Reducing health inequality of introducing SGLT2i therapy in a real-world type 2 diabetes population with diverse patient characteristics: A distributional cost-effectiveness analysis

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Background and objective

- Despite emerging evidence suggesting multiple health benefits of sodium-glucose cotransporter 2 inhibitors (SGLT2is) in patients with diverse characteristics[1-3], whether health inequality exists after widely adopting SGLT2is in modern clinical practice remains unclear.
- We sought to conduct the distributional cost-effectiveness analyses (DCEAs) of using SGLT2is versus dipeptidyl peptidase 4 inhibitors (DPP4is) by individual characteristics among Taiwanese patients with type 2 diabetes (T2D).

Methods

Cost-effectiveness analysis:
A state-transition microsimulation model comprised of cardiovascular events from a healthcare sector perspective over 5 years of simulation with annual cycle length[4].

Target patient subgroups[1-3]

1) Age: <65 years vs. ≥65 years
2) eGFR: ≥90 ml/min/1.73m^2 vs. 60≤eGFR<90 ml/min/1.73m^2
3) HbA1c: <8.5% vs. ≥8.5%
4) BMI: <30 kg/m^2 vs. ≥30 kg/m^2

Interventions:

✓ SGLT2is vs. DPP4is

Modelling health inequality impacts[5-7]

1) Equally-distributed-equivalents health (EDEH)

✓ Inequality aversion index: 10.95[8]

✓ Health in each group: simulate the QALYs of each subgroup using electronical health records in NCKUH and NTUH and extrapolated to nationwide Taiwanese T2D populations

2) Net health benefits (NHB)

✓ Health opportunity cost: 1 times GDP per capita in Taiwan

✓ Proportion of patients receiving SGLT2is: 16% (published literature[9] derived from nationwide Taiwanese T2D populations)

Population health equity (QALYs):
Difference between population ΔEDEH and population ΔNHB

Sensitivity analyses varied by:

✓ Inequality aversion index

✓ Health opportunity cost

✓ Patients receiving SGLT2is (%)

Abbreviations: BMI, body mass index; eGFR, estimated glomerular filtration rate; HbA1c, glycated hemoglobin; NCKUH, National Cheng Kung University Hospital; NTUH, National Taiwan University Hospital; QALYs, quality-adjusted life years.

Results

Table 1. Results of base-case distributional cost-effectiveness analysis

Subgroup	Effectiveness (QALYs)	Population EDE (QALYs)	Population ΔEDE (QALYs)	Individual ΔNHB (QALYs)	Weighted ΔNHB (QALYs)	Population ΔNHB (QALYs)	Population health equity (QALYs)
Age (<65 years / ≥65 years) (N†=432,247; n1/n2‡=305,767/126,480)							
SGLT2i	4.49 / 4.21	6,427,205¶	153,790	-0.004/ -0.008	-0.006¶	2,778	151,012
DPP4i	4.47 / 4.07	6,273,415¶					
eGFR (≥90 ml/min/1.73m^2 / 60≤eGFR<90 ml/min/1.73m^2) (N†=406,002; n1/n2‡=306,399/99,603)							
SGLT2i	4.46 / 4.31	6,067,243¶	77,562	-0.001/ -0.020	-0.005¶	2,010	75,552
DPP4i	4.42 / 4.24	5,989,681¶					
A1c (<8.5% / ≥8.5%) (N†=432,247; n1/n2‡=269,720/162,527)							
SGLT2i	4.41 / 4.42	6,558,735¶	91,212	-0.008/ -0.006	-0.008¶	3,302	87,910
DPP4i	4.34 / 4.37	6,467,523¶					
BMI (<30 kg/m^2 / ≥30 kg/m^2) (N†=432,247; n1/n2‡=310,984/121,263)							
SGLT2i	4.40 / 4.45	6,572,943¶	91,507	-0.009/ -0.006	-0.008¶	3,391	88,116
DPP4i	4.33 / 4.40	6,481,436¶					

†N represents the number of SGLT2i and DPP4i new users obtained from a nationwide cohort study in Taiwan between 2016 and 2019[9].
‡The proportions of each subgroup (e.g., age<65 and ≥65 years) are estimated by the total patient number of each subgroup (e.g., age<65 years) divided by the total population of whole group (e.g., age group) in two institutions (i.e., National Cheng Kung University Hospital and National Taiwan University Hospital). After then, the number of total SGLT2i and DPP4i users (N) multiplied by the proportion of corresponding subgroup will generate the n1 and n2.
¶The estimates were derived from the pooled cohort of each subgroup.

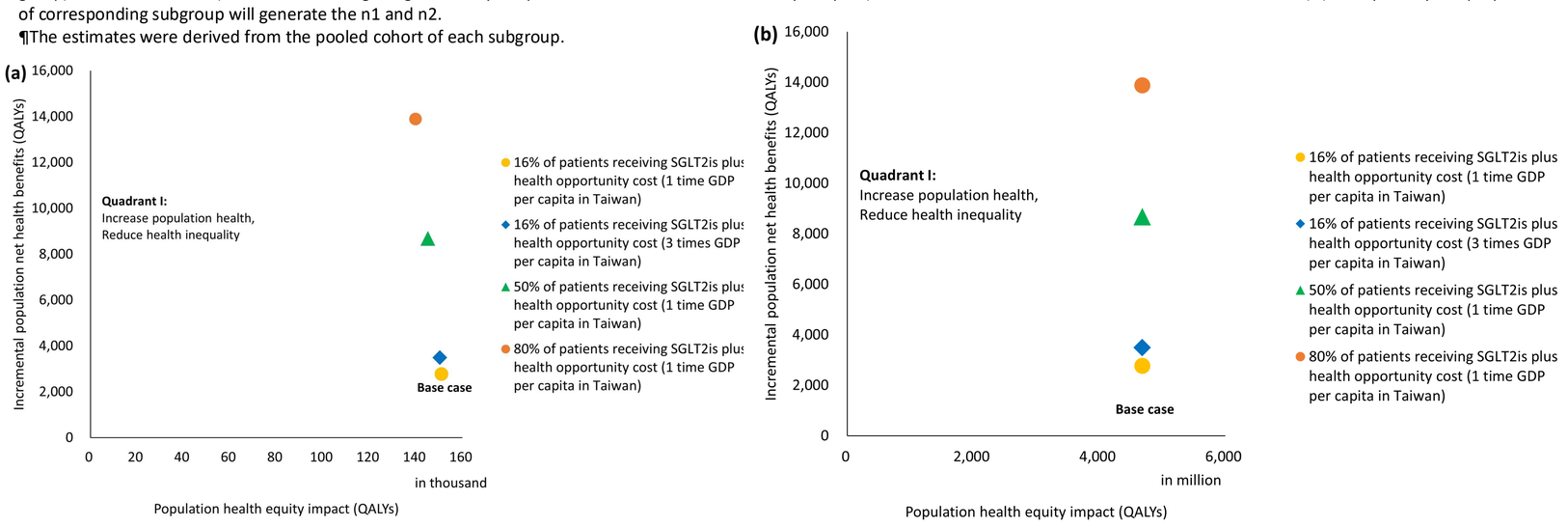

Figure 1. Health equity plane used to visualize the results of distributional cost-effectiveness analysis using age subgroups for illustration: (a) inequality aversion index = 10.95 (b) inequality aversion index = 2.0441[10]

✓ With adopting SGLT2is over DPP4is, the population incremental NHB ranged from 2,010 QALYs (eGFR subgroups) to 3,391 QALYs (BMI subgroups) and the health inequality ranged from 75,552 QALYs (eGFR subgroups) to 151,012 QALYs (age subgroups), suggesting the enhancement of both efficiency and equity from using SGLT2is across subgroups compared to DPP4is (**Table 1**).

✓ Results of sensitivity analyses (**Figure 2**) were consistent with the primary findings.

Discussion

✓ Beyond traditional factors (e.g., social economic status) which might not be of concern under a universal health care setting, we focused health equity issues for clinically or biologically vulnerable patient populations.

✓ The increase in the number of patients receiving SGLT2is increased incremental NHB, which provides supporting evidence to encourage the adoption of SGLT2i therapy for eligible patients and thus alleviates its underuse in current practice.

✓ Future studies that create an explicit inequality aversion index and health opportunity cost specific to our case (e.g., focusing on clinical characteristics) are warranted.

Conclusions

✓ Adopting SGLT2is over DPP4is would increase population health and reduce health inequality across real-world T2D patients with diverse clinical characteristics.

✓ A classic cost-effectiveness analysis in conjunction with DCEAs could enhance the health technology re-assessment of new technologies in real-world populations to provide evidence on guiding the selection and prioritization of treatment options and optimizing the allocation of healthcare resources.

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