

Investigating socioeconomic disparities in prescribing new diabetes medications in individuals with type 2 diabetes and very high cardiovascular risk in the Netherlands

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ABSTRACT

Aims: This study aims to analyze prescription patterns of new diabetes medication and assess socioeconomic disparities in their initiation among individuals with T2DM with very high cardiovascular risk.

Methods: Individuals diagnosed with T2DM and very high cardiovascular risk were identified (N = 10,768) based on general practitioner's electronic health record data. SGLT-2is and GLP-1RAs prescription patterns were examined. Furthermore, the association between SES and the prescription of SGLT-2is and GLP-1RAs in 2022 was investigated.

Results: Despite the increase in prescription rates of SGLT-2is and GLP-1RAs between 2019 and 2022, approximately 85 % and 93 % of eligible individuals did not receive SGLT-2is and GLP-1RAs in 2022, respectively. We found a positive association between SGLT-2is prescription and SES in only the 4th quintile compared to 1st quintile (referent) in the fully adjusted model (OR 1.29 95 % CI:1.08–1.54).

Conclusions: The prescription rates among eligible individuals highlight significant room for improvement in aligning prescribing practices with guidelines. We found no profound socioeconomic gradient in initiation of SGLT-2is and GLP-1RAs. The latter may be due to guidelines' clear indication of the eligible population and GP education. Future development and potential disparities in initiation and maintenance should be monitored to ensure equitable prescribing.

1. Introduction

Type 2 diabetes mellitus (T2DM) prevalence is rising and populations affected by this disease are large and heterogeneous [1–3]. Within the T2DM population worldwide, differences in socioeconomic

backgrounds are associated with diverse health risks, care use, and care expenditures [4–8]. In particular, in high-income countries, low socioeconomic status (SES) is related to a higher prevalence of T2DM as well as increased risk of cardiovascular disease (CVD) and higher mortality [9–11]. This increased CVD prevalence is attributed to a combination of

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biological, behavioural, and psychosocial risk factors that are more commonly found in disadvantaged populations [12,13]. For instance, low levels of education and health literacy can negatively affect the ability to manage diabetes and cardiovascular risk factors [4,5,14,15]. Financial difficulties and worse mental and social functioning have consistently been associated with CVD risk [10–13,16].

In recent years, trials revealed that sodium-glucose cotransporter-2 inhibitors (SGLT-2is) and glucagon-like-peptide-1 receptor agonists (GLP-1RAs) significantly reduce risk and progression of CVD, chronic kidney damage, and, specifically to SGLT-2is, hospitalisations for heart failure in individuals with T2DM with a very high cardiovascular risk [17–20]. In addition to decreasing adverse CVD and renal outcomes and mortality in individuals, these medications address existing hyperglycaemia [17,18,21]. In accordance with these findings, Dutch diabetes treatment guidelines were altered in 2021 to recommend SGLT-2is (or GLP-1RA if SGLT2i is contra-indicated) for persons with very high cardiovascular risk (i.e. those with a history of cardiovascular events, advanced or chronic kidney disease, or subjects with heart failure with a decreased ejection fraction) [18].

However, there is growing international concern that within the T2DM population, individuals with low SES are less likely to receive SGLT-2is or GLP-1RAs as part of their treatment than individuals with a higher SES, despite having a very high cardiovascular risk [7,22–27]. Recent studies point to differences in people’s health literacy, variations in general practitioners’ (GPs) prescribing behaviour, limitations in insurance coverage, and cost barriers and/or poor access to care among the low SES group as possible explanations for this discrepancy [7,22,23, 25,26,27]. These findings are concerning as inequalities in prescription of state-of-the-art medications between subgroups of persons with T2DM may further increase.

Therefore, the aim of this study was to examine SGLT-2is and GLP-1RAs prescription patterns from 2019 to 2022 and assess socioeconomic discrepancies in initiation of these new medications in the treatment of individuals with T2DM with very high cardiovascular risk in the Netherlands, the year after guideline adaptations (2022).

2. Methods

2.1. Setting

In the Netherlands, 6.5 % of adults is diagnosed with T2DM [3]. The majority (83 % in 2018) is enrolled in integrated diabetes care facilitated within primary care, facilitated through care groups [28]. These care groups are regionally established provider-led entities, exclusively owned by GPs who contract generic diabetes care. Subsequently, the care groups subcontract health care providers (among which dieticians, podiatrists, and diabetes practice nurses) to deliver the contracted care [29]. More complex T2DM patients are treated by medical specialists. Both treatment options are covered by the Dutch statutory health insurance, which includes a mandatory annual deductible of at least €385 per year. In this high-risk population, however, the deductible is typically exhausted early in the calendar year due to their extensive healthcare utilization. In principle, all individuals with type 2 diabetes receive care based on the stepwise treatment guideline for T2DM management [18], unless there are well described reasons to deviate from the general protocols. Since 2021, in the primary care guidelines it is advised to prescribe individuals with very high risk of CVD (criteria displayed in Table 1) SGLT-2is or GLP-1RAs either as the first-line treatment step or added to other already existing treatment (if HbA1c > 53 mmol/mol) [30]. The stepwise diabetes treatment guidelines for those with very high cardiovascular risk recommend: (1) initial prescription of SGLT-2is (GLP-1RAs in case of contraindication for SGLT-2is); (2) adding metformin, (3) adding GLP-1RAs. If this is not sufficient a sulfonylurea derivative, and/or DPP4i and/or insulin may be prescribed [18]. In the decision aid supporting medication choices in individuals with T2DM in need of intensified glucose-lowering

treatment, the decision tree emphasis is on initiating SGLT2-is and in a follow-up step on substituting SGLT2-is by or adding GLP1Ras. This is also emphasized in the countrywide teaching initiatives with regards to (changes) in primary care guidelines.

2.2. Data sources

We used data from the Extramural LUMC (Leiden University Medical Center) Academic Network (ELAN) that links data on all these aspects at the patient level [31]. This study specifically employed data from the electronic health record (EHR) of the GPs and linked these data to the System of Social Statistical Datasets (SSD) [32]. Additional details regarding the diverse routine healthcare data available within ELAN, including the GP and SSD-data have been previously documented [31].

In adherence to Dutch legislation, GPs informed their patients about the use of data for research purposes, offering individuals the opportunity to withdraw from the study through an informed opt-out procedure. The SSD data is utilized for research purposes in accordance with Dutch SN privacy laws. Approval for the current study was obtained from the internal Science Committee of Leiden University Medical Center (LUMC) and the Medical Review Committee (Dutch abbreviation: nWmo) under the reference number 23-3113.

2.3. Study population

From an overall population of approximately 751,000 individuals across 151 GP practices, we identified individuals with T2DM and very high CVD risk. We jointly used three criteria to identify individuals diagnosed with T2DM. First, we identified individuals recorded with the ICPC code T90.02 ("diabetes type 2") in the EHR of the GPs. Second, to correct for incomplete registrations, we included individuals registered with the ICPC code T90 only, but distinguished by their use of glucose-lowering medications categorized under the ATC coding A10B. Third, we identified individuals with T2DM who did not have a specific ICPC code based on use of glucose-lowering medications listed under the ATC coding A10B. We excluded those who were solely using either A10BJ (GLP-1RAs) or A10BK (SGLT-2is) because this generally indicates individuals without T2DM who are treated for obesity [32] and heart failure or chronic kidney disease [33], respectively.

The presence of a very high CVD risk was based on guidelines for T2DM [18] from the Dutch College of General Practitioners (Dutch

Table 1
Inclusion criteria for the identification of individuals with a very high risk of CVD (as formulated in the Dutch primary care standard).

Individuals with a history of cardiovascular diseases	Angina pectoris (ICPC: K74) Acute coronary syndrome (ICPC: K75) Transient ischemic attack (ICPC: K89) Intracerebral hemorrhage (K90.02) Ischemic stroke (ICPC: K90.03) Atherosclerosis (ICPC: K91) Intermittent claudication (ICPC: K92.01) Aortic aneurysm (ICPC: K99.01)
Individuals with chronic kidney disease with a moderate to high cardiovascular risk	eGFR > 60 ml/min/1.73 m ² and ACR > 30 mg/mmol eGFR > 45–59 ml/min/1.73 m ² and ACR > 3 mg/mmol
Individuals with heart failure*	eGFR > 10–44 ml/min/1.73 m ² Heart failure with moderate or reduced left ventricular ejection fraction

* When searching for individuals with heart failure, the following ICPC codes were included: decompensation cordis (K77), heart failure with moderate or reduced left ventricular ejection fraction (ICPC: K77.04), heart failure with preserved left ventricular ejection fraction (ICPC: K77.03), chronic decompensated heart failure (ICPC: K77.02). The combination of these ICPC codes will yield a slightly larger search yield than only searching for ICPC K77.04.

abbreviation: NHG). Guidelines define the very high CVD risk population as individuals with a history of cardiovascular events, advanced chronic kidney disease, or heart failure (for the definition used in the Dutch situation: see also Table 1). Cardiovascular disease history was constructed based on ICPC codes (Table 1). Patients with chronic kidney disease were included based on the estimated Glomerular Filtration Rate (eGFR, NHG Lab codes: 3583 and 1919) and Albumin-to-Creatinine Ratio (ACR, NHG Lab codes: 40) from the lab results from the GPs EHR (Table 1). We extracted the most recent measurements from the preceding four years leading up to the year of interest (2019–2022). Heart failure with a moderate or reduced left ventricular ejection fraction was determined based on ICPC codes.

The guideline also recommends including only non-frail patients with a life expectancy of > 5 years and an eGFR of > 10 ml/min. We were unable to define life expectancy since there is no structured data entry possible to systematically record life expectancy in the EHRs of the GPs. We excluded frailty as an inclusion criterion due to its inconsistent definition [34]. For eGFR > 10 ml/min, 90.0 % of individuals had measurements from 2019 to 2022; 37 (0.3 %) had eGFR ≤ 10 ml/min and were excluded. Furthermore, since we included individuals with T2DM and a very high CVD risk between 2019 and 2022, there was a possibility that some may have died before the year of analysis (2022). Consequently, we included only patients with a fully recorded income data for the year 2021 to ensure their survival status until the start of 2022.

2.4. Assessment of SES and prescription rates SGLT-2is and GLP-1RAs

SES was defined as standardized disposable household income (SDHI), since income is an adequate index for SES [35]. The SDHI comprises the disposable income of a household, adjusted for the number of individuals within the household, by dividing the disposable household income by the household's equivalence factor. The SDHI was divided into quintiles whereby the first quintile was based on the lowest

and increasing to the fifth quintile represented the highest national SDHI group. The SDHI quintiles were derived from the income distribution of the entire population in the Netherlands in 2022, rather than from the income data of the study population. The data for SGLT-2is (A10BK) and GLP-1RAs (A10BJ) medication were extracted from the GPs EHR using the ATC-codes [36].

2.5. Covariate assessment

Covariates included in this study were sex (women/men), age (continuous), living alone (yes/no), migration background (Dutch, non-Dutch western, non-western), all extracted from the SSD [32]. Body Mass Index (BMI, NHG Lab code: 1272) was derived from the EHR of the GP. To utilize a relatively recent BMI and weight and height value, we extracted the most recent measurements from the preceding four years leading up to the year of interest (2019–2022). We also included the history in cardiovascular events as covariates (Table 1).

2.6. Statistical analysis

Descriptive prescriptions over time for SGLT-2is and GLP-1RAs were determined by assessing the prescription proportions annually (2019–2022) (Fig. 1). The results of the multiple logistic regression models (Table 3) assessing the relationship between SES and prescription of SGLT-2is and GLP-1RAs were presented across three models: an unadjusted model (Model 1), a model adjusted for sex and age (Model 2), and a comprehensive model corrected for sex, age, living alone, migration background, BMI and lifetime history in cardiovascular events (Model 3). We corrected for the different types of cardiovascular diseases once again because it was expected that certain CVD conditions would be overrepresented compared to others [37]. The associations were expressed as odds ratios (ORs) with corresponding 95 % confidence intervals (CIs). Statistical significance was determined at P-values < 0.05. Missing values underwent imputation using the Markov chain

Table 2

Baseline characteristics of included individuals with T2DM with a very high cardiovascular risk (n = 10.768) in 2022, stratified for SES, utilized as standardized disposable household income in quintiles.

	Total n = 10.768	1st quintile n = 2589	2nd quintile n = 3391	3rd quintile n = 2072	4th quintile n = 1582	5th quintile n = 1134
Sex (women), n (%)	4359 (40.5)	1233 (47.6)	1521 (44.9)	801 (38.7)	511 (32.2)	293 (25.8)
Age, mean ± SD	73.3 (10.4)	72.5 ± 11.0	76.5 ± 9.5	73.0 ± 9.9	70.5 ± 10.2	69.3 ± 10.0
SDHI (yearly in euros), median (IQR)	24.582 (13.871)	17.267 (12.720)	22.226 (3017)	29.610 (3599)	37.325 (4419)	50.439 (12,816)
SDHI (yearly in euros), min-max*	0–430.000	0–19.499	19.500–25.999	26.000–33.499	33.500–42.999	43.000–430.000
Migration background, n (%)						
Dutch	7586 (70.5)	1386 (53.5)	2628 (77.5)	1584 (76.4)	1162 (73.5)	826 (72.8)
Other western	1168 (10.8)	219 (8.5)	354 (10.4)	241 (11.6)	200 (12.6)	154 (13.6)
Other non-western	2014 (18.7)	984 (38.0)	409 (12.1)	247 (11.9)	220 (13.9)	154 (13.6)
Living alone (yes), n (%)	3879 (36.0)	1309 (50.6)	1419 (41.8)	6648 (31.3)	335 (21.2)	168 (14.8)
BMI, mean ± SD	28.8 ± 5.1	29.1 ± 5.3	28.7 ± 5.1	28.8 ± 5.1	28.9 ± 5.1	28.9 ± 4.8
SGLT-2is prescribed (yes), n (%)	1563 (14.5)	368 (14.2)	385 (11.4)	322 (15.5)	306 (19.3)	182 (16.0)
GLP-1RAs prescribed (yes), n (%)	725 (6.7)	175 (6.8)	190 (5.6)	146 (7.0)	127 (8.0)	87 (7.7)
History in CVD, n (%)						
Acute coronary syndrome	2976 (27.6)	692 (26.7)	894 (26.4)	585 (28.2)	457 (28.8)	348 (30.6)
Angina pectoris	2829 (26.3)	727 (28.1)	878 (25.9)	543 (26.2)	378 (23.9)	303 (26.7)
TIA	1693 (15.7)	386 (15.0)	547 (16.1)	327 (15.8)	254 (16.1)	179 (15.8)
Ischemic stroke	984 (9.1)	230 (8.9)	318 (9.4)	210 (10.1)	148 (9.4)	78 (6.9)
Intracerebral hemorrhage	108 (1.0)	26 (1.0)	27 (0.8)	15 (0.7)	25 (1.6)	15 (1.3)
Intermittent claudication	1460 (13.6)	374 (14.3)	485 (14.3)	295 (14.2)	196 (12.4)	114 (10.1)
Aorta Aneurysm	509 (4.7)	89 (3.4)	166 (4.9)	113 (5.5)	81 (5.1)	60 (5.3)
Atherosclerosis	307 (2.9)	67 (2.6)	88 (2.6)	66 (3.2)	53 (3.4)	33 (2.9)
Chronic kidney failure, n (%)	3910 (36.3)	1011 (39.0)	1386 (40.9)	739 (35.7)	490 (31.0)	284 (25.0)
Heart failure, n (%)	304 (2.8)	74 (2.9)	111 (3.3)	52 (2.5)	45 (2.8)	22 (1.9)

Abbreviations: SDHI, Standardized Disposable Household Income; BMI, Body Mass Index; CVD, Cardiovascular diseases; SES, Socioeconomic status; SGLT-2is, Sodium-glucose co-transporter 2 inhibitors; GLP-1RAs, Glucagon-Like Peptide 1 receptor agonists; SD, Standard Deviation; TIA, Transient Ischemic Attack.

* The shown minimum and maximum values are close approximations of the actual minimum and maximum values. This approach is used to prevent the actual values from potentially being traceable to an individual.

Monte Carlo method [38]. After the imputation procedure, the effect estimates were pooled and used in the analyses. All statistical analyses were conducted using SPSS version 26.

3. Results

3.1. Study population descriptives

From the total of 33,526 individuals with T2DM, we identified 10,768 individuals with T2DM and very high CVD risk. Table 2 shows the baseline characteristics (2022) of the population with T2DM and a very high CVD, stratified for SES in quintiles. We observe that the proportion of women compared to men is highest within the first (lowest) SES quintile (47.6 %), with the percentage of women decreasing as SES quintiles ascend to 25.8 % in the fifth (highest) SES quintile. Within all SES quintiles, the majority of patients were men and mean age ranged between 69.3 (fifth quintile) and 76.5 (second quintile). We observed a difference between the second through the fifth (highest) SES quintiles compared to the first (lowest) quintile in migration background, as 53.5 % have a Dutch and 38.0 % have a non-Western migration background in quintile 1 (lowest), whereas the remaining SES quintiles range between 72.8–77.5 % and 11.9–13.9 %, respectively. Furthermore, the first (lowest) SES quintile contains the highest percentage of patients living alone (50.6 %), and the percentage decreases progressively with higher SES quintiles. Within SES quintile 2 the lowest percentage of individuals with T2DM with very high CVD risk received a SGLT-2i (11.4 %) or GLP-1RA (5.6 %) prescriptions and SES quintile 4 received the highest share of prescriptions for SGLT-2is and GLP-1RAs with 19.3 % and 8.0 %, respectively. Among individuals with a history of CVD, predominantly acute coronary syndrome or angina pectoris was observed within all quintiles. In quintile 2, we observed the highest percentage of individuals with chronic kidney disease (40.9 %), whereas the lowest percentage is found in quintile 5 (highest) (25.0 %).

3.2. SGLT-2is and GLP-1RAs: prescription rates over time (2019–2022)

Fig. 1 shows that within the whole study population in 2022, SGLT-2is were prescribed proportionally more often than GLP-1RAs in 2022 (SGLT-2is: 14.5 % vs GLP1-RAs: 6.7 %). Also, the percentage prescriptions for SGLT-2is and GLP-1RAs increases with advancing years, with the most substantial growth evident in the latest year (2022).

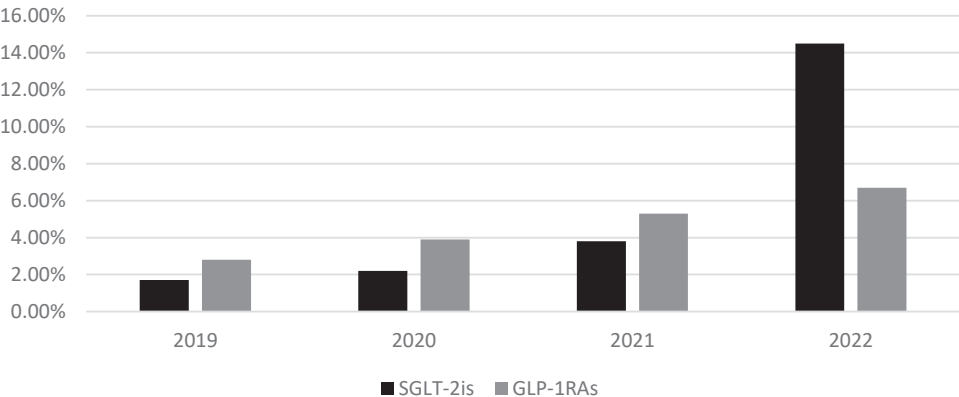


Fig. 1. SGLT-2is and GLP-1RAs prescriptions for individuals with T2DM and a very high cardiovascular risk (n = 10,768) between 2019 and 2022.

Table 3
Odds ratio's (95 % CI) for the association between SES (in quintiles) and prescribing SGLT-2i and GLP-1RA medication in 2022.

	Model 1 OR, 95 % CI	Model 2 OR, 95 % CI	Model 3 OR, 95 % CI
SGLT-2i			
First quintile (lowest)	(Referent)	(Referent)	(Referent)
Second quintile	<u>0.77 (0.66–0.90)</u>	0.93 (0.80–1.09)	0.94 (0.80–1.11)
Third quintile	1.11 (0.94–1.31)	1.11 (0.94–1.31)	1.13 (0.95–1.34)
Fourth quintile	<u>1.45 (1.23–1.71)</u>	<u>1.26 (1.06–1.49)</u>	<u>1.29 (1.08–1.54)</u>
Fifth quintile (highest)	1.15 (0.95–1.40)	0.91 (0.74–1.11)	0.93 (0.75–1.14)
GLP-1RA			
First quintile (lowest)	(Referent)	(Referent)	(Referent)
Second quintile	0.82 (0.66–1.01)	1.07 (0.86–1.33)	0.96 (0.76–1.21)
Third quintile	1.05 (0.83–1.31)	1.11 (0.88–1.40)	0.98 (0.77–1.26)
Fourth quintile	1.20 (0.95–1.53)	1.10 (0.86–1.41)	0.98 (0.75–1.27)
Fifth quintile (highest)	1.15 (0.90–1.50)	0.99 (0.75–1.30)	0.88 (0.66–1.19)

Abbreviations: OR, Odds Ratio; CI, Confidence Interval; SES, Socioeconomic status; SGLT-2i, Sodium-glucose co-transporter-2 inhibitor; GLP-1RA, Glucagon-Like Peptide-1 receptor agonists.
Model 1: Unadjusted.
Model 2: Adjusted for sex and age (continuous).
Model 3: Adjusted for sex, age (continuous), migration background, living alone (yes/no), previously diagnosed cardiovascular diseases, and Body Mass Index (continuous).
*Underlined values indicate a statistically significant association.

3.3. Association between social economic status and the prescription of SGLT-2i and GLP-1RA

The relationship between SES and the prescription of SGLT-2i and GLP-1RA is detailed in Table 3. Model 1 illustrates that, without adjustments, the second quintile exhibits a negative significant association (SES quintile 2 vs quintile 1: OR 0.77, 95 % CI: 0.66–0.90), while the fourth quintile shows a positive significant association (quintile 4 vs quintile 1: OR 1.45, 95 % CI: 1.23–1.71) with the prescription of SGLT-2i. In Model 2 (adjusted for sex and age) and Model 3 (adjusted for all relevant covariates), only the positive significant association for the fourth quintile persists for the SGLT-2i prescriptions (Model 2, quintile 4 vs quintile 1: OR 1.26, 95 % CI 1.06–1.49) (Model 3, quintile 4 vs quintile 1: OR 1.29 95 % CI:1.08–1.54). Furthermore, Table 3 presents

the association between SES (in quintiles) and the prescription of GLP-1RA, with none of the models showing significant associations.

4. Discussion

In this study, we examined prescription patterns of SGLT-2is and GLP-1RAs over time and assessed SES disparities in the prescription of these new medications within the Dutch T2DM population with very high cardiovascular risk. Our results show an increase in SGLT-2is and GLP-1RAs, especially after the Dutch guideline recommendations changed in 2021. We did not observe a socioeconomic gradient in SGLT-2is and GLP-1RAs initiation.

Our findings are in contrast with prior research indicating that individuals with lower socioeconomic backgrounds are less likely to be prescribed SGLT-2is and GLP-1RAs than those with a higher SES [7, 22–27]. Falkentoft et al. [7] found socioeconomic disparities in SGLT-2is and GLP-1RAs initiation in Denmark. A key difference is that during the Falkentoft study (2012–2020) Danish T2DM guidelines included SGLT-2is and GLP-1RAs as a second-line add-on option to metformin for all people with T2DM [7]. This in contrast to current guidelines for T2DM in the Netherlands, which specify SGLT-2is and GLP-1RAs as a first-line treatment for those with T2DM and very high cardiovascular risk. In the current version of the Dutch T2DM NHG-guidelines, SGLT-2is are prioritized as the first treatment option for individuals with very high cardiovascular risk, while GLP-1RAs are explicitly mentioned as a secondary or alternative option in the treatment pathway [39]. We hypothesize that the narrow specification of the target population in the Dutch treatment guidelines, and the fact that it concerns a group with relatively poorer health, contributes to increased equity in prescription of SGLT-2is and GLP-1RAs [17–19,40,41]. Moreover, as we study a later time period than Falkentoft et al. [7], who studied the time period 2012–2020, the growing body of evidence showing protective cardiovascular and renal effects of SGLT-2is and GLP-1RAs is likely to have increased providers' confidence in and willingness to prescribe these medications [17–20,40,41–44]. The organization of integrated T2DM care in the Netherlands, with a central role for primary care groups, may also have contributed positively to treatment equity. Care groups organize continuous training for participating primary care professionals to update their knowledge on T2DM treatment options, and have been shown to reduce practice variation and positively affect the uptake of new protocols and guidelines [45].

Our study shows that although SGLT-2is and GLP-1RAs prescription rates increased rapidly in the year after these were recommended in T2DM treatment guidelines for patients with very high cardiovascular risk, around 85 % of the potentially eligible population did not receive either drug in 2022. This (possible) underutilization is recognized in prior research in other countries, where similar prescription rates of SGLT-2is and GLP-1RAs are observed in T2DM populations with high cardiovascular and/or renal risk [43,44,46]. A share of the underutilization could be a result of careful consideration resulting in the decision not to initiate these medications, for example because of patient preferences, contraindications, prior experienced side effects, or limited life expectancy. The number of SGLT-2is and GLP-1RAs prescriptions may additionally have been affected by the primary focus on glucose-regulation in the treatment of diabetes. For people whose HbA1c is well controlled, GPs, practice nurses as well as patients may not be inclined to alter diabetes treatment due to cardiovascular or renal risks, or may not be aware of who is eligible for SGLT-2is or GLP-1RAs. Moreover, while both SGLT-2is and GLP-1RAs are proven cost-effective, cost considerations (GLP-1RAs are more expensive than SGLT-2is) and differences in administration routes (GLP-1RAs are mostly injectables whilst SGLT-2is are oral tablets) might still lead to reluctance/hesitation of GPs and nurses when considering prescription of these medications [42,47,48]. Furthermore, the number of prescriptions may have been influenced by the fact that the guideline was implemented during the later stages of the COVID-19 pandemic.

A major strength of this study is its contribution to the insight in socioeconomic disparities in prescription of SGLT-2is and GLP-1RAs. This was enabled by use of a dataset in which we could link EHR data of the GPs to socioeconomic- and demographic data from SN at the individual level. The EHR data enabled us to confidently identify patients with type 2 diabetes with very high cardiovascular risk. Although comprehensive, the dataset had limitations. In addition, because of the time lag in available data we were only able to study the first year after diabetes treatment guideline adaptations. Prescriptions are likely to have increased further since 2022 and prescription (in)equities may have evolved as well. Furthermore, we used the NHG-guidelines to determine cardiovascular risk. However, previous research has indicated that existing cardiovascular risk models may not always be valid for certain disadvantaged populations. Consequently, we may have underestimated the actual cardiovascular risk for populations with lower socioeconomic status (SES) [49].

In conclusion, despite rapid increase in prescriptions in 2022, still around 85 % of the eligible population (i.e. those with T2DM and very high cardiovascular risk) did not receive either drug. Notably, we did not observe a socioeconomic gradient in the prescription of SGLT-2is and GLP-1RAs. Yet, as guideline changes to include SGLT-2is and GLP-1RAs were recently adopted in the Netherlands, our observations are limited to only the first year after guideline alterations (2022). In coming years, SGLT-2is and GLP-1RAs initiation and maintenance should be monitored within the T2DM population, focusing on presence of socioeconomic disparities and look deeper into differences in age, sex and GP-practice level for an extended period of time. If disparities occur or underutilization persists, it is essential to gain insight into the underlying reasons from both the perspective of the healthcare provider and the patient. By revealing the underlying mechanisms, appropriate measures can be implemented to contribute to equitable prescribing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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