

Identifying Care Gaps in the Use of Sodium-Glucose Cotransporter 2 (SGLT2) Inhibitors and county-specific quality of prescribing among Diabetes Patients with Chronic Kidney Disease: A Population Based Study in Taiwan

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Background

Sodium-glucose cotransporter 2 (SGLT2) inhibitors have been shown to provide significant cardiovascular and renal benefits for adults with chronic kidney disease (CKD) and type 2 diabetes. Recent diabetes guidelines recommend SGLT2 inhibitors for end-organ protection in patients with CKD. In this study, conducted in Taiwan, we aimed to determine the prevalence and predictors of SGLT2 inhibitor use and to evaluate county-specific prescribing quality among type 2 diabetic patients with CKD.

Methods

We identified 108,582 patients with type 2 diabetes and stage 3-5 CKD from the National Health Insurance Research Database (NHIRD) in Taiwan from 2019-2021. CKD was defined as a yearly mean estimated glomerular filtration rate (eGFR) of less than 60 mL/min/1.73 m². Logistic regression was used to identify predictors (sociodemographic characteristics, clinical parameters, comorbidities, medications use and health care utilization) of SGLT2 inhibitor use. Overall and county-specific prevalence of index mediations that could

be accounted for quality of prescribing was also calculated to evaluate county-level variation of prescribing pattern. Utilization rates of glucagon-like peptide 1 (GLP-1) receptor agonist, pentoxifylline, and febuxostat were also evaluated.

Results

The mean age of patients was 73.1 years, and 51.5% were male. Of the study population, 24.2% were using SGLT2 inhibitors. After multivariable adjustment, older age, higher blood pressure, lower hemoglobin A1c (HbA1c) and eGFR levels, female sex, lower income, and hospital admission were associated with non-use of SGLT2 inhibitors. Non-use of SGLT2 inhibitors was also associated with comorbid cerebrovascular disease and the use of calcium channel blockers and diuretics. Cardiologist visits were associated with higher SGLT2 inhibitor use. The utilization rates for ACE inhibitors/ARBs and long-term NSAID use (more than 90 days) were 73.0% and 7.68%, respectively, while the rates for GLP-1 receptor agonists, pentoxifylline, and febuxostat were 7.88%, 22.8%, and 19%. We also found county-level variation in utilization rates.

Discussion / Conclusions

SGLT2 inhibitors were underutilized among type 2 diabetes patients with CKD in Taiwan, despite their cardiovascular and renal benefits. Various factors, such as age, comorbidities, healthcare utilization, and region, were associated with non-use. Efforts should be made to optimize pharmacologic management among this population, and interventions should be tailored to address regional variations in prescribing patterns.

Table 1. factors associated with SGLT-2i prescribing among diabetes patient with CKD

	Crude OR (95%CI)	Adjusted OR(95%CI)
Age, mean (SD), years	0.96 (0.96-0.96)	0.97 (0.97-0.97)
Male sex, n (%)	1.44 (1.40-1.48)	1.24 (1.20-1.28)
Socioeconomic status, n(%) (regular salary tertile)		
3 (highest)	1.29 (1.25-1.34)	1.09 (1.05-1.13)
2	1.14 (1.10-1.18)	1.10 (1.06-1.15)
1 (lowest)	Ref	Ref
Clinical parameters		
Overweight and obesity, %	1.52 (1.37-1.68)	1.06 (0.95-1.19)
HbA1c		
>9.0	1.23 (1.18-1.27)	1.13 (1.08-1.17)
7.0-9.0	Ref	Ref
<7.0	0.45 (0.44-0.47)	0.51 (0.49-0.53)
eGFR, ml/min		
45-59	Ref	Ref
30-44	0.76 (0.74-0.79)	0.80 (0.77-0.83)
15-29	0.35 (0.34-0.36)	0.38 (0.36-0.40)
< 15	0.15 (0.14-0.17)	0.18 (0.17-0.20)
SBP, mmHg		
>160	0.89 (0.83-0.96)	0.91 (0.84-0.99)
140-160	Ref	Ref
120-139	1.10 (1.05-1.15)	1.10 (1.05-1.15)
<120	1.14 (1.07-1.22)	1.14 (1.06-1.22)
LDL-cholesterol, mg/dL		
>140	1.02 (0.94-1.10)	0.94 (0.86-1.02)
120-140	Ref	Ref
100-119	0.98 (0.92-1.05)	1.03 (0.96-1.10)
<100	0.93 (0.88-0.98)	1.02 (0.96-1.08)
Co-morbidities		
Hypertension, n (%)	0.90 (0.87-0.94)	1.00 (0.95-1.04)
Coronary artery disease	1.20 (1.17-1.24)	1.09 (1.05-1.13)
Cerebrovascular disease	0.61 (0.59-0.63)	0.81 (0.78-0.84)
Cardiac dysrhythmia	0.79 (0.76-0.83)	0.96 (0.92-1.01)
Congestive heart failure	0.87 (0.85-0.90)	1.19 (1.14-1.25)
Peripheral vascular disease	1.04 (0.98-1.10)	1.13 (1.07-1.20)
Hyperlipidemia	1.58 (1.53-1.63)	1.05 (1.01-1.09)
Charlson comorbidity index, mean (SD)	0.92 (0.92-0.93)	0.98 (0.98-0.99)
Medications (>=2 prescription)		
Aspirin, n (%)	1.19 (1.16-1.23)	1.06 (1.02-1.09)
statin, n (%)	1.65 (1.60-1.70)	1.33 (1.28-1.37)
RAASi, n(%)	1.65 (1.59-1.71)	1.44 (1.39-1.50)
b-blocker	1.16 (1.13-1.19)	1.13 (1.10-1.17)
Calcium channel blocke	0.62 (0.60-0.64)	0.81 (0.79-0.84)
Diuretic	0.63 (0.62-0.65)	0.88 (0.85-0.91)
Health care utilization		
Cardiologist visit >=1		
No. of Cardiologist visit, mean+-SD	1.03 (1.03-1.03)	1.04 (1.04-1.04)
Endocrinologist visit		
No. of Endocrinologist visit visit, mean+-SD	1.02 (1.01-1.02)	0.99 (0.99-1.00)
Nephrologist visit		
No. of nephrologist visit, mean+-SD	0.97 (0.97-0.97)	1.00 (0.99-1.00)
Medical center visit	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Regional hospital visit	0.99 (0.99-1.00)	1.00 (1.00-1.00)
Local medical clinic	1.01 (1.01-1.01)	1.00 (1.00-1.01)
Hospitalization		
No. of hospitalization	0.61 (0.59-0.62)	0.85 (0.82-0.88)

Table 2. county-specific prevalence of medications use (%)

County name	RAASi	SGLT-2i	Metformin use in eGFR<30	Selective and Non-selective NSAID
基隆市	76.05	23.31	55.84	8.39
新北市	72.31	24.02	54.01	7.27
台北市	71.58	24.56	55.90	6.85
宜蘭縣	67.18	20.84	57.52	6.81
桃園市	72.75	24.31	52.76	7.53
新竹市	70.25	26.66	62.14	5.98
新竹縣	71.09	25.23	59.59	7.95
苗栗縣	72.13	24.25	58.53	7.99
台中市	72.93	24.75	57.92	7.65
彰化縣	75.05	21.59	55.65	8.42
南投縣	74.69	26.78	55.86	8.40
雲林縣	73.59	24.76	54.56	8.80
台南市	69.76	20.86	56.71	5.98
嘉義市	79.21	27.22	59.21	6.59
嘉義縣	77.15	21.01	52.75	8.63
高雄市	75.02	24.04	55.91	7.79
屏東縣	75.16	24.46	57.08	8.54
花蓮縣	72.74	27.06	65.74	13.15
台東縣	77.23	31.68	64.91	12.75
離島	78.52	27.59	59.87	7.42