A Chronological Overview of Type 2 Diabetes Mellitus: a focus on medication and complications using OHDSI ATLAS

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Background

Diabetes guideline updates annually according to the available evidence to provide a better reference for diabetes treatment. Recently, most guidelines recommend individualized glycemic control targets based on patients' clinical characteristics. A shift in patient type 2 diabetes mellitus (T2DM) medication patterns has been observed due to the changes to the treatment guidelines every year. Characterizing typical treatment pathways and complications among diabetic patients is essential to determining whether this promising change is successful. This study aims to identify treatment pathways and common complications in T2DM patients.

Methods

This study collected data from Taipei Medical University Clinical Research Data (TMUCRD), including 3 affiliated hospitals (TMU Hospital, Wanfang Hospital, and Shuang Ho Hospital). The data was mapped to the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM), and we utilized OHDSI ATLAS to build cohort definitions to which the first use of the T2DM drug and first occurrence of complication as a cohort entry event. The inclusion criteria are patients first diagnosed with T2DM (2008-2020) before taking the drug and having at least 1-year database history into 2 different time-based groups (2008-2015 and 2016-2020).

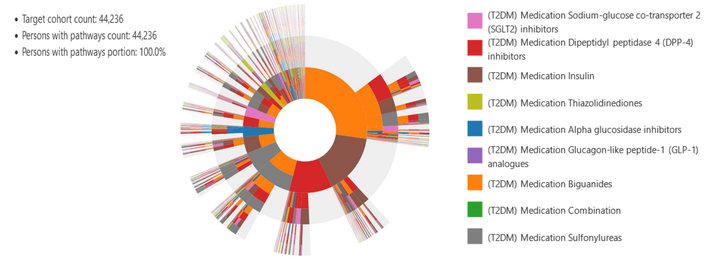
Concept ID for a drug is created based on the drug class, which consists of biguanides, sulfonylureas, thiazolidinediones, sodium-glucose co-transporter 2 (SGLT2) inhibitors, glucagon-like peptide-1 (GLP-1) analogues, alpha-glucosidase inhibitors, dipeptidyl peptidase 4 (DPP-4) inhibitors, insulin, and combination (from 2 different classes). Regarding complications, we focused on metabolic syndrome, including hypertension (excluding hypertension that correlated to obstetric and cancer) and dyslipidemia; cardiovascular disease, including acute myocardial infarction, hemorrhagic stroke, ischemic stroke, and heart failure; and renal impairment. We used cohort pathways to create sunburst graphs to visualize the treatment and complication pathway and used characterization to set patients' demographic.

Results

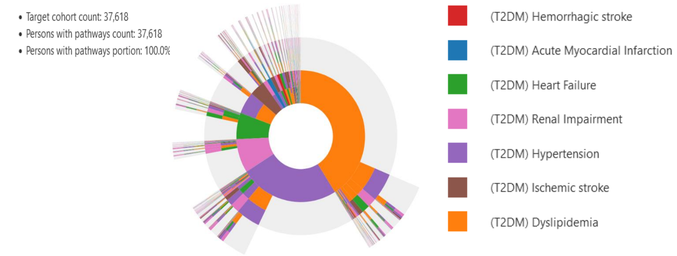
There were 44,236 patients with T2DM treated between 2008 and 2020, with an average age of 62 and a Charlson Comorbidity Index of 3.18. In 2014-2020, hypertension without congestive heart failure increased compared to 2008-2013. One interesting finding was that some patients had taken metformin, insulin, glimepiride, and linagliptin for at least one month in the year preceding the index date.

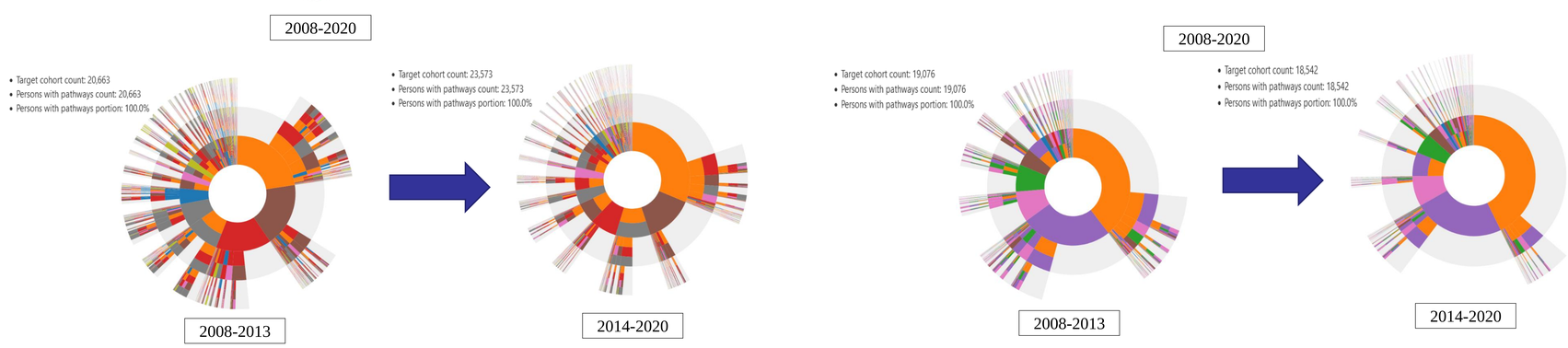
Biguanides, insulin, DPP-4 inhibitors, sulfonylureas, and alpha-glucosidase inhibitors are the top five first-line classes of diabetes treatment between 2008-2020. Compared to 2008-2013, there was an increase in the use of biguanides and SGLT2 inhibitors and a decrease in the use of insulin, DPP-4 inhibitors, sulfonylureas, and alpha-glucosidase inhibitors from 2014-2020.

Treatment pathways



Complication pathways





A total of 44,236 patients with T2DM were treated, of which 37,618 experienced complications. In order of the most frequent occurrence, dyslipidemia, hypertension, renal impairment, heart failure, and ischemic stroke are the first complications .

Conclusions

A change has been made to the first line of T2DM therapy, although it does not appear to have a significant impact. Metformin remains the first line for T2DM for a safe and well-tolerated treatment. There was a reduction in alpha glucosidase inhibitors and insulin use in 2014-2020 compared to 2008-2013. Meanwhile, SGLT2 inhibitors are being considered for use recently as a line of therapy. There is a high probability that T2DM patients will experience complications, and it is only natural that they should be monitored periodically for their target blood sugar and future prognosis. We considered our limitation in visualizing complications related to type 2 diabetes, where complications in 2008-2013 tended to be more varied and numerous because of the longer period observed.

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