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Quality of hospital and follow-up care among patients with type 2 diabetes and newly diagnosed cardiovascular disease: a cohort study in Sweden

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ABSTRACT

Objective To examine hospital discharge practices, including clinical and laboratory assessments, in patients with type 2 diabetes mellitus (T2DM) following their first hospitalisation for cardiovascular disease (CVD), and to explore the association of these practices with adverse events, defined as hospital readmission, emergency department visits and mortality.

Design Retrospective cohort study.

Setting Follow-up for 100 days after a newly diagnosed CVD among patients with T2DM in Region Halland, Sweden.

Participant A total of 1482 patients with T2DM and a new diagnosis of CVD during hospitalisation were included. Patients were followed from hospital discharge for up to 100 days. Inclusion criteria were a hospital discharge diagnosis of CVD and a prior diagnosis of T2DM. Patients with incomplete discharge data or without follow-up records were excluded.

Primary and secondary outcome measures The primary outcome was the overall risk of serious adverse events after hospital discharge, including mortality, hospital readmission and ED encounters, within 100 days of discharge. Secondary outcomes included primary care visits and pharmacotherapy adjustments for CVD and T2DM during the same period.

Results The readmission rate within the study period was 27%, while 86% of patients visited primary care within 100 days after discharge. Cardiovascular pharmacotherapy increased, with beta-blocker usage rising to 73% and statin use reaching 82%. A significant, though modest, increase in pharmacotherapy for T2DM was observed, with metformin use increasing from 53% to 57% (p<0.001). Laboratory test results and clinical measurements at discharge, including missing glycated haemoglobin values (68%) and elevated systolic blood pressures, were associated with modest treatment adjustments at discharge, suggesting potential gaps in discharge practices and documentation.

Conclusions Despite moderate improvements in postdischarge pharmacotherapy, limited changes in diabetes management suggest room for optimisation. The findings emphasise the need for improved discharge planning and continuity of care. Future research should investigate the effects of standardised discharge protocols on treatment outcomes and readmission rates for this patient group.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Cohort study based on linkage of Swedish registry data, which has minimal recall bias.
⇒ Included a large sample size of patients, enhancing the robustness of the findings.
⇒ Followed participants for 100 days postdischarge to capture short-term outcomes.
⇒ Focused on both primary and secondary outcomes, including readmission rates and pharmacotherapy adjustments.
⇒ Information on ethnic or migrant background, diet, exercise, cardiac rehabilitation was unavailable.

INTRODUCTION

Diabetes mellitus (DM), one of the common chronic diseases globally, significantly increases the risk of cardiovascular disease (CVD), with individuals living with DM experiencing a two-fold elevation in CVD-related outcomes.[1–3] This risk is particularly pronounced among women, younger patients and those with long-standing diabetes accompanied by microvascular complications, such as renal disease or proteinuria.[4] Type 2 DM (T2DM) accounts for around 95% of all types of DM.[1] Studies have indicated that individuals with T2DM exhibit higher mortality rates due to CVD, with recent findings reporting CVD mortality rates of 17.15 per 1000 person-years for patients with T2DM, compared with 12.86 per 1000 person-years in matched controls.[5 6] Sweden has low CVD mortality compared with other high-income countries, while diabetes-related mortality is similar, with regional variations in care quality.[2 3 7] Furthermore, the risk of developing coronary heart disease and other CVD events escalates at glycated haemoglobin (HbA1c) levels below 53 mmol/mol, highlighting the importance of early intervention.[8]

For patients with T2DM who are diagnosed with established CVD, the prognosis is especially concerning, placing them in a

very high-risk category for subsequent CVD events.[9] This high-risk group encompasses individuals with significant organ damage, such as those with proteinuria, impaired renal function and other comorbidities.[2] It also includes patients with multiple risk factors such as hypertension, dyslipidaemia and obesity.[9] The management of these patients is critical, as lifestyle modifications, effective glucose control and appropriate treatment of blood pressure and lipid levels can markedly improve their prognostic outlook.[10–12]

Previous studies have indicated that individuals with T2DM who are newly diagnosed with CVD are often identified during hospitalisation.[13] Sweden has a publicly funded universal healthcare system that provides all residents with access to hospital and primary care services.[14] Follow-up care is typically managed within primary care settings. Identifying factors at the time of hospitalisation that could enhance postdischarge management is crucial for underscoring the vital role of primary care in the effective management of both T2D and CVD. Despite the known risks and the importance of timely interventions, there is a gap in understanding the clinical course and healthcare utilisation of patients with T2DM within the critical 100 days following their first CVD event. It is particularly evident in the immediate postdischarge phase, where detailed data on healthcare utilisation and it is essential to address this gap for improving patient outcomes, as it highlights the need for better discharge planning and continuity of care.[15 16]

The purpose of this study was to examine the effect of hospital discharge routines, including clinical and laboratory assessments, in patients with T2DM following their first hospitalisation for CVD, and to explore the association with adverse events, defined as CVD hospital readmission, emergency department visits and mortality.

METHODS

This study is designed as a retrospective cohort study conducted within Region Halland. The study period covers 2011 to 2020, including a 5-year lookback period to observe comorbidities and identify patients aged ≥18 years with T2DM based on the 10th revision of International Classification of Diseases codes E11–E14. The Cohort selection included all patients in Region Halland with a prior diagnosis of T2DM who were alive at some point during the period 2016–2020 and experienced their first hospitalisation for a CVD event within that timeframe. The first diagnosis of CVD, defined as the index event, was identified using ICD codes from hospitalisations between 1 January 2016 and 31 December 2020, as shown in online supplemental table 1. To ensure that the hospitalisation represented the first recorded CVD event, patients with any CVD diagnosis prior to the inclusion event were not included. The lookback period for identifying prior CVD diagnoses extended from 1 January 2011, up to the date of the inclusion hospitalisation. Mortality was registered from the date of discharge following the inclusion event/hospitalisation and followed up to 100 days. A flowchart illustrating the study participant selection process is displayed in online supplemental figure 2.

Data source

The data for this study were sourced from the Regional Healthcare Information Platform (RHIP), which encompasses a comprehensive range of healthcare utilisation data, including primary healthcare, emergency department visits, hospital admissions and outpatient care.[17] RHIP has been used in earlier studies regarding diabetes and chronic kidney disease.[13 18–20] This extensive dataset provides a unique opportunity to gain a holistic understanding of the impact on patients, caregivers and the healthcare system. RHIP contains complete information on the patient population within the region, linking clinical, operational and healthcare cost data at the individual patient encounter level. Additionally, it includes system resource and capacity metrics, such as the number of full-time equivalent nurses and physicians, as well as hospital bed occupancy rates. The healthcare infrastructure in the region comprises 3 acute care hospitals, 40 inpatient wards, 2 emergency departments, 30 outpatient specialty clinics and 45 primary care clinics, along with a prehospital ambulance system. RHIP includes vital status data, allowing for the identification of deceased patients along with their dates of death, thereby providing sufficient information to assess all-cause mortality within the cohort. Medication data will be obtained from the linkage to Swedish Prescribed Drug Register, capturing all relevant prescriptions and treatments received by the patients.

Study process

The primary outcomes assessed within 100 days following the hospital discharge include readmissions for CVD, mortality and healthcare visits related to CVD. The follow-up period was set for 100 days from the date of hospital discharge. This duration was chosen to capture early postdischarge events relevant to care transitions, while maintaining clinical relevance and minimising confounding from unrelated long-term developments. At the initial hospital admission, data were collected on various patient characteristics, including age, sex, comorbidities, specific cardiovascular diagnoses, estimated glomerular filtration rate (eGFR), HbA1c, plasma glucose (P-glucose), cholesterol values and recorded systolic blood pressure measurements. Details regarding comorbidities and cardiovascular diagnoses are found in online supplemental table 1. P-glucose levels varied, with samples obtained either from venous or capillary sources, and occasionally taken in a fasting state. These different sampling methods have distinct reference ranges for identifying abnormal values, detailed in online supplemental table 2. The definition for high P-glucose was venous random plasma glucose 7.8 mmol/L or higher (online supplemental table 2). Laboratory results and systolic blood pressure readings were collected during

the hospitalisation period at index study period and subsequently averaged, with follow-up laboratory values obtained within 3 months before the inclusion of the study period.

Pharmacotherapies for high blood pressure, diabetes and high cholesterol levels were retrieved, and their corresponding Anatomical Therapeutic Chemical codes are specified in online supplemental table 3. For each patient, the total number of days under care, as well as hospitalisations, outpatient care visits, primary care visits and emergency department visits, were documented. Outpatient and primary care visits were further categorised by the type of healthcare provider involved, whether it be a physician, nurse or paramedical personnel. The study recorded the frequency of follow-up visits in outpatient care, primary care and the emergency department, along with the possibility of subsequent readmissions. Visits to the emergency department, deaths were noted. Readmissions and outpatient visits were included if they occurred at medical clinics and were associated with a cardiovascular diagnosis, as identified by ICD codes (online supplemental table 1). Diagnosis-specific data for each visit were not extracted, as the study focus was on overall patterns of postdischarge care rather than on the categorisation of individual return visit diagnoses. Due to limitations in the completeness of primary care diagnostic coding, visit categorisation based on primary care data was not performed.

Statistical analyses

Descriptive statistics were used to characterise the study population, including variables such as age, sex, comorbidities, laboratory test results and medication usage. The ages were categorised as <60, 60–80 and >80 years. HbA1c values were categorised into three groups: <52 mmol/mol, 52–70 mmol/mol and >70 mmol/mol. All P-glucose samples were classified as either within normal limits or abnormal and were recorded based on whether sampling had been conducted. Total cholesterol levels were classified as either >4.5 mmol/L or ≤4.5 mmol/L, while low-density lipoprotein (LDL) cholesterol was divided into two categories: >2.5 mmol/L or ≤2.5 mmol/L. Renal function was stratified into three eGFR categories: >60 mL/min/1.73 m², 30–60 mL/min/1.73 m², and <30 mL/min/1.73 m².[21] Systolic blood pressure was categorised into three ranges: <130 mm Hg, 131–139 mm Hg and >140 mm Hg. Continuous variables were reported as means and SD, while categorical variables were expressed as frequencies and percentages. Comparisons of continuous variables were conducted using Student's t-test, and χ^2 test was employed when comparing categorical variables. McNemar's test was used to evaluate whether there was a statistically significant change in pharmacotherapy from baseline to postdischarge. All statistical tests were two-sided, unless stated otherwise, with a significance level set at $p<0.05$. The study employed complete-case analysis. As missing values were minimal, no data imputation was applied. The impact of missing data on the results was considered to be negligible. Cox regression was used to estimate HRs with 95% CIs for a composite endpoint comprising emergency department visits, hospitalisations and mortality, considered as serious adverse events, as well as for mortality analysed as a separate outcome. Patients who were alive and did not experience an event during follow-up were censored at 100 days after discharge. The model was adjusted for age, sex, elevated P-glucose levels, kidney function, systolic blood pressure and a hospital stay longer than 5 days at the time of inclusion. Due to observed overdispersion, a negative binomial regression analysis was performed for hospital admissions adjusted for age, sex, elevated P-glucose levels, kidney function, systolic blood pressure and a hospital stay longer than 5 days at the time of inclusion. These analyses are performed with the understanding that most emergency department visits result in hospital admissions and consequently, emergency department encounters with no hospital admission were low. Since the HbA1c testing rate was low, it was not used in the analysis. Statistical analyses were conducted using IBM SPSS Statistics V.29.

RESULTS

The study comprised a total of 1482 patients, with 567 (38%) being women and 915 (62%) men. During the study period, there were 159 (11%) patients who died and 72 (5%) of these patients died during initial hospitalisation and were never discharged. The overall mean age of the cohort was 75 years (SD 11), with a mean age of 77 years (SD 11) for women (range 40–100) and 74 years (SD 10) for men (range 34–98). The basic characteristics are displayed in table 1.

Clinical and laboratory findings at the time of initial hospital admission are summarised in online supplemental table 4. The average heart rate on hospitalisation was 78 bpm and 730 patients (49%) did not have a

Table 1 Baseline characteristics of study participants

Variable	Numbers and means
Total study population, n	1482
Ages	
Age, average years (SD)	75 (11)
<60 years, n (%)	133 (9)
60–80 years, n (%)	825 (56)
>80 years, n (%)	524 (35)
Comorbidities	
Hypertension, n (%)	1208 (82)
Atrial fibrillation, n (%)	372 (25)
COPD, n (%)	137 (9)
CKD, n (%)	243 (16)
Dyslipidaemia, n (%)	396 (27)

CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; n, numbers; T2DM, type 2 diabetes mellitus.

Table 2 Distribution of medication at index and postdischarge period

	Treatment		McNemar's test
Medication	At index	Postdischarge	P value
Glucose-lowering drugs			
Metformin, n (%)	787 (53)	849 (57)	<0.001
Sulfonylurea, n (%)	56 (4)	37 (2)	<0.001
Insulins, n (%)	553 (37)	615 (42)	<0.001
GLP-1 analogues, n (%)	124 (8)	149 (10)	<0.001
DPP-4 inhibitors, n (%)	238 (16)	277 (19)	<0.001
SGLT-2 inhibitors, n (%)	124 (8)	149 (10)	<0.001
Cardiovascular drugs			
Beta-blockers, n (%)	1007 (68)	1085 (73)	<0.001
ACEi, n (%)	593 (40)	467 (32)	<0.001
ARB, n (%)	459 (31)	335 (23)	<0.001
RAS inhibitor, n (%)	1006 (68)	1077 (73)	<0.001
Diuretics, n (%)	537 (36)	453 (31)	<0.001
Aldosterone-receptor-antagonists, n (%)	208 (14)	266 (18)	<0.001
Lipid-lowering drugs			
Ezetimibe, n (%)	36 (2)	65 (4)	<0.001
Statins, n (%)	1087 (73)	1212 (82)	<0.001
Platelet aggregation inhibitors			
Acetylsalicylic acid, n (%)	841 (57)	942 (64)	<0.001
ADP receptor inhibitors, n (%)	200 (14)	300 (20)	<0.001

ADP, ADP diphosphate; ARB, angiotensin II receptor blocker; DPP-4, dipeptidyl peptidase-4; GLP-1, glucagon like peptide-1; n, numbers; RAS, renin-angiotensin-system; SGLT-2, sodium-glucose co-transporter-2.

heart rate registered during their hospital stay. The mean systolic and diastolic blood pressures were 142.7 mm Hg and 78.5 mm Hg, respectively, with 57% of patients having a systolic blood pressure ≥140 mm Hg. Kidney function was moderately impaired, with a mean eGFR of 54.8 mL/min, and 15% of patients had an eGFR of <30 mL/min. HbA1c values during hospitalisation were missing for 1006 (68%) of participants, and among those with available data, the mean HbA1c was 59.5 mmol/mol. Mean total cholesterol and LDL-cholesterol levels were 4.4 mmol/L and 2.7 mmol/L, respectively.

Table 2 presents detailed information on distribution of medication at index hospitalisation and postdischarge period. A significant increase in metformin, insulin, glucagon-like peptide-1 analogues, dipeptidyl peptidase-4 inhibitors, sodium–glucose cotransporter-2 inhibitors, beta-blockers, renin-angiotensin-system (RAS) inhibitors, aldosterone-receptor-antagonists, ezetimibe, statins, acetylsalicylic acid, ADP receptor inhibitors was observed in postdischarge. A significant decrease in sulfonylurea, ACEi, angiotensin II receptor blocker, diuretics in postdischarge was observed.

Healthcare utilisation following the initial hospital admission is summarised in online supplemental table 5. The mean hospital length of stay during the first admission was 9.0 days (SD 10.8), and 46% of patients had a hospital stay longer than 5 days. Hospital readmissions after discharge occurred in 23% of patients, with a mean readmission rate of 0.2 (SD 0.4). The mean number of emergency department visits was 0.5 (SD 1.1). In outpatient hospital care, the mean number of physician visits was 1.0 (SD 1.6) and nurse visits was 1.3 (SD 3.9). In primary care, patients had a mean of 1.7 (SD 1.9) physician visits and 3.6 (SD 5.1) nurse visits.

Within 100 days postdischarge, 396 patients (27%) visited the emergency department. Additionally, 685 patients (46%) had follow-up appointments with a nurse or doctor in the hospital's outpatient care, and 1281 patients (86%) returned for visits to primary care during the study period.

A Cox regression analysis with severe adverse events defined by death or hospital readmission as outcome measures showed an increased HR for women (table 3). Advancing age was associated with a significantly elevated risk. Similar results were found for severe renal impairment, defined by an eGFR <30 mL/min and length of stay for over 5 days. Higher blood pressure did not demonstrate a significant difference in risk within the first 100 days after the onset of CVD. Cox regression analysis was also performed for mortality as the outcome. Older age, severe renal impairment and length of study over 5 days were found to be significantly associated with higher risk of mortality.

Table 3 HR and 95% CI for severe adverse events or mortality during 100-day follow-up period

	Serious adverse events				Mortality			
		95% CI				95% CI		
	HR	Lower	Upper	P value	HR	Lower	Upper	P value
Women	1.09	0.90	1.32	0.39	0.93	0.67	1.28	0.64
Age (years)	1.02	1.01	1.03	0.002	1.07	1.05	1.09	<0.001
High P-glucose	1.33	0.85	2.08	0.22	1.09	0.53	2.21	0.82
eGFR>60 mL/min	1.00			<0.001	1.00			<0.001
eGFR 30–60 mL/min	1.20	0.95	1.52	0.12	1.37	0.87	2.18	0.18
eGFR<30 mL/min	2.15	1.64	2.81	<0.001	3.15	1.95	5.10	<0.001
Systolic blood pressure (mm Hg)	1.00	1.00	1.01	0.37	1.00	1.00	1.01	0.46
Length of stay over 5 days	1.41	1.16	1.71	<0.001	1.60	1.14	2.24	0.006

eGFR, estimated glomerular filtration rate.

Healthcare utilisation during the study period measured by hospitalisation days and emergency department visits after initial hospital discharge was analysed with negative binomial regression and is displayed in table 4. Age significantly affected hospital days (p<0.001). High P-glucose levels had no significant impact. An eGFR of 30–60 mL/min significantly affected hospital days (p=0.004) and marginally affected emergency department visits (p=0.05). An eGFR of less than 30 mL/min significantly affected the number of hospital days (p<0.001). Increased systolic blood pressure significantly affected hospital days (p=0.04).

DISCUSSION

The present study found that, during index hospitalisation, key laboratory and clinical measurements such as HbA1c and heart rate were often inadequately recorded among patients with T2DM with CVD. Nearly half of the patients lacked heart rate data and two-thirds of patients did not have information on HbA1c. A substantial number had elevated blood pressure. Postdischarge pharmacotherapy for diabetes and cardiovascular conditions showed moderate but significant increases yet remained below levels expected for high-risk patients. The readmission rate within the study period was 27% while 86% of patients had at least one primary care visit after discharge.

Patients with T2DM who are hospitalised for a new cardiovascular event have a higher risk of increased care requirements and mortality.[13] Effectively managing risk factors during hospitalisation is crucial to ensuring optimal follow-up care. Addressing cardiovascular risk factors like blood glucose, blood pressure and lipid levels at this stage can significantly improve patient outcomes.[2 22] At the index hospitalisation, laboratory data revealed significant gaps in HbA1c and heart rate measurements. For instance, only 32% of patients had an HbA1c measurement recorded, despite HbA1c being an essential marker for assessing glycaemic control and cardiovascular risk. It is essential to highlight that laboratory samples were collected during the initial phase of care, although HbA1c, as a long-term marker of glucose regulation, may include samples obtained 2–3 months before hospitalisation. While HbA1c is not a required test on admission, the close association between diabetes

Table 4 Negative binomial regression for hospital days and for emergency department visits after initial hospital discharge

	Hospital days				Emergency department visits			
		95% Wald CI				95% Wald CI		
	RR	Lower	Upper	P value	RR	Lower	Upper	P value
Women	0.94	0.83	1.05	0.25	1.07	0.88	1.29	0.50
Age (years)	0.99	0.98	0.99	<0.001	1.00	1.00	1.01	0.38
High P-glucose	1.23	0.97	1.55	0.09	1.21	0.80	1.82	0.36
eGFR>60 mL/min	1.00				1.00			
eGFR 30–60 mL/min	1.21	1.06	1.37	0.004	0.81	0.65	1.00	0.05
eGFR<30 mL/min	1.59	1.34	1.88	<0.001	0.78	0.58	1.04	0.09
Systolic blood pressure (mm Hg)	1.00	1.00	1.00	0.04	1.00	1.00	1.00	0.10

eGFR, estimated glomerular filtration rate.

and CVD warrants careful consideration of glucose regulation during CVD-related hospitalisations.[23–25] In this context, a single P-glucose measurement offers only limited insight. Nearly half of the patients (49%) lacked heart rate data during the admission, but it is likely that the ECG was recorded during the hospitalisation and included the heart rate. However, this information was not documented in the patient's medical record, which means it is not readily accessible to subsequent caregivers. The systolic blood pressure was markedly elevated, with 57% of patients showing readings above 140 mm Hg. The presence of hypertension has been considered to be related to increased risk of CVD.[9] Laboratory data showed moderate renal impairment in a substantial subset, with 36% presenting eGFR levels between 30 and 59 mL/min and 15% with severe impairment (eGFR <30 mL/min).

Pharmacological therapy plays an important role in the management of cardiovascular risk factors.[26] Three-quarters of the patients were prescribed beta-blockers and RAS inhibitors, and 82% received statins at discharge. Although there were significant changes in the number of patients receiving diabetes medications, these increases were relatively modest, between 3% and 5%. In a previous study, metformin has been associated with lower rates of all-cause mortality and in the present study metformin remained the most frequently used diabetes medication, with its usage rising slightly from 53% to 57%.[26] This limited change may partly reflect that many patients were already on diabetes treatment prior to their CVD onset. Nevertheless, adjustments to diabetes treatment appeared limited for patients hospitalised due to new cardiovascular events. The moderate increases observed may suggest a gap in optimising treatment intensity, as further modifications could more effectively address the elevated cardiovascular risks linked to poorly controlled blood glucose and blood pressure.

The present study is unique as we studied the readmission or mortality within 100 days after first hospitalisation for CVD among patients with T2DM. Some previous studies focused on the readmission and death after hospitalisation for type 2 diabetes, different length periods of morality or compared with individuals without diabetes. Among individuals aged ≥65 years with T2DM, the increasing age was associated with the higher odds of readmission within 30 days.[27] Women with T2DM had greater risk of mortality than men.[28] A register-based study from Sweden found that patients with diabetes had higher 1-year mortality risk and less likely to get lipid-lowering treatment at discharge.[29] An earlier clinical trial among patients with T2DM at high cardiovascular risk showed that lower GFR at baseline was associated with the risk of adverse events, such as mortality.[30]

The increase in guideline-recommended cardiometabolic pharmacotherapy following hospitalisation suggests that such events represent key opportunities for optimising treatment in patients with type 2 diabetes and CVD. However, HbA1c values were not recorded in 68% of patients during hospitalisation, despite this being their first cardiovascular event. This gap in glycaemic monitoring highlights the need for more systematic diabetes assessment during hospital care to guide management decisions. Furthermore, the high rates of early rehospitalisation and emergency visits, particularly among older patients and those with reduced renal function, indicate the need for improved transitional care. Risk stratification using factors such as eGFR and length of stay could help identify individuals at increased risk for poor outcomes. To enhance care quality and reduce avoidable hospital use, healthcare systems should prioritise comprehensive in-hospital evaluation, discharge planning and timely follow-up tailored to patients' clinical risk profiles.

Strengths and limitations

One key strength of this study is the use of comprehensive, high-quality registry-based data, which provides real-world insights into the treatment patterns and outcomes of patients with T2DM and CVD across multiple healthcare settings. This approach minimises recall bias and allows for robust tracking of clinical parameters, pharmacotherapy and outcomes, such as readmissions and primary care visits, throughout the study period. Additionally, by focusing on the transition from hospital to outpatient care, this study addresses a critical phase in chronic disease management, highlighting opportunities for improvement in discharge planning and follow-up care.

However, the study also has limitations. First, the reliance on registry data may result in some misclassification or under-reporting of specific variables, particularly if they are inconsistently documented across different healthcare providers. For instance, certain clinical parameters or lifestyle factors influencing outcomes may not be uniformly recorded. Second, the observational design of the study limits the ability to infer causation; while we can identify associations between discharge practices and subsequent care needs, causative links cannot be definitively established. Third, there is no information on socioeconomic status, ethnicity and countries of birth as they might be related to the adverse outcome among people with T2D and newly diagnosed with CVD.[31] Due to legal restrictions, ethnicity and race are not recorded in Swedish registers or commonly used in health research. The population is predominantly Caucasian. Finally, our findings are based on data from a specific population and healthcare system, which may affect generalisability. Future studies with broader populations or interventional designs could build on these insights to examine how standardised discharge protocols might improve outcomes for T2DM and CVD patients transitioning to primary care.

Conclusion

This study highlights significant gaps in the management of cardiovascular risk factors during hospitalisation for patients with type 2 diabetes and newly diagnosed CVD. Despite the moderate increases in pharmacotherapy

postdischarge, changes in diabetes management remained limited, suggesting opportunities to optimise treatment. Key clinical measurements, such as HbA1c and heart rate, were poorly recorded, which could hinder effective follow-up care after discharge. The observed readmission rate and the moderate improvements in follow-up care underscore the importance of refining discharge planning and enhancing continuity of care. Future studies should explore the impact of standardised discharge protocols on improving treatment outcomes and reducing readmissions for patients with T2DM and CVD.

Contributors JMJ and BA were responsible for the conceptualisation and design of the study. Data collection was conducted by BA. Statistical analysis was performed by JMJ and BA. The manuscript was drafted, and tables were prepared by JMJ and BA. Both authors reviewed and approved the final manuscript. BA is responsible for the overall content as guarantor.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study received ethical approval from the Swedish Ethical Review Board at the Department of Medicine in Gothenburg, under registration number 2020–05769. Due to the retrospective nature of this observational cohort study, the requirement for informed consent was waived in accordance with approvals from the Swedish Ethical Review Board. All methods and procedures in this research adhered strictly to relevant research guidelines and regulations.

Provenance and peer review Not commissioned; externally peer-reviewed.

Data availability statement The data supporting the findings of this study are available upon reasonable request from the corresponding author. Due to privacy and ethical considerations, the data are not publicly accessible.

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