the LVEF result closest to HF diagnosis date was used for patient stratification, but this does not guarantee that the value perfectly describes the patient's LVEF value at the index date.

In addition, differences in baseline characteristics between patients treated with and without SGLT2 inhibitors, particularly the higher prevalence of type 2 diabetes among SGLT2 inhibitor users, may represent confounding. As this was a descriptive study without causal inference objectives, no multivariable adjustment was performed, and results should be interpreted accordingly.

Conclusion

The objective of this study was to describe the evolution in treatment and healthcare costs in patients with HF. Uptake of SGLT2 inhibitors among patients with HF increased rapidly after regulatory and reimbursement approvals for HF treatment. Patients receiving SGLT2 inhibitors following HF diagnosis had lower healthcare costs than patients not using SGLT2 inhibitors. This difference was most notable in hospitalization costs, the largest cost component among patients with HF. Further research is needed on the causal impact of the introduction of SGLT2 inhibitors and other treatments on outcomes and costs in HF patients in real-world clinical practice. These findings are descriptive in nature and should be interpreted in the context of differences in patient characteristics between treatment groups. Further research is warranted to assess the causal impact of SGLT2 inhibitors and other therapies on clinical outcomes and healthcare costs in real-world HF populations.

Data Sharing Statement

No patient-level data can be made available to other researchers due to Finnish data legislation. Use of data followed local privacy and data protection regulations and data were stored at the Kapseli server environment.

Informed Consent

Individual informed consent was not required for this study and was therefore not collected.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

Johan Liseth Hansen, Marija Vasilevska, Patrik Sandin and Johan Mesterton are employees of Quantify Research. Miikka Tarkia, Eralda Asllanaj and Karlijn Wammes are employees of Boehringer Ingelheim. K.E. Juhani Airaksinen: Speaker: Bayer, Pfizer and Boehringer-Ingelheim. Research grants from the Finnish Foundation for Cardiovascular Research and Clinical Research Fund of Turku University Hospital, Turku, Finland. Pending patent application WO2023187258 (A1) -

ASSAY FOR LONG FORMS OF CARDIAC TROPONIN T. The authors report no other conflicts of interest in this work.

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