

Supplemental Online Content

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eAppendix. Database

eTable 1. Clinical diagnosis, and other codes used in the platform that are used to determine the status of variables for study population definitions, exposures, outcomes, and those for propensity-score matching for groups

eTable 2. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for baseline covariates related to esophageal cancer for the study populations of patients with T2D and no history of any OAC

eTable 3. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to breast cancer for the study populations of women (age 55 and older) with T2D and no history of any OAC

eTable 4. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to endometrial cancer for the study populations of women with T2D and no history of any OAC

eTable 5. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to gallbladder cancer for the study populations of patients with T2D and no history of any OAC

eTable 6. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to stomach cancer for the study populations of patients with T2D and no history of any OAC

eTable 7. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to kidney cancer for the study populations of patients with T2D and no history of any OAC

eTable 8. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to liver cancer for the study populations of patients with T2D and no history of any OAC

eTable 9. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to ovarian cancer for the study populations of women with T2D and no history of any OAC

eTable 10. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to pancreatic cancer for the study populations of patients with T2D and no history of any OAC

eTable 11. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to thyroid cancer for the study populations of patients with T2D and no history of any OAC

eTable 12. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to meningioma for the study populations of patients with T2D and no history of any OAC

eTable 13. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to multiple myeloma for the study populations of patients with T2D and no history of any OAC

eTable 14. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to esophageal cancer for the study populations of patients with T2D and no history of any OAC

eTable 15. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to breast cancer for the study populations of women (age 55 and older) with T2D and no history of any OAC

eTable 16. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to colorectal cancer for the study populations of patients with T2D and no history of any OAC

eTable 17. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to endometrial cancer for the study populations of women with T2D and no history of any OAC

eTable 18. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to gallbladder cancer for the study populations of patients with T2D and no history of any OAC

eTable 19. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to stomach cancer for the study populations of patients with T2D and no history of any OAC

eTable 20. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to kidney cancer for the study populations of patients with T2D and no history of any OAC

eTable 21. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to liver cancer for the study populations of patients with T2D and no history of any OAC

eTable 22. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to ovarian cancer for the study populations of women with T2D and no history of any OAC

eTable 23. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to pancreatic cancer for the study populations of patients with T2D and no history of any OAC

eTable 24. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to thyroid cancer for the

study populations of patients with T2D and no history of any OAC

eTable 25. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to meningioma for the study populations of patients with T2D and no history of any OAC

eTable 26. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to multiple myeloma for the study populations of patients with T2D and no history of any OAC

This supplemental material has been provided by the authors to give readers additional information about their work.

eAppendix. Database

The data used in this study were collected and analyzed on April 26, 2024 within the TriNetX Analytics platform based on the “Research US Collaborative Network”. We used the TriNetX platform to access aggregated and de-identified electronic health records (EHRs) of 113 million patients from 64 healthcare organizations in the US across 50 states, covering diverse geographic regions (22% Northeast, 16% Midwest, 39% South, 13% West, 10% Unspecified), age, race/ethnic, income and insurance groups and clinical setting. TriNetX, LLC is compliant with the Health Insurance Portability and Accountability Act (HIPAA). Any data displayed on the TriNetX Platform in aggregate form, or any patient level data provided in a data set generated by the TriNetX Platform only contains de-identified data as per the de-identification standard defined in Section §164.514(a) of the HIPAA Privacy Rule. TriNetX built-in analytic functions (e.g., incidence, prevalence, outcomes analysis, survival analysis, propensity score matching) allow for patient-level analyses, while only reporting population-level data. The MetroHealth System, Cleveland OH, IRB determined research in the way described here, is not Human Subject Research and therefore IRB is not required.

TriNetX is a platform that de-identifies and aggregates electronic health record (EHR) data from contributing healthcare systems, most of which are large academic medical institutions with both inpatient and outpatient facilities at multiple locations, across all 50 states in the US. TriNetX Analytics provides web-based and secure access to patient EHR data from hospitals, primary care, and specialty treatment providers, covering diverse geographic locations, age groups, racial and ethnic groups, income levels and insurance types including various commercial insurances, governmental insurance (Medicare and Medicaid), self-pay/uninsured, worker compensation insurance, military/VA insurance among others.

Self-reported sex (female, male), race and ethnicity data in TriNetX comes from the underlying clinical EHR systems of the contributing healthcare systems. TriNetX maps race and ethnicity data from the contributing healthcare systems to the following categories: (1) Race: Asian, American Indian or Alaskan Native, Black or African American, Native Hawaiian or Other, White, Unknown race; and (2) Ethnicity: Hispanic or Latino, Not Hispanic or Latino, Unknown Ethnicity.

TriNetX completes an intensive data preprocessing stage to minimize missing values. TriNetX maps the data to a consistent clinical data model with a consistent semantic meaning so that the data can be queried consistently regardless of the underlying data source. All covariates are either binary, categorical (which expands to a set of binary columns), or continuous but essentially guaranteed to exist. Age is guaranteed to exist. Missing sex values are represented using “Unknown Sex”. The missing data for race and ethnicity are presented as “Unknown race” or “Unknown Ethnicity”. For other variables including medical conditions, procedures, lab tests and socio-economic determinant health, the value is either present or absent so “missing” is not pertinent.

eTable 1. Clinical diagnosis, and other codes used in the platform that are used to determine the status of variables for study population definitions, exposures, outcomes, and those for propensity-score matching for groups

Study population	T2D	Type 2 diabetes mellitus (International Classification of Diseases, Tenth Revision (ICD-10 or ICD-10 code: E11)	present/absent
Exposure (the first prescription of GLP-1RA, insulins or metformin in 4/2005-11/2018)	GLP-1RAs	A10BJGlucagon-like peptide-1 (GLP-1) analogues (The Anatomical Therapeutic Chemical (ATC) code: A10BJ)	present/absent
	Insulins	INSULINS AND ANALOGUES (ATC code: A10A)	present/absent
	Metformin	Metformin (RxNorm code: 6809)	present/absent
Outcomes (13 OACs) (15-year follow-up following the exposure or index event)	Esophageal cancer	Malignant neoplasm of esophagus (ICD-10 code: C15)	present/absent
	Breast cancer	Malignant neoplasm of breast (ICD-10 code: C50)	
	Colorectal cancer	<ul style="list-style-type: none"> • Malignant neoplasm of colon (ICD-10 code: C18) • Malignant neoplasm of rectosigmoid junction (ICD-10 code: C19) • Malignant neoplasm of rectum (ICD-10 code: C20) 	
	Endometrial cancer	Malignant neoplasm of endometrium (ICD-10 code: C54.1)	
	Gallbladder cancer	Malignant neoplasm of gallbladder (ICD-10 code: C23)	
	Stomach cancer	Malignant neoplasm of stomach (ICD-10 code: C16)	
	Kidney cancer	Malignant neoplasm of kidney, except renal pelvis (ICD-10 code: C64)	
	Ovarian cancer	Malignant neoplasm of ovary (ICD-10 code: C56)	
	Pancreatic cancer	Malignant neoplasm of pancreas (ICD-10 code: C25)	
	Thyroid cancer	Malignant neoplasm of thyroid gland (ICD-10 code: C73)	

	Hepatocellular carcinoma	Liver cell carcinoma (ICD-10 code: C22.0)	
	Meningioma	Malignant neoplasm of meninges (ICD-10 code: C70)	
	Multiple myeloma	Multiple myeloma (ICD-10 code: C90.0)	
Demographics (variables to be propensity-score matched)	Age at the index event	Age	continuous
	Female	F	present/absent
	Male	M	present/absent
	Asian	Asian (Demographics: 2028-9)	present/absent
	American Indian or Alaska Native	American Indian or Alaska Native (Demographics: 1002--5)	Ik8ju76543e2w1aq`
	Black or African American	Black or African American (Demographics: 2054-5)	present/absent
	Native Hawaiian or Other Pacific Islander	Native Hawaiian or Other Pacific Islander (Demographics: 2076-8)	
	White	White (Demographics: 2106-3)	present/absent
	Hispanic/Latino	Hispanic or Latino (Demographics: 2135-2)	present/absent
	Not Hispanic or Latino	Not Hispanic or Latino (Demographics: 2186-5)	present/absent
	Unknown race	Unknown Race (Demographics: 2131-1)	present/absent
	Unknown ethnicity	Unknown Ethnicity (Demographics: UN)	present/absent
Adverse socioeconomic determinants of health, lifestyle factors, medical conditions, medication	Adverse socioeconomic and psychosocial circumstances	<p>Persons with potential health hazards related to socioeconomic and psychosocial circumstances (ICD-10 code: Z55-Z65)</p> <ul style="list-style-type: none"> • Problems related to education and literacy (ICD-10 code: Z55) • Problems related to employment and unemployment (ICD-10 code: Z56) • Problems related to housing and economic 	present/absent

prescriptions, (anytime to 1 day before the index event)	<ul style="list-style-type: none"> circumstances (ICD-10 code: Z59) • Problems related to social environment (ICD-10 code: Z60) • Problems related to upbringing (ICD-10 code: Z62) • Other problems related to primary support group, including family circumstances (ICD-10 code: Z63) • Problems related to certain psychosocial circumstances ICD-10 code: Z64) • Problems related to other psychosocial circumstances (ICD-10 code: Z65) 	
Family history of cancer	Family history of primary malignant neoplasm (ICD-10 code: Z80)	present/absent
Family history of cancer of digestive organs	Family history of malignant neoplasm of digestive organs (ICD-10 code: Z80.0)	
Family history of colonic polyps	Family history of colonic polyps (ICD-10 code: Z83.71)	
Genetic susceptibility to cancer	Genetic susceptibility to malignant neoplasm (ICD-10 code: Z15.0)	present/absent
Personal history of cancer	Personal history of malignant neoplasm (ICD-10 code: Z85)	present/absent
Obesity/overweight	Overweight and obesity (ICD-10 code: E66) Body mass index [BMI] 40 or greater, adult (ICD-10 code: Z68.4) Body mass index [BMI] 30-39, adult (ICD-10 code: Z68.3)	present/absent

	<p>Body mass index [BMI] 25.0-25.9, adult (ICD-10 code: Z68.25)</p> <p>Body mass index [BMI] 26.0-26.9, adult (ICD-10 code: Z68.26)</p> <p>Body mass index [BMI] 27.0-27.9, adult (ICD-10 code: Z68.27)</p> <p>Body mass index [BMI] 28.0-28.9, adult (ICD-10 code: Z68.28)</p> <p>Body mass index [BMI] 29.0-29.9, adult (ICD-10 code: Z68.29)</p>	
Alcohol related disorders	Alcohol related disorders (ICD-10 code: F10)	present/absent
Nicotine dependence	Nicotine dependence (ICD-10 code: F17)	present/absent
Crohn's disease	Crohn's disease [regional enteritis] (ICD-10 code: K50)	present/absent
Ulcerative colitis	Ulcerative colitis (ICD-10 code: K51)	present/absent
Cystic fibrosis	Cystic fibrosis (ICD-10 code: E84)	present/absent
Colon polyps	Polyp of colon (ICD-10 code: K63.5)	present/absent
Benign neoplasm of colon and rectum	Benign neoplasm of colon, rectum, anus and anal canal (ICD-10 code: D12)	
Bariatric surgery	Bariatric surgery status (ICD-10 code: Z98.84)	present/absent
Encounter for screening for malignant neoplasms	Encounter for screening for malignant neoplasms (ICD-10 code: Z12)	present/absent
Colonoscopy	Colonoscopy (The Current Procedural Terminology (CPT) code: 1022231)	
DPP-4 inhibitors	Dipeptidyl peptidase 4 (DPP-4) inhibitors (ATC code: A10BH)	present/absent

	SGLT2 inhibitors	Sodium-glucose co-transporter 2 (SGLT2) inhibitors (ATC code: A10BK)	present/absent
	Sulfonylureas	Sulfonylureas (ATC code: A10BB)	present/absent
	Thiazolidinediones	Thiazolidinediones (ATC code: A10BG)	present/absent
	Alpha glucosidase inhibitors	Alpha glucosidase inhibitors (ATC code: A10BF)	present/absent
	Other blood glucose lowering drugs	Other blood glucose lowering drugs, excl. insulins (ATC code: A10BJ)	present/absent

eTable 2. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for baseline covariates related to esophageal cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index 55.9 +/- 11.7 61.8 +/- 15.9	48,983 1,044,745	100%	<0.001	0.420	
				100%			
1	2106-3	White American Indian or Alaska Native	32,592 199 633,989	66.5% 0.4% 0.3%	<0.001	0.122	
				60.7%			
1	1002-5	Unknown Race Female	199 3,443	0.4% 0.3%	0.004	0.013	
				14.5% 53.1%			
1	UN	Unknown Gender Native Hawaiian or Other Pacific Islander	7,099 26,011 142,470 205 10,677	14.5% 53.1% 13.6% 0.4% 1.0%	<0.001	0.025	
				13.6% 45.6%			
1	2076-8	Unknown Gender Native Hawaiian or Other Pacific Islander	2,252 27,321	4.6% 2.6%	<0.001	0.106	
				1.0%			
1	2186-5	Not Hispanic or Latino Hispanic or Latino	33,188 659,375 4,151 94,136	67.8% 63.1% 8.5% 9.0%	<0.001	0.098	
				1			
1	2135-2	Black or African American Male	6,265 178,267 20,720 541,314	12.8% 17.1% 42.3% 51.8%	<0.001	0.120	
				1			
1	2028-9	Asian	1,204 41,822	2.5% 4.0%	<0.001	0.087	
				1			
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and	686	1.4%	<0.001	0.022	
				1.2%			

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	F10	Alcohol related disorders	563	1.1%	<0.00	0.115
2			28,538	2.7%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	F17	Nicotine dependence	3,593	7.3%	<0.00	0.070
2			96,860	9.3%	1	

1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	
2			69,998	6.7%	1	0.366
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150	0.3%		
2			3,643	0.3%	0.118	0.007
1	E66.3	Overweight	1,010	2.1%	<0.00	
2			6,796	0.7%	1	0.122
1	E66.8	Other obesity	235	0.5%	<0.00	
2			1,298	0.1%	1	0.065
1	E66.9	Obesity, unspecified	13,805	28.2%	<0.00	
2			118,555	11.3%	1	0.433
1	Z72.0	Tobacco use	1,064	2.2%	<0.00	
2			13,876	1.3%	1	0.064
1	K21	Gastro-esophageal reflux disease	9,681	19.8%	<0.00	
2			149,344	14.3%	1	0.146
1	K22.7	Barrett's esophagus	399	0.8%	<0.00	
2			4,995	0.5%	1	0.042
1	K22.0	Achalasia of cardia	32	0.1%		
2			783	0.1%	0.446	0.004
1	D69.4	Evans syndrome	0	0%		
2	1		33	0.0%	0.214	0.008
1	D50.1	Sideropenic dysphagia	86	0.2%	<0.00	
2			1,038	0.1%	1	0.021
1	S27.81	Injury of esophagus (thoracic part)	0	0%		
2			55	0.0%	0.108	0.010
1	C34	Malignant neoplasm of bronchus and lung	67	0.1%	<0.00	
2			10,154	1.0%	1	0.113
1	C06	Malignant neoplasm of other and unspecified parts of mouth	10	0.0%	<0.00	
2			1,096	0.1%	1	0.034
1	C32	Malignant neoplasm of larynx	10	0.0%	<0.00	
2			1,426	0.1%	1	0.041
1	B97.7	Papillomavirus as the cause of diseases classified elsewhere	114	0.2%	<0.00	
2			900	0.1%	1	0.037
1	R87.8	High risk human papillomavirus (HPV) DNA test positive from female genital organs	158	0.3%	<0.00	
2	1		830	0.1%	1	0.054

1	Z80.0	Family history of malignant neoplasm of digestive organs	784	1.6%	<0.00	
2			6,889	0.7%	1	0.089
1	D10	Benign neoplasm of mouth and pharynx	60	0.1%	0.153	0.006
2			1,059	0.1%		
1	D13.0	Benign neoplasm of esophagus	11	0.0%	0.816	0.001
2			252	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B		27,075	55.3%	<0.00	
2	A	Biguanides	199,802	19.1%	1	0.806
1	A10B		14,077	28.7%	<0.00	
2	B	Sulfonylureas	125,703	12.0%	1	0.424
1	A10B	Alpha glucosidase inhibitors	229	0.5%	<0.00	
2	F		1,718	0.2%	1	0.054
1	A10B		4,107	8.4%	<0.00	
2	G	Thiazolidinediones	35,435	3.4%	1	0.213
1	A10B		9,485	19.4%	<0.00	
2	H	Dipeptidyl peptidase 4 (DPP-4) inhibitors	44,595	4.3%	1	0.481
1	A10B		4,808	9.8%	<0.00	
2	K	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	6,447	0.6%	1	0.423
1	A10B		614	1.3%	<0.00	
2	X	Other blood glucose lowering drugs, excl. insulins	7,048	0.7%	1	0.059

Group 1 (N = 48,437) and group 2 (N = 48,437) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.9 +/- 11.7	48,437	100%	<0.00
2			56.2 +/- 13.4	48,437	100%	1
1	2106-3	White		32,239	66.6%	<0.00
2				33,166	68.5%	1
1	1002-5	American Indian or Alaska Native		196	0.4%	1
2				196	0.4%	<0.001
1	UNK	Unknown Race		6,973	14.4%	0.001
2				6,605	13.6%	0.022
1	F	Female		25,706	53.1%	0.001
2				26,204	54.1%	0.021

1	2076-8	Native Hawaiian or Other Pacific Islander	204	0.4%	0.032	0.014
2			163	0.3%		
1	UN	Unknown Gender	2,163	4.5%	0.009	0.017
2			1,997	4.1%		
1	2186-5	Not Hispanic or Latino	32,828	67.8%	0.001	0.022
2			33,324	68.8%		
1	2135-2	Hispanic or Latino	4,113	8.5%	0.198	0.008
2			4,002	8.3%		
1	2054-5	Black or African American	6,223	12.8%	0.001	0.022
2			5,878	12.1%		
1	M	Male	20,568	42.5%	0.031	0.014
2			20,236	41.8%		
1	2028-9	Asian	1,195	2.5%	0.015	0.016
2			1,080	2.2%		
Diagnosis						
Group			Mean \pm SD	Patients	% of Group	P-Value
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances			<0.001	0.024
2	Z65			677	1.4%	
				546	1.1%	
1	E66	Overweight and obesity	17,983	37.1%	0.806	0.002
2			18,020	37.2%		
1	Z68.3	Body mass index [BMI] 30-39, adult	4,040	8.3%	<0.001	0.026
2			3,695	7.6%		
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,779	7.8%	<0.001	0.025
2			3,456	7.1%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156	0.3%	0.293	0.007
2			138	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.4%	0.160	0.009
2			146	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	284	0.6%	0.001	0.021
2			213	0.4%		

1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	332	0.7%	0.043	0.013
2			282	0.6%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	382	0.8%	0.117	0.010
2			340	0.7%		
1	F10	Alcohol related disorders	562	1.2%	<0.001	0.024
2			444	0.9%	1	
1	Z80	Family history of primary malignant neoplasm	1,993	4.1%	0.001	0.021
2			1,795	3.7%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	22	0.0%	0.034	0.014
2			10	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	11,921	24.6%	0.003	0.019
2			11,527	23.8%		
1	Z85	Personal history of malignant neoplasm	1,229	2.5%	0.001	0.021
2			1,075	2.2%		
1	Z98.84	Bariatric surgery status	614	1.3%	0.450	0.005
2			588	1.2%		
1	F17	Nicotine dependence	3,571	7.4%	<0.001	0.035
2			3,141	6.5%	1	
1	E66.0	Obesity due to excess calories	8,908	18.4%	0.450	0.005
2			8,817	18.2%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	149	0.3%	0.281	0.007
2			131	0.3%		
1	E66.3	Overweight	980	2.0%	0.016	0.016
2			877	1.8%		
1	E66.8	Other obesity	219	0.5%	0.496	0.004
2			205	0.4%		
1	E66.9	Obesity, unspecified	13,461	27.8%	0.280	0.007
2			13,612	28.1%		
1	Z72.0	Tobacco use	1,040	2.1%	0.008	0.017
2			924	1.9%		
1	K21	Gastro-esophageal reflux disease	9,520	19.7%	0.006	0.018
2			9,180	19.0%		
1	K22.7	Barrett's esophagus	390	0.8%	0.773	0.002
2			382	0.8%		
1	K22.0	Achalasia of cardia	31	0.1%	0.276	0.007
2			23	0.0%		

1	D69.4	Evans syndrome	0	0%	--	--
2	1		0	0%		
1	D50.1	Sideropenic dysphagia	83	0.2%	0.814	0.002
2			80	0.2%		
1	S27.81	Injury of esophagus (thoracic part)	0	0%	0.002	0.020
2			10	0.0%		
1	C34	Malignant neoplasm of bronchus and lung	67	0.1%	0.864	0.001
2			69	0.1%		
1	C06	Malignant neoplasm of other and unspecified parts of mouth	10	0.0%	0.003	0.019
2			28	0.1%		
1	C32	Malignant neoplasm of larynx	10	0.0%	0.317	0.006
2			15	0.0%		
1	B97.7	Papillomavirus as the cause of diseases classified elsewhere	114	0.2%	0.687	0.003
2			108	0.2%		
1	R87.8	High risk human papillomavirus (HPV) DNA test positive from female genital organs	154	0.3%	0.024	0.014
2	1		117	0.2%		
1	Z80.0	Family history of malignant neoplasm of digestive organs	764	1.6%	0.003	0.019
2			654	1.4%		
1	D10	Benign neoplasm of mouth and pharynx	59	0.1%	1	<0.001
2			59	0.1%		
1	D13.0	Benign neoplasm of esophagus	11	0.0%	0.077	0.011
2			21	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	26,535	54.8%	0.003	0.019
2	A		27,001	55.7%		
1	A10B	Sulfonylureas	13,752	28.4%	0.001	0.022
2	B		14,240	29.4%		
1	A10B	Alpha glucosidase inhibitors	221	0.5%	0.260	0.007
2	F		198	0.4%		
1	A10B	Thiazolidinediones	4,019	8.3%	0.063	0.012
2	G		4,180	8.6%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,079	18.7%	0.954	<0.001
2	H		9,086	18.8%		

1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,290	8.9%	<0.001	0.034
2	K		3,835	7.9%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	604	1.2%	0.579	0.004
2	X		585	1.2%		

eTable 3. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to breast cancer for the study populations of women (age 55 and older) with T2D and no history of any OAC

Group 1 (N = 13,865) and group 2 (N = 284,997) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	63.5 +/- 6.2	13,865	100%	<0.00	
2			67.4 +/- 7.5	284,997	100%	1	0.566
1	2106-3	White		9,776	70.5%	<0.00	
2				174,355	61.2%	1	0.198
1	1002-5	American Indian or Alaska Native		50	0.4%	0.264	0.009
2				874	0.3%		
1	UNK	Unknown Race		1,328	9.6%	<0.00	0.043
2				31,022	10.9%	1	
1	2076-8	Native Hawaiian or Other Pacific Islander		48	0.3%	<0.00	0.074
2				2,664	0.9%	1	
1	UN	Unknown Ethnicity		2,902	20.9%	<0.00	0.133
2				75,794	26.6%	1	
1	2186-5	Not Hispanic or Latino		9,979	72.0%	<0.00	0.158
2				184,217	64.6%	1	
1	2135-2	Hispanic or Latino		984	7.1%	<0.00	0.062
2				24,986	8.8%	1	
1	2054-5	Black or African American		2,027	14.6%	<0.00	0.123
2				54,813	19.2%	1	
1	2028-9	Asian		279	2.0%	<0.00	0.129
2				12,141	4.3%	1	
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to		196	1.4%	<0.00	0.044
2	Z65	socioeconomic and psychosocial circumstances		2,666	0.9%	1	
1	E66	Overweight and obesity		4,915	35.4%	<0.00	0.400
2				51,523	18.1%	1	

1	Z68.3	Body mass index [BMI] 30-39, adult	983 11,795	7.1% 4.1%	<0.00 1	0.128
1	Z68.4	Body mass index [BMI] 40 or greater, adult	857 10,539	6.2% 3.7%	<0.00 1	0.115
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	32 663	0.2% 0.2%	0.965	<0.001
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	39 662	0.3% 0.2%	0.244	0.010
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	63 803	0.5% 0.3%	<0.00 1	0.029
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	72 920	0.5% 0.3%	<0.00 1	0.030
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	75 989	0.5% 0.3%	<0.00 1	0.029
1	F10	Alcohol related disorders	84 3,218	0.6% 1.1%	<0.00 1	0.056
1	Z80	Family history of primary malignant neoplasm	791 7,754	5.7% 2.7%	<0.00 1	0.149
1	Z15.0	Genetic susceptibility to malignant neoplasm	10 60	0.1% 0.0%	<0.00 1	0.024
1	Z12	Encounter for screening for malignant neoplasms	4,506 44,384	32.5% 15.6%	<0.00 1	0.404
1	Z85	Personal history of malignant neoplasm	421 10,433	3.0% 3.7%	<0.00 1	0.035
1	Z98.84	Bariatric surgery status	234 2,038	1.7% 0.7%	<0.00 1	0.089
1	E66.0	Obesity due to excess calories	2,298 22,234	16.6% 7.8%	<0.00 1	0.271
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	40 1,313	0.3% 0.5%	0.003	0.028
1	E66.3	Overweight	262 1,855	1.9% 0.7%	<0.00 1	0.111

1	E66.8	Other obesity	64	0.5%	<0.00	
2			367	0.1%	1	0.061
1	E66.9	Obesity, unspecified	3,747	27.0%	<0.00	
2			36,255	12.7%	1	0.364
1	O92.7	Other and unspecified disorders of lactation	0	0%	0.485	0.008
2			10	0.0%		
1	Z79.89	Hormone replacement therapy	88	0.6%	<0.00	
2	0		1,050	0.4%	1	0.038
1	Z92.23	Personal history of estrogen therapy	10	0.1%	0.058	0.014
2			111	0.0%		
1	Z98.82	Breast implant status	10	0.1%	0.002	0.021
2			75	0.0%		
1	Z80.3	Family history of malignant neoplasm of breast	392	2.8%	<0.00	
2			3,435	1.2%	1	0.116
1	R92	Abnormal and inconclusive findings on diagnostic imaging of breast	1,289	9.3%	<0.00	
2			11,640	4.1%	1	0.210
1	D24	Benign neoplasm of breast	113	0.8%	<0.00	
2			1,201	0.4%	1	0.050
1	N60	Benign mammary dysplasia	496	3.6%	<0.00	
2			4,263	1.5%	1	0.133
1	N62	Hypertrophy of breast	79	0.6%	<0.00	
2			529	0.2%	1	0.063
1	N63	Unspecified lump in breast	700	5.0%	<0.00	
2			7,212	2.5%	1	0.132
1	N64	Other disorders of breast	759	5.5%	<0.00	
2			7,195	2.5%	1	0.151
1	N61	Inflammatory disorders of breast	70	0.5%	<0.00	
2			781	0.3%	1	0.037
1	D05	Carcinoma in situ of breast	31	0.2%	0.005	0.021
2			381	0.1%		
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	C1789	Prosthesis, breast (implantable)	0	0%	0.464	0.009
2			11	0.0%		

1	58300	Insertion of intrauterine device (IUD)	18 66	0.1% 0.0%	<0.00 1	0.039
1	1001	Radiation	28 1,571	0.2% 0.6%	<0.00 1	0.057
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	7,389	53.3%	<0.00	0.716
2	A		59,166	20.8%	1	
1	A10B	Sulfonylureas	4,083	29.4%	<0.00	0.429
2	B		35,332	12.4%	1	
1	A10B	Alpha glucosidase inhibitors	64	0.5%	<0.00	0.052
2	F		488	0.2%	1	
1	A10B	Thiazolidinediones	1,173	8.5%	<0.00	0.211
2	G		9,921	3.5%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	2,792	20.1%	<0.00	0.471
2	H		14,092	4.9%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,294	9.3%	<0.00	0.409
2	K		1,768	0.6%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	198	1.4%	<0.00	0.070
2	X		2,014	0.7%	1	
1	HS200	CONTRACEPTIVE S,SYSTEMIC	143	1.0%	<0.00	0.109
2			535	0.2%	1	

Group 1 (N = 13,768) and group 2 (N = 13,768) characteristics after propensity score matching

Demographics		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	63.6 +/- 6.2 63.5 +/- 6.3	13,768 13,768	100% 100%	0.545 0.007
1	2106-3	White		9,696 9,941	70.4% 72.2%	0.001 0.039
1	1002-5	American Indian or Alaska Native		50 48	0.4% 0.3%	0.840 0.002
1	UNK	Unknown Race		1,322 1,234	9.6% 9.0%	0.068 0.022

1	2076-8	Native Hawaiian or Other Pacific Islander	48	0.3%	0.190	0.016
2			36	0.3%		
1	UN	Unknown Ethnicity	2,889	21.0%	0.689	0.005
2			2,862	20.8%		
1	2186-5	Not Hispanic or Latino	9,901	71.9%	0.142	0.018
2			10,010	72.7%		
1	2135-2	Hispanic or Latino	978	7.1%	0.050	0.024
2			896	6.5%		
1	2054-5	Black or African American	2,017	14.6%	0.186	0.016
2			1,940	14.1%		
1	2028-9	Asian	278	2.0%	0.068	0.022
2			237	1.7%		
Diagnosis						
Group			Mean ± SD	Patients	% of Group	P-Value
Persons with potential health hazards related to socioeconomic and psychosocial circumstances						
1	Z55-			193	1.4%	0.151
2	Z65			166	1.2%	0.017
1	E66	Overweight and obesity	4,850 4,776	35.2% 34.7%	0.350	0.011
1	Z68.3	Body mass index [BMI] 30-39, adult	966 855	7.0% 6.2%	0.007	0.032
1	Z68.4	Body mass index [BMI] 40 or greater, adult	848 761	6.2% 5.5%	0.025	0.027
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	32 19	0.2% 0.1%	0.068	0.022
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	39 38	0.3% 0.3%	0.909	0.001
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	63 57	0.5% 0.4%	0.583	0.007
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	70 71	0.5% 0.5%	0.933	0.001

1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	74	0.5%	0.868	0.002
2			72	0.5%		
1	F10	Alcohol related disorders	83	0.6%	0.035	0.025
2			58	0.4%		
1	Z80	Family history of primary malignant neoplasm	777	5.6%	0.152	0.017
2			723	5.3%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	10	0.1%	1	<0.001
2			10	0.1%		
1	Z12	Encounter for screening for malignant neoplasms	4,437	32.2%	0.060	0.023
2			4,292	31.2%		
1	Z85	Personal history of malignant neoplasm	417	3.0%	0.184	0.016
2			380	2.8%		
1	Z98.84	Bariatric surgery status	230	1.7%	0.191	0.016
2			203	1.5%		
1	E66.0	Obesity due to excess calories	2,271	16.5%	0.246	0.014
2			2,200	16.0%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	40	0.3%	1	<0.001
2			40	0.3%		
1	E66.3	Overweight	258	1.9%	0.621	0.006
2			247	1.8%		
1	E66.8	Other obesity	63	0.5%	0.661	0.005
2			68	0.5%		
1	E66.9	Obesity, unspecified	3,692	26.8%	0.714	0.004
2			3,719	27.0%		
1	O92.7	Other and unspecified disorders of lactation	0	0%	--	--
2			0	0%		
1	Z79.89	Hormone replacement therapy	88	0.6%	0.151	0.017
2	0		70	0.5%		
1	Z92.23	Personal history of estrogen therapy	10	0.1%	1	<0.001
2			10	0.1%		
1	Z98.82	Breast implant status	10	0.1%	1	<0.001
2			10	0.1%		
1	Z80.3	Family history of malignant neoplasm of breast	385	2.8%	0.264	0.013
2			355	2.6%		

1	R92	Abnormal and inconclusive findings on diagnostic imaging of breast	1,274	9.3%	0.091	0.020
1	D24	Benign neoplasm of breast	113	0.8%	0.122	0.019
2			91	0.7%		
1	N60	Benign mammary dysplasia	491	3.6%	0.153	0.017
2			448	3.3%		
1	N62	Hypertrophy of breast	78	0.6%	0.407	0.010
2			68	0.5%		
1	N63	Unspecified lump in breast	686	5.0%	0.299	0.013
2			649	4.7%		
1	N64	Other disorders of breast	747	5.4%	0.098	0.020
2			686	5.0%		
1	N61	Inflammatory disorders of breast	68	0.5%	0.864	0.002
2			70	0.5%		
1	D05	Carcinoma in situ of breast	31	0.2%	0.599	0.006
2			27	0.2%		
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	C1789	Prosthesis, breast (implantable)	0	0%		
2			10	0.1%	0.002	0.038
1	58300	Insertion of intrauterine device (IUD)	18	0.1%		
2			18	0.1%	1	<0.001
1	1001	Radiation	28	0.2%		
2			25	0.2%	0.680	0.005
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	7,292	53.0%		
2	A		7,344	53.3%	0.530	0.008
1	A10B	Sulfonylureas	4,021	29.2%		
2	B		4,148	30.1%	0.094	0.020
1	A10B	Alpha glucosidase inhibitors	64	0.5%		
2	F		56	0.4%	0.464	0.009
1	A10B	Thiazolidinediones	1,162	8.4%		
2	G		1,184	8.6%	0.635	0.006

1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	2,714	19.7%	0.258	0.014
2	H		2,789	20.3%		
1	A10B	Sodium-glucose co- transporter 2 (SGLT2) inhibitors	1,197	8.7%	0.001	0.040
2	K		1,046	7.6%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	194	1.4%	0.295	0.013
2	X		215	1.6%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	139	1.0%	0.808	0.003
2			135	1.0%		

eTable 4. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to endometrial cancer for the study populations of women with T2D and no history of any OAC

Group 1 (N = 26,011) and group 2 (N = 476,110) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	54.9 +/- 11.9	26,011	100%	<0.00	
2			61.7 +/- 16.7	476,110	100%	1	0.469
1	2106-3	White		17,165	66.0%	<0.00	
2				282,423	59.3%	1	0.138
1	1002-5	American Indian or Alaska Native		123	0.5%	0.003	0.018
2				1,701	0.4%		
1	UNK	Unknown Race		2,772	10.7%	<0.00	0.035
2				55,979	11.8%	1	
1	2076-8	Native Hawaiian or Other Pacific Islander		105	0.4%	<0.00	0.075
2				4,943	1.0%	1	
1	UN	Unknown Ethnicity		5,078	19.5%	<0.00	0.156
2				124,092	26.1%	1	
1	2186-5	Not Hispanic or Latino		18,384	70.7%	<0.00	0.142
2				304,990	64.1%	1	
1	2135-2	Hispanic or Latino		2,549	9.8%	0.682	0.003
2				47,028	9.9%		
1	2054-5	Black or African American		4,436	17.1%	<0.00	0.077
2				95,352	20.0%	1	
1	2028-9	Asian		619	2.4%	<0.00	0.098
2				19,593	4.1%	1	
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to		468	1.8%	<0.00	0.048
2	Z65	socioeconomic and psychosocial circumstances		5,762	1.2%	1	
1	E66	Overweight and obesity		10,477	40.3%	<0.00	0.493
2				87,968	18.5%	1	

1	Z68.3	Body mass index [BMI] 30-39, adult	1,815 17,667	7.0% 3.7%	<0.00 1	0.146
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,154 18,645	8.3% 3.9%	<0.00 1	0.183
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	56 1,000	0.2% 0.2%	0.857	0.001
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	50 959	0.2% 0.2%	0.747	0.002
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	87 1,140	0.3% 0.2%	0.003	0.018
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	107 1,266	0.4% 0.3%	<0.00 1	0.025
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	119 1,376	0.5% 0.3%	<0.00 1	0.028
1	Z80	Family history of primary malignant neoplasm	1,430 11,367	5.5% 2.4%	<0.00 1	0.160
1	Z15.0	Genetic susceptibility to malignant neoplasm	18 100	0.1% 0.0%	<0.00 1	0.023
1	Z12	Encounter for screening for malignant neoplasms	7,877 65,044	30.3% 13.7%	<0.00 1	0.410
1	Z85	Personal history of malignant neoplasm	593 14,844	2.3% 3.1%	<0.00 1	0.052
1	Z98.84	Bariatric surgery status	474 3,408	1.8% 0.7%	<0.00 1	0.099
1	E66.0	Obesity due to excess calories	5,392 39,813	20.7% 8.4%	<0.00 1	0.356
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	82 1,919	0.3% 0.4%	0.029	0.015
1	E66.3	Overweight	535 3,181	2.1% 0.7%	<0.00 1	0.120
1	E66.8	Other obesity	134 702	0.5% 0.1%	<0.00 1	0.064

1	E66.9	Obesity, unspecified	7,879	30.3%	<0.00	
2			61,596	12.9%	1	0.431
1	Z79.89	Hormone replacement therapy	137	0.5%	<0.00	
2	0		1,374	0.3%	1	0.037
1	Z92.23	Personal history of estrogen therapy	10	0.0%	0.233	0.007
2			124	0.0%		
1	E28.2	Polycystic ovarian syndrome	979	3.8%	<0.00	
2			2,780	0.6%	1	0.219
1	Z80.41	Family history of malignant neoplasm of ovary	104	0.4%	<0.00	
2			554	0.1%	1	0.056
1	Z80.49	Family history of malignant neoplasm of other genital organs	38	0.1%	<0.00	
2			315	0.1%	1	0.025
1	N85.0	Endometrial hyperplasia	182	0.7%	<0.00	
2			1,527	0.3%	1	0.053
1	D25	Leiomyoma of uterus	1,031	4.0%	<0.00	
2			8,571	1.8%	1	0.130
1	D26	Other benign neoplasms of uterus	45	0.2%	<0.00	
2			377	0.1%	1	0.026
1	D27	Benign neoplasm of ovary	95	0.4%	<0.00	
2			902	0.2%	1	0.033
1	Z80.3	Family history of malignant neoplasm of breast	736	2.8%	<0.00	
2			5,122	1.1%	1	0.127

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	58300	Insertion of intrauterine device (IUD)	306	1.2%	<0.00	
2			825	0.2%	1	0.123
1	1001	Radiation	53	0.2%	<0.00	
2			2,303	0.5%	1	0.048

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	14,271	54.9%	<0.00	
2	A		93,949	19.7%	1	0.780
1	A10B	Sulfonylureas	6,822	26.2%	<0.00	
2	B		56,352	11.8%	1	0.373

1	A10B	Alpha glucosidase inhibitors	112	0.4%	<0.00	0.049
2	F		784	0.2%	1	
1	A10B	Thiazolidinediones	1,834	7.1%	<0.00	0.170
2	G		15,689	3.3%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	4,637	17.8%	<0.00	0.444
2	H		20,235	4.3%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	2,219	8.5%	<0.00	0.391
2	K		2,614	0.5%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	297	1.1%	<0.00	0.047
2	X		3,287	0.7%	1	
1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,345	5.2%	<0.00	0.237
2			5,117	1.1%	1	
1	10324	tamoxifen	37	0.1%	<0.00	0.026
2			287	0.1%	1	

Group 1 (N = 25,750) and group 2 (N = 25,750) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	54.9 +/- 11.9	25,750	100%	0.621
2			54.9 +/- 13.6	25,750	100%	
1	2106-3	White		16,960	65.9%	<0.00
2				17,446	67.8%	1
1	1002-5	American Indian or Alaska Native		122	0.5%	0.796
2				118	0.5%	
1	UNK	Unknown Race		2,753	10.7%	0.041
2				2,611	10.1%	
1	2076-8	Native Hawaiian or Other Pacific Islander		105	0.4%	0.623
2				98	0.4%	
1	UN	Unknown Ethnicity		5,052	19.6%	0.018
2				4,841	18.8%	
1	2186-5	Not Hispanic or Latino		18,166	70.5%	0.013
2				18,423	71.5%	
1	2135-2	Hispanic or Latino		2,532	9.8%	0.494
2				2,486	9.7%	
1	2054-5	Black or African American		4,407	17.1%	0.094
2				4,265	16.6%	

1	2028-9	Asian	616	2.4%	0.001	0.029
Diagnosis						
Group			Mean ± SD	Patients	% of Group	P-Value
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-			462	1.8%	0.616
2	Z65			447	1.7%	0.004
1	E66	Overweight and obesity		10,268 10,283	39.9% 39.9%	0.893 0.001
1	Z68.3	Body mass index [BMI] 30-39, adult		1,777 1,633	6.9% 6.3%	0.011 0.022
1	Z68.4	Body mass index [BMI] 40 or greater, adult		2,098 1,888	8.1% 7.3%	0.001 0.031
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult		56 48	0.2% 0.2%	0.432 0.007
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult		50 40	0.2% 0.2%	0.291 0.009
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult		87 55	0.3% 0.2%	0.007 0.024
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult		106 79	0.4% 0.3%	0.047 0.018
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult		118 98	0.5% 0.4%	0.173 0.012
1	Z80	Family history of primary malignant neoplasm		1,399 1,312	5.4% 5.1%	0.086 0.015
1	Z15.0	Genetic susceptibility to malignant neoplasm		17 11	0.1% 0.0%	0.257 0.010
1	Z12	Encounter for screening for malignant neoplasms		7,704 7,448	29.9% 28.9%	0.013 0.022

1	Z85	Personal history of malignant neoplasm	590	2.3%	0.049	0.017
2			525	2.0%		
1	Z98.84	Bariatric surgery status	455	1.8%	0.543	0.005
2			437	1.7%		
1	E66.0	Obesity due to excess calories	5,269	20.5%	0.484	0.006
2			5,205	20.2%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	82	0.3%	0.064	0.016
2			60	0.2%		
1	E66.3	Overweight	514	2.0%	0.034	0.019
2			449	1.7%		
1	E66.8	Other obesity	130	0.5%	0.088	0.015
2			104	0.4%		
1	E66.9	Obesity, unspecified	7,716	30.0%	0.223	0.011
2			7,843	30.5%		
1	Z79.89	Hormone replacement therapy	136	0.5%	0.045	0.018
2	0		105	0.4%		
1	Z92.23	Personal history of estrogen therapy	10	0.0%	1	<0.001
2			10	0.0%		
1	E28.2	Polycystic ovarian syndrome	938	3.6%	0.814	0.002
2			928	3.6%		
1	Z80.41	Family history of malignant neoplasm of ovary	99	0.4%	0.338	0.008
2			86	0.3%		
1	Z80.49	Family history of malignant neoplasm of other genital organs	37	0.1%	0.722	0.003
2			34	0.1%		
1	N85.0	Endometrial hyperplasia	180	0.7%	0.387	0.008
2			164	0.6%		
1	D25	Leiomyoma of uterus	1,018	4.0%	0.107	0.014
2			948	3.7%		
1	D26	Other benign neoplasms of uterus	43	0.2%	0.365	0.008
2			35	0.1%		
1	D27	Benign neoplasm of ovary	94	0.4%	0.017	0.021
2			64	0.2%		
1	Z80.3	Family history of malignant neoplasm of breast	724	2.8%	0.081	0.015
2			660	2.6%		

Procedure

Group	Mean ± SD	Patients	% of Group	P-Value	SMD
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1	58300	Insertion of intrauterine device (IUD)	290	1.1%	0.144	0.013
2			256	1.0%		
1	1001	Radiation	53	0.2%	0.844	0.002
2			51	0.2%		
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	14,013	54.4%	0.018	0.021
2	A		14,280	55.5%		
1	A10B	Sulfonylureas	6,700	26.0%	0.013	0.022
2	B		6,948	27.0%		
1	A10B	Alpha glucosidase inhibitors	109	0.4%	0.892	0.001
2	F		107	0.4%		
1	A10B	Thiazolidinediones	1,799	7.0%	0.311	0.009
2	G		1,858	7.2%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	4,454	17.3%	0.077	0.016
2	H		4,607	17.9%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,978	7.7%	<0.001	0.042
2	K		1,699	6.6%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	291	1.1%	0.934	0.001
2	X		293	1.1%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,299	5.0%	0.025	0.020
2			1,190	4.6%		
1	10324	tamoxifen	37	0.1%	0.096	0.015
2			24	0.1%		

eTable 5. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to gallbladder cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	55.9 +/- 11.7	48,983	100%	<0.00	
2			61.8 +/- 15.9	1,044,745	100%	1	0.420
1	2106-3	White		32,592	66.5%	<0.00	
2				633,989	60.7%	1	0.122
1	UNK	Unknown Race		7,099	14.5%	<0.00	
2				142,470	13.6%	1	0.025
1	F	Female		26,011	53.1%	<0.00	
2				476,110	45.6%	1	0.151
1	UN	Unknown Gender		2,252	4.6%	<0.00	
2				27,321	2.6%	1	0.106
1	2186-5	Not Hispanic or Latino		33,188	67.8%	<0.00	
2				659,375	63.1%	1	0.098
1	2135-2	Hispanic or Latino		4,151	8.5%	<0.00	
2				94,136	9.0%	1	0.019
1	2054-5	Black or African American		6,265	12.8%	<0.00	
2				178,267	17.1%	1	0.120
1	M	Male		20,720	42.3%	<0.00	
2				541,314	51.8%	1	0.191
1	2028-9	Asian		1,204	2.5%	<0.00	
2				41,822	4.0%	1	0.087
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to		686	1.4%	<0.00	
2	Z65	socioeconomic and psychosocial circumstances		12,021	1.2%	1	0.022
1	E66	Overweight and obesity		18,401	37.6%	<0.00	
2				166,445	15.9%	1	0.504

1	Z68.3	Body mass index [BMI] 30-39, adult	4,204 43,128	8.6% 4.1%	<0.00 1	0.183
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886 33,396	7.9% 3.2%	<0.00 1	0.208
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157 3,510	0.3% 0.3%	0.563	0.003
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171 3,632	0.3% 0.3%	0.957	<0.001
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288 4,209	0.6% 0.4%	<0.00 1	0.026
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344 4,508	0.7% 0.4%	<0.00 1	0.036
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398 4,843	0.8% 0.5%	<0.00 1	0.044
1	F17	Nicotine dependence	3,593 96,860	7.3% 9.3%	<0.00 1	0.070
1	E66.0	Obesity due to excess calories	9,157 69,998	18.7% 6.7%	<0.00 1	0.366
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150 3,643	0.3% 0.3%	0.118	0.007
1	E66.3	Overweight	1,010 6,796	2.1% 0.7%	<0.00 1	0.122
1	E66.8	Other obesity	235 1,298	0.5% 0.1%	<0.00 1	0.065
1	E66.9	Obesity, unspecified	13,805 118,555	28.2% 11.3%	<0.00 1	0.433
1	Z72.0	Tobacco use	1,064 13,876	2.2% 1.3%	<0.00 1	0.064
1	Q44.5	Other congenital malformations of bile ducts	11 396	0.0% 0.0%	0.083	0.009
1	K82.4	Cholesterolosis of gallbladder	99 1,160	0.2% 0.1%	<0.00 1	0.023
1	K83.0	Primary sclerosing cholangitis	10 87	0.0% 0.0%	0.005	0.010

1	A01.0	Typhoid fever	10	0.0%	<0.00	0.017
2			23	0.0%	1	
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%	0.571	0.003
2			256	0.0%		
1	D13.5	Benign neoplasm of extrahepatic bile ducts	27	0.1%	0.314	0.004
2			472	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	27,075	55.3%	<0.00	0.806
2	A		199,802	19.1%	1	
1	A10B	Sulfonylureas	14,077	28.7%	<0.00	0.424
2	B		125,703	12.0%	1	
1	A10B	Alpha glucosidase inhibitors	229	0.5%	<0.00	0.054
2	F		1,718	0.2%	1	
1	A10B	Thiazolidinediones	4,107	8.4%	<0.00	0.213
2	G		35,435	3.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,485	19.4%	<0.00	0.481
2	H		44,595	4.3%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,808	9.8%	<0.00	0.423
2	K		6,447	0.6%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	614	1.3%	<0.00	0.059
2	X		7,048	0.7%	1	

Group 1 (N = 48,587) and group 2 (N = 48,587) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.9 +/- 11.8	48,587	100%	0.005
2			56.1 +/- 12.6	48,587	100%	
1	2106-3	White		32,319	66.5%	<0.00
2				33,024	68.0%	0.031
1	UNK	Unknown Race		7,011	14.4%	0.007
2				6,716	13.8%	0.017
1	F	Female		25,779	53.1%	0.979
2				25,775	53.0%	<0.001

1	UN	Unknown Gender	2,186	4.5%	0.465	0.005
2			2,139	4.4%		
1	2186-5	Not Hispanic or Latino	32,920	67.8%	0.019	0.015
2			33,260	68.5%		
1	2135-2	Hispanic or Latino	4,126	8.5%	0.074	0.011
2			3,972	8.2%		
1	2054-5	Black or African American	6,241	12.8%	0.159	0.009
2			6,095	12.5%		
1	M	Male	20,622	42.4%	0.741	0.002
2			20,673	42.5%		
1	2028-9	Asian	1,199	2.5%	0.022	0.015
2			1,091	2.2%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55- 2 Z65	Persons with potential health hazards related to socioeconomic and psychosocial circumstances	682 596	1.4% 1.2%	0.015	0.016
E66	Overweight and obesity	17,410 17,367	36.9% 36.8%	0.772	0.002	
1	Z68.3 2	Body mass index [BMI] 30-39, adult	3,964 3,562	8.4% 7.5%	<0.001	0.031
1	Z68.4 2	Body mass index [BMI] 40 or greater, adult	3,642 3,272	7.7% 6.9%	<0.001	0.030
1	Z68.25 2	Body mass index [BMI] 25.0-25.9, adult	151 134	0.3% 0.3%	0.313	0.007
1	Z68.26 2	Body mass index [BMI] 26.0-26.9, adult	169 156	0.4% 0.3%	0.470	0.005
1	Z68.27 2	Body mass index [BMI] 27.0-27.9, adult	278 236	0.6% 0.5%	0.063	0.012
1	Z68.28 2	Body mass index [BMI] 28.0-28.9, adult	322 286	0.7% 0.6%	0.143	0.010

1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	382	0.8%	0.042	0.013
2			328	0.7%		
1	F17	Nicotine dependence	3,576	7.4%	<0.001	0.032
2			3,185	6.6%	1	
1	E66.0	Obesity due to excess calories	8,635	18.3%	0.345	0.006
2			8,523	18.0%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	139	0.3%	0.762	0.002
2			134	0.3%		
1	E66.3	Overweight	941	2.0%	0.075	0.012
2			866	1.8%		
1	E66.8	Other obesity	204	0.4%	1	<0.001
2			204	0.4%		
1	E66.9	Obesity, unspecified	13,034	27.6%	0.948	<0.001
2			13,043	27.6%		
1	Z72.0	Tobacco use	1,044	2.2%	0.157	0.009
2			981	2.0%		
1	K82.4	Cholesterolosis of gallbladder	93	0.2%	0.040	0.013
2			67	0.1%		
1	K83.0	Primary sclerosing	10	0.0%	1	<0.001
2	1	cholangitis	10	0.0%		
1	A01.0	Typhoid fever	10	0.0%	1	<0.001
2			10	0.0%		
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%	1	<0.001
2			10	0.0%		
1	D13.5	Benign neoplasm of extrahepatic bile ducts	26	0.1%	0.297	0.007
2			19	0.0%		

Medication

Group		Mean \pm SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	26,679	54.9%	0.010	0.017
2	A		27,080	55.7%		
1	A10B	Sulfonylureas	13,835	28.5%	0.011	0.016
2	B		14,192	29.2%		
1	A10B	Alpha glucosidase inhibitors	219	0.5%	0.924	0.001
2	F		217	0.4%		
1	A10B	Thiazolidinediones	4,045	8.3%	0.532	0.004
2	G		4,099	8.4%		

1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,167	18.9%	0.556	0.004
2	H		9,239	19.0%		
1	A10B	Sodium-glucose co- transporter 2 (SGLT2) inhibitors	4,419	9.1%	<0.00	0.028
2	K		4,037	8.3%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	609	1.3%	0.098	0.011
2	X		553	1.1%		

eTable 6. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to stomach cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index 55.9 +/- 11.7 61.8 +/- 15.9	48,983 1,044,745	100%	<0.001	0.420	
				100%			
1	2106-3	White	32,592 633,989	66.5% 60.7%	<0.001	0.122	
1	1002-5	American Indian or Alaska Native	199 3,443	0.4% 0.3%	0.004	0.013	
1	UNK	Unknown Race	7,099 142,470	14.5% 13.6%	<0.001	0.025	
1	F	Female	26,011 476,110	53.1% 45.6%	<0.001	0.151	
1	2076-8	Native Hawaiian or Other Pacific Islander	205 10,677	0.4% 1.0%	<0.001	0.071	
1	UN	Unknown Gender	2,252 27,321	4.6% 2.6%	<0.001	0.106	
1	2186-5	Not Hispanic or Latino	33,188 659,375	67.8% 63.1%	<0.001	0.098	
1	2135-2	Hispanic or Latino	4,151 94,136	8.5% 9.0%	<0.001	0.019	
1	2054-5	Black or African American	6,265 178,267	12.8% 17.1%	<0.001	0.120	
1	M	Male	20,720 541,314	42.3% 51.8%	<0.001	0.191	
1	2028-9	Asian	1,204 41,822	2.5% 4.0%	<0.001	0.087	
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and	686 12,021	1.4% 1.2%	<0.001	0.022	

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	F10	Alcohol related disorders	563	1.1%	<0.00	0.115
2			28,538	2.7%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	F17	Nicotine dependence	3,593	7.3%	<0.00	0.070
2			96,860	9.3%	1	

1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	
2			69,998	6.7%	1	0.366
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150	0.3%		
2			3,643	0.3%	0.118	0.007
1	E66.3	Overweight	1,010	2.1%	<0.00	
2			6,796	0.7%	1	0.122
1	E66.8	Other obesity	235	0.5%	<0.00	
2			1,298	0.1%	1	0.065
1	E66.9	Obesity, unspecified	13,805	28.2%	<0.00	
2			118,555	11.3%	1	0.433
1	Z72.0	Tobacco use	1,064	2.2%	<0.00	
2			13,876	1.3%	1	0.064
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%		
2			256	0.0%	0.571	0.003
1	B96.8	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	254	0.5%	<0.00	
2	1		3,973	0.4%	1	0.021
1	D13.1	Benign neoplasm of stomach	213	0.4%	<0.00	
2			3,086	0.3%	1	0.023
1	K31.7	Polyp of stomach and duodenum	266	0.5%	<0.00	
2			3,728	0.4%	1	0.028
1	D51.0	Vitamin B12 deficiency anemia due to intrinsic factor deficiency	143	0.3%	<0.00	
2			2,101	0.2%	1	0.018
1	Z80.0	Family history of malignant neoplasm of digestive organs	784	1.6%	<0.00	
2			6,889	0.7%	1	0.089
1	D83	Common variable immunodeficiency	19	0.0%		
2			356	0.0%	0.582	0.002
1	B27	Infectious mononucleosis	45	0.1%	<0.00	
2			513	0.0%	1	0.016

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	10073	Excision Procedures	10	0.0%		
2	52	on the Stomach	115	0.0%	0.057	0.008

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1 A10B	Biguanides		27,075	55.3%	<0.00	
2 A			199,802	19.1%	1	0.806
1 A10B	Sulfonylureas		14,077	28.7%	<0.00	
2 B			125,703	12.0%	1	0.424
1 A10B	Alpha glucosidase inhibitors		229	0.5%	<0.00	
2 F			1,718	0.2%	1	0.054
1 A10B	Thiazolidinediones		4,107	8.4%	<0.00	
2 G			35,435	3.4%	1	0.213
1 A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors		9,485	19.4%	<0.00	
2 H			44,595	4.3%	1	0.481
1 A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors		4,808	9.8%	<0.00	
2 K			6,447	0.6%	1	0.423
1 A10B	Other blood glucose lowering drugs, excl. insulins		614	1.3%	<0.00	
2 X			7,048	0.7%	1	0.059

Group 1 (N = 48,449) and group 2 (N = 48,449) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1 AI	Age at Index	55.9 +/- 11.7	48,449	100%	0.030	0.014
2		56.1 +/- 13.2	48,449	100%		
1 2106-3	White		32,245	66.6%	<0.00	
2			33,198	68.5%	1	0.042
1 1002-5	American Indian or Alaska Native		196	0.4%	0.091	0.011
2			164	0.3%		
1 UNK	Unknown Race		6,980	14.4%	0.002	0.020
2			6,650	13.7%		
1 F	Female		25,712	53.1%	0.004	0.018
2			26,156	54.0%		
1 2076-8	Native Hawaiian or Other Pacific Islander		204	0.4%	0.011	0.016
2			156	0.3%		
1 UN	Unknown Gender		2,170	4.5%	0.037	0.013
2			2,038	4.2%		
1 2186-5	Not Hispanic or Latino		32,837	67.8%	0.036	0.013
2			33,141	68.4%		

1	2135-2	Hispanic or Latino	4,114	8.5%	0.525	0.004
2			4,059	8.4%		
1	2054-5	Black or African American	6,222	12.8%	0.001	0.021
2			5,889	12.2%		
1	M	Male	20,567	42.5%	0.042	0.013
2			20,255	41.8%		
1	2028-9	Asian	1,196	2.5%	0.003	0.019
2			1,055	2.2%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
Persons with potential health hazards related to socioeconomic and psychosocial circumstances						
1	Z55-		676	1.4%	0.004	0.019
2	Z65		574	1.2%		
Overweight and obesity						
1	E66		17,989	37.1%	0.942	<0.001
2			17,978	37.1%		
1	Z68.3	Body mass index [BMI] 30-39, adult	4,050	8.4%	<0.001	0.029
2			3,670	7.6%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,782	7.8%	<0.001	0.032
2			3,380	7.0%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156	0.3%	0.293	0.007
2			138	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.4%	0.345	0.006
2			154	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	282	0.6%	0.019	0.015
2			229	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	332	0.7%	0.302	0.007
2			306	0.6%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	386	0.8%	0.027	0.014
2			327	0.7%		
1	F10	Alcohol related disorders	563	1.2%	0.018	0.015
2			487	1.0%		

1	Z80	Family history of primary malignant neoplasm	1,992	4.1%	0.009	0.017
2			1,834	3.8%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	22	0.0%	0.527	0.004
2			18	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	11,930	24.6%	0.002	0.020
2			11,522	23.8%		
1	Z85	Personal history of malignant neoplasm	1,232	2.5%	0.003	0.019
2			1,090	2.2%		
1	Z98.84	Bariatric surgery status	614	1.3%	0.795	0.002
2			605	1.2%		
1	F17	Nicotine dependence	3,576	7.4%	<0.001	0.032
2			3,185	6.6%	1	
1	E66.0	Obesity due to excess calories	8,912	18.4%	0.967	<0.001
2			8,907	18.4%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	148	0.3%	0.724	0.002
2			142	0.3%		
1	E66.3	Overweight	976	2.0%	0.040	0.013
2			888	1.8%		
1	E66.8	Other obesity	220	0.5%	0.259	0.007
2			197	0.4%		
1	E66.9	Obesity, unspecified	13,470	27.8%	0.863	0.001
2			13,494	27.9%		
1	Z72.0	Tobacco use	1,044	2.2%	0.157	0.009
2			981	2.0%		
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%	1	<0.001
2			10	0.0%		
1	B96.8	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	253	0.5%	0.253	0.007
2	1		228	0.5%		
1	D13.1	Benign neoplasm of stomach	209	0.4%	0.039	0.013
2			169	0.3%		
1	K31.7	Polyp of stomach and duodenum	259	0.5%	0.300	0.007
2			236	0.5%		
1	D51.0	Vitamin B12 deficiency anemia	139	0.3%	0.088	0.011
2			112	0.2%		

		due to intrinsic factor deficiency				
1	Z80.0	Family history of malignant neoplasm of digestive organs	763 688	1.6% 1.4%	0.047	0.013
1	D83	Common variable immunodeficiency	18 15	0.0% 0.0%	0.601	0.003
1	B27	Infectious mononucleosis	44 47	0.1% 0.1%	0.753	0.002
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	10073	Excision Procedures	10	0.0%	1	<0.001
2	52	on the Stomach	10	0.0%		
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	26,543 26,933	54.8% 55.6%	0.012	0.016
2	A					
1	A10B	Sulfonylureas	13,757 14,099	28.4% 29.1%	0.015	0.016
2	B					
1	A10B	Alpha glucosidase inhibitors	222 192	0.5% 0.4%	0.140	0.009
2	F					
1	A10B	Thiazolidinediones	4,018 4,115	8.3% 8.5%	0.261	0.007
2	G					
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,089 9,203	18.8% 19.0%	0.349	0.006
2	H					
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,303 3,823	8.9% 7.9%	<0.001 1	0.036
2	K					
1	A10B	Other blood glucose lowering drugs, excl. insulins	606 583	1.3% 1.2%	0.502	0.004
2	X					

eTable 7. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to kidney cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index 55.9 +/- 11.7 61.8 +/- 15.9	48,983 1,044,745	100% 100%	<0.00 1	0.420	
1	2106-3	White	32,592 633,989	66.5% 60.7%	<0.00 1	0.122	
1	1002-5	American Indian or Alaska Native	199 3,443	0.4% 0.3%	0.004	0.013	
1	UNK	Unknown Race	7,099 142,470	14.5% 13.6%	<0.00 1	0.025	
1	F	Female	26,011 476,110	53.1% 45.6%	<0.00 1	0.151	
1	2076-8	Native Hawaiian or Other Pacific Islander	205 10,677	0.4% 1.0%	<0.00 1	0.071	
1	UN	Unknown Gender	2,252 27,321	4.6% 2.6%	<0.00 1	0.106	
1	2186-5	Not Hispanic or Latino	33,188 659,375	67.8% 63.1%	<0.00 1	0.098	
1	2135-2	Hispanic or Latino	4,151 94,136	8.5% 9.0%	<0.00 1	0.019	
1	2054-5	Black or African American	6,265 178,267	12.8% 17.1%	<0.00 1	0.120	
1	M	Male	20,720 541,314	42.3% 51.8%	<0.00 1	0.191	
1	2028-9	Asian	1,204 41,822	2.5% 4.0%	<0.00 1	0.087	
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and	686 12,021	1.4% 1.2%	<0.00 1	0.022	

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	I10	Essential (primary) hypertension	29,049	59.3%	<0.00	0.218
2			506,936	48.5%	1	
1	F17	Nicotine dependence	3,593	7.3%	<0.00	0.070
2			96,860	9.3%	1	

1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	
2			69,998	6.7%	1	0.366
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150	0.3%		
2			3,643	0.3%	0.118	0.007
1	E66.3	Overweight	1,010	2.1%	<0.00	
2			6,796	0.7%	1	0.122
1	E66.8	Other obesity	235	0.5%	<0.00	
2			1,298	0.1%	1	0.065
1	E66.9	Obesity, unspecified	13,805	28.2%	<0.00	
2			118,555	11.3%	1	0.433
1	Z72.0	Tobacco use	1,064	2.2%	<0.00	
2			13,876	1.3%	1	0.064
1	Z80.51	Family history of malignant neoplasm of kidney	18	0.0%		
2			207	0.0%	0.011	0.010
1	N18	Chronic kidney disease (CKD)	2,631	5.4%	<0.00	
2			143,501	13.7%	1	0.287
1	N19	Unspecified kidney failure	98	0.2%	<0.00	
2			13,506	1.3%	1	0.127
1	Z99.2	Dependence on renal dialysis	40	0.1%	<0.00	
2			17,914	1.7%	1	0.174
1	N17-	Acute kidney failure and chronic kidney disease	3,016	6.2%	<0.00	
2	N19		187,587	18.0%	1	0.368
1	Q85.8	Von Hippel-Lindau syndrome	0	0%		
2	3		10	0.0%	0.494	0.004
1	Q85.1	Tuberous sclerosis	10	0.0%	<0.00	
2			30	0.0%	1	0.016
1	D57.1	Sickle-cell disease without crisis	10	0.0%		
2			516	0.0%	0.004	0.016
1	D30.0	Benign neoplasm of kidney	31	0.1%		
2			451	0.0%	0.038	0.009

Medication

Group		Mean \pm SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	27,075	55.3%	<0.00	
2	A		199,802	19.1%	1	0.806
1	A10B	Sulfonylureas	14,077	28.7%	<0.00	
2	B		125,703	12.0%	1	0.424

1	A10B	Alpha glucosidase inhibitors	229	0.5%	<0.00	0.054
2	F		1,718	0.2%	1	
1	A10B	Thiazolidinediones	4,107	8.4%	<0.00	0.213
2	G		35,435	3.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,485	19.4%	<0.00	0.481
2	H		44,595	4.3%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,808	9.8%	<0.00	0.423
2	K		6,447	0.6%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	614	1.3%	<0.00	0.059
2	X		7,048	0.7%	1	
1	161	acetaminophen	13,013	26.6%	<0.00	0.068
2			309,279	29.6%	1	

Group 1 (N = 48,322) and group 2 (N = 48,322) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	55.9 +/- 11.8	48,322	100%	<0.00	
2			56.3 +/- 13.7	48,322	100%	1	0.026
1	2106-3	White		32,173	66.6%	<0.00	
2				33,049	68.4%	1	0.039
1	1002-5	American Indian or Alaska Native		197	0.4%	1	<0.001
2				197	0.4%		
1	UNK	Unknown Race		6,946	14.4%	0.002	0.020
2				6,604	13.7%		
1	F	Female		25,662	53.1%	0.004	0.019
2				26,111	54.0%		
1	2076-8	Native Hawaiian or Other Pacific Islander		203	0.4%	0.015	0.016
2				157	0.3%		
1	UN	Unknown Gender		2,143	4.4%	0.039	0.013
2				2,013	4.2%		
1	2186-5	Not Hispanic or Latino		32,743	67.8%	0.012	0.016
2				33,107	68.5%		
1	2135-2	Hispanic or Latino		4,109	8.5%	0.431	0.005
2				4,041	8.4%		
1	2054-5	Black or African American		6,204	12.8%	0.003	0.019
2				5,901	12.2%		

1	M	Male	20,517	42.5%	0.038	0.013
2			20,198	41.8%		
1	2028-9	Asian	1,193	2.5%	0.001	0.022
2			1,036	2.1%		
Diagnosis						
Group			Mean ± SD	Patients	% of Group	P-Value
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances		675	1.4%	0.049
2	Z65			605	1.3%	0.013
1	E66	Overweight and obesity	17,884 17,874	37.0% 37.0%	0.947	<0.001
1	Z68.3	Body mass index [BMI] 30-39, adult	4,013 3,732	8.3% 7.7%	0.001	0.021
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,743 3,394	7.7% 7.0%	<0.001	0.028
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	155 138	0.3% 0.3%	0.320	0.006
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	170 145	0.4% 0.3%	0.158	0.009
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	278 238	0.6% 0.5%	0.077	0.011
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	327 328	0.7% 0.7%	0.969	<0.001
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	382 346	0.8% 0.7%	0.180	0.009
1	Z80	Family history of primary malignant neoplasm	1,969 1,862	4.1% 3.9%	0.078	0.011
1	Z15.0	Genetic susceptibility to malignant neoplasm	22 15	0.0% 0.0%	0.250	0.007

1	Z12	Encounter for screening for malignant neoplasms	11,859	24.5%	0.003	0.019
2			11,466	23.7%		
1	Z85	Personal history of malignant neoplasm	1,223	2.5%	0.010	0.017
2			1,100	2.3%		
1	Z98.84	Bariatric surgery status	615	1.3%	0.469	0.005
2			590	1.2%		
1	I10	Essential (primary) hypertension	28,525	59.0%	0.647	0.003
2			28,455	58.9%		
1	F17	Nicotine dependence	3,567	7.4%	<0.001	0.031
2			3,184	6.6%		
1	E66.0	Obesity due to excess calories	8,844	18.3%	0.139	0.010
2			8,667	17.9%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	145	0.3%	0.303	0.007
2			128	0.3%		
1	E66.3	Overweight	966	2.0%	0.010	0.017
2			857	1.8%		
1	E66.8	Other obesity	224	0.5%	0.156	0.009
2			195	0.4%		
1	E66.9	Obesity, unspecified	13,394	27.7%	0.199	0.008
2			13,573	28.1%		
1	Z72.0	Tobacco use	1,042	2.2%	0.012	0.016
2			932	1.9%		
1	Z80.51	Family history of malignant neoplasm of kidney	17	0.0%	0.724	0.002
2			15	0.0%		
1	N18	Chronic kidney disease (CKD)	2,624	5.4%	<0.001	0.035
2			2,256	4.7%		
1	N19	Unspecified kidney failure	98	0.2%	0.056	0.012
2			73	0.2%		
1	Z99.2	Dependence on renal dialysis	40	0.1%	0.564	0.004
2			35	0.1%		
1	N17-	Acute kidney failure and chronic kidney disease	3,009	6.2%	<0.001	0.041
2	N19		2,548	5.3%		
1	Q85.8	Von Hippel-Lindau syndrome	0	0%	--	--
2	3		0	0%		
1	Q85.1	Tuberous sclerosis	10	0.0%	1	<0.001
2			10	0.0%		
1	D57.1	Sickle-cell disease without crisis	10	0.0%	0.827	0.001
2			11	0.0%		

1	D30.0	Benign neoplasm of kidney	31	0.1%	0.276	0.007
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1 A10B	Biguanides		26,421	54.7%		
2 A			26,729	55.3%	0.046	0.013
1 A10B	Sulfonylureas		13,668	28.3%		
2 B			14,012	29.0%	0.014	0.016
1 A10B	Alpha glucosidase inhibitors		220	0.5%		
2 F			200	0.4%	0.328	0.006
1 A10B	Thiazolidinediones		4,005	8.3%		
2 G			4,030	8.3%	0.771	0.002
1 A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors		9,006	18.6%		
2 H			8,953	18.5%	0.661	0.003
1 A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors		4,203	8.7%	<0.001	
2 K			3,583	7.4%		0.047
1 A10B	Other blood glucose lowering drugs, excl. insulins		603	1.2%		
2 X			606	1.3%	0.931	0.001
1 161	acetaminophen		12,902	26.7%	<0.001	
2			12,334	25.5%		0.027

eTable 8. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to liver cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index 55.9 +/- 11.7	48,983	100%	<0.00 1	0.420
2		61.8 +/- 15.9	1,044,745	100%		
1	2106-3	White American Indian or Alaska Native	32,592	66.5%	<0.00 1	0.122
2			633,989	60.7%		
1	1002-5	American Indian or Alaska Native Unknown Race	199	0.4%	0.004	0.013
2			3,443	0.3%		
1	UNK	Unknown Race Female	7,099	14.5%	<0.00 1	0.025
2			142,470	13.6%		
1	F	Female Native Hawaiian or Other Pacific Islander	26,011	53.1%	<0.00 1	0.151
2			476,110	45.6%		
1	2076-8	Native Hawaiian or Other Pacific Islander Unknown Gender	205	0.4%	<0.00 1	0.071
2			10,677	1.0%		
1	UN	Unknown Gender Not Hispanic or Latino	2,252	4.6%	<0.00 1	0.106
2			27,321	2.6%		
1	2186-5	Not Hispanic or Latino Hispanic or Latino	33,188	67.8%	<0.00 1	0.098
2			659,375	63.1%		
1	2135-2	Hispanic or Latino Black or African American	4,151	8.5%	<0.00 1	0.019
2			94,136	9.0%		
1	2054-5	Black or African American Male	6,265	12.8%	<0.00 1	0.120
2			178,267	17.1%		
1	M	Male Asian	20,720	42.3%	<0.00 1	0.191
2			541,314	51.8%		
1	2028-9	Asian Persons with potential health hazards related to socioeconomic and	1,204	2.5%	<0.00 1	0.087
2			41,822	4.0%		
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and	686	1.4%	<0.00 1	0.022
2	Z65		12,021	1.2%		

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	F10	Alcohol related disorders	563	1.1%	<0.00	0.115
2			28,538	2.7%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	E88.81	Metabolic syndrome and other insulin resistance	1,536	3.1%	<0.00	0.182
2			6,923	0.7%	1	

1	E78	Disorders of lipoprotein metabolism and other lipidemias	28,438 399,702	58.1% 38.3%	<0.00 1	0.404
1	I10	Essential (primary) hypertension	29,049 506,936	59.3% 48.5%	<0.00 1	0.218
1	K75.8	Nonalcoholic steatohepatitis (NASH)	475 3,277	1.0% 0.3%	<0.00 1	0.082
1	F17	Nicotine dependence	3,593 96,860	7.3% 9.3%	<0.00 1	0.070
1	E66.0	Obesity due to excess calories	9,157 69,998	18.7% 6.7%	<0.00 1	0.366
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150 3,643	0.3% 0.3%	0.118	0.007
1	E66.3	Overweight	1,010 6,796	2.1% 0.7%	<0.00 1	0.122
1	E66.8	Other obesity	235 1,298	0.5% 0.1%	<0.00 1	0.065
1	E66.9	Obesity, unspecified	13,805 118,555	28.2% 11.3%	<0.00 1	0.433
1	Z72.0	Tobacco use	1,064 13,876	2.2% 1.3%	<0.00 1	0.064
1	B18	Chronic viral hepatitis	260 12,879	0.5% 1.2%	<0.00 1	0.075
1	K74	Fibrosis and cirrhosis of liver	433 19,545	0.9% 1.9%	<0.00 1	0.085
1	K76.0	Fatty (change of) liver, not elsewhere classified	3,131 23,105	6.4% 2.2%	<0.00 1	0.207
1	K74.3	Primary biliary cirrhosis	20 786	0.0% 0.1%	0.006	0.014
1	E83.11	Hereditary hemochromatosis	40 251	0.1% 0.0%	<0.00 1	0.025
1	E70.21	Tyrosinemia	10 56	0.0% 0.0%	<0.00 1	0.013
1	E88.01	Alpha-1-antitrypsin deficiency	16 245	0.0% 0.0%	0.197	0.006
1	E80.1	Porphyria cutanea tarda	10 27	0.0% 0.0%	<0.00 1	0.017

1	E74.0	Glycogen storage disease	10	0.0%	0.227	0.005
2			144	0.0%		
1	E83.00	Disorder of copper metabolism, unspecified	10	0.0%	0.018	0.009
2			99	0.0%		
1	T64	Toxic effect of aflatoxin and other mycotoxin food contaminants	10	0.0%	0.554	0.003
2			176	0.0%		
1	D13.4	Benign neoplasm of liver	35	0.1%	0.002	0.013
2			434	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	27,075	55.3%	<0.00	0.806
2	A		199,802	19.1%	1	
1	A10B	Sulfonylureas	14,077	28.7%	<0.00	0.424
2	B		125,703	12.0%	1	
1	A10B	Alpha glucosidase inhibitors	229	0.5%	<0.00	0.054
2	F		1,718	0.2%	1	
1	A10B	Thiazolidinediones	4,107	8.4%	<0.00	0.213
2	G		35,435	3.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,485	19.4%	<0.00	0.481
2	H		44,595	4.3%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,808	9.8%	<0.00	0.423
2	K		6,447	0.6%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	614	1.3%	<0.00	0.059
2	X		7,048	0.7%	1	
1	A14A	ANABOLIC STEROIDS	60	0.1%	<0.00	0.031
2			379	0.0%	1	

Group 1 (N = 48,397) and group 2 (N = 48,397) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.9 +/- 11.7	48,397	100%	0.004
2			56.2 +/- 13.7	48,397	100%	
1	2106-3	White		32,208	66.5%	<0.00
2				33,287	68.8%	1
						0.048

1	1002-5	American Indian or Alaska Native	196	0.4%	0.191	0.008
2			171	0.4%		
1	UNK	Unknown Race	6,970	14.4%	<0.00	0.032
2			6,443	13.3%	1	
1	F	Female	25,674	53.0%	<0.00	0.024
2			26,256	54.3%	1	
1	2076-8	Native Hawaiian or Other Pacific Islander	204	0.4%	0.088	0.011
2			171	0.4%		
1	UN	Unknown Gender	2,164	4.5%	<0.00	0.029
2			1,881	3.9%	1	
1	2186-5	Not Hispanic or Latino	32,793	67.8%	<0.00	0.022
2			33,299	68.8%	1	
1	2135-2	Hispanic or Latino	4,114	8.5%	0.042	0.013
2			3,939	8.1%		
1	2054-5	Black or African American	6,219	12.8%	0.027	0.014
2			5,991	12.4%		
1	M	Male	20,559	42.5%	0.052	0.013
2			20,260	41.9%		
1	2028-9	Asian	1,193	2.5%	<0.00	0.025
2			1,012	2.1%	1	

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to	677	1.4%	0.088	0.011
2	Z65	socioeconomic and psychosocial circumstances	616	1.3%		
1	E66	Overweight and obesity	17,951 18,078	37.1% 37.4%	0.398	0.005
1	Z68.3	Body mass index [BMI] 30-39, adult	4,032 3,671	8.3% 7.6%	<0.00 1	0.028
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,768 3,414	7.8% 7.1%	<0.00 1	0.028
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156 129	0.3% 0.3%	0.109	0.010

1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.4%	0.178	0.009
2			147	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	282	0.6%	0.048	0.013
2			237	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	331	0.7%	0.361	0.006
2			308	0.6%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	385	0.8%	0.182	0.009
2			349	0.7%		
1	F10	Alcohol related disorders	562	1.2%	<0.001	0.026
2			436	0.9%		
1	Z80	Family history of primary malignant neoplasm	1,983	4.1%	0.131	0.010
2			1,891	3.9%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	22	0.0%	0.182	0.009
2			14	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	11,908	24.6%	0.004	0.018
2			11,526	23.8%		
1	Z85	Personal history of malignant neoplasm	1,229	2.5%	<0.001	0.027
2			1,032	2.1%		
1	Z98.84	Bariatric surgery status	611	1.3%	0.142	0.009
2			561	1.2%		
1	E88.81	Metabolic syndrome and other insulin resistance	1,480	3.1%	0.752	0.002
2			1,497	3.1%		
1	E78	Disorders of lipoprotein metabolism and other lipidemias	27,908	57.7%	0.927	0.001
2			27,922	57.7%		
1	I10	Essential (primary) hypertension	28,605	59.1%	0.896	0.001
2			28,625	59.1%		
1	K75.8	Nonalcoholic steatohepatitis (NASH)	445	0.9%	0.374	0.006
2	1		419	0.9%		
1	F17	Nicotine dependence	3,568	7.4%	<0.001	0.033
2			3,165	6.5%		

1	E66.0	Obesity due to excess calories	8,878	18.3%	0.727	0.002
2			8,836	18.3%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	149	0.3%	0.230	0.008
2			129	0.3%		
1	E66.3	Overweight	975	2.0%	0.080	0.011
2			900	1.9%		
1	E66.8	Other obesity	218	0.5%	0.378	0.006
2			200	0.4%		
1	E66.9	Obesity, unspecified	13,442	27.8%	0.057	0.012
2			13,708	28.3%		
1	Z72.0	Tobacco use	1,039	2.1%	0.262	0.007
2			989	2.0%		
1	B18	Chronic viral hepatitis	259	0.5%	0.030	0.014
2			212	0.4%		
1	K74	Fibrosis and cirrhosis of liver	428	0.9%	0.001	0.021
2			337	0.7%		
1	K76.0	Fatty (change of) liver, not elsewhere classified	3,006	6.2%	0.129	0.010
2			2,893	6.0%		
1	K74.3	Primary biliary cirrhosis	20	0.0%	0.398	0.005
2			15	0.0%		
1	E83.11	Hereditary hemochromatosis	39	0.1%	0.059	0.012
2	0		24	0.0%		
1	E70.21	Tyrosinemia	10	0.0%	1	<0.001
2			10	0.0%		
1	E88.01	Alpha-1-antitrypsin deficiency	16	0.0%	0.862	0.001
2			17	0.0%		
1	E80.1	Porphyria cutanea tarda	10	0.0%	0.002	0.020
2			0	0%		
1	E74.0	Glycogen storage disease	10	0.0%	1	<0.001
2			10	0.0%		
1	E83.00	Disorder of copper metabolism, unspecified	10	0.0%	1	<0.001
2			10	0.0%		
1	T64	Toxic effect of aflatoxin and other mycotoxin food contaminants	10	0.0%	1	<0.001
2			10	0.0%		
1	D13.4	Benign neoplasm of liver	33	0.1%	0.181	0.009
2			23	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1 A10B	Biguanides		26,497	54.7%		
2 A			26,968	55.7%	0.002	0.020
1 A10B	Sulfonylureas		13,741	28.4%		
2 B			14,100	29.1%	0.011	0.016
1 A10B	Alpha glucosidase inhibitors		223	0.5%		
2 F			217	0.4%	0.774	0.002
1 A10B	Thiazolidinediones		4,019	8.3%		
2 G			4,113	8.5%	0.276	0.007
1 A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors		9,071	18.7%		
2 H			9,142	18.9%	0.559	0.004
1 A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors		4,271	8.8%	<0.001	0.043
2 K			3,699	7.6%		
1 A10B	Other blood glucose lowering drugs, excl. insulins		606	1.3%		
2 X			630	1.3%	0.492	0.004
1 A14A	ANABOLIC STEROIDS		59	0.1%		
2			46	0.1%	0.204	0.008

eTable 9. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to ovarian cancer for the study populations of women with T2D and no history of any OAC

Group 1 (N = 26,011) and group 2 (N = 476,110) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	54.9 +/- 11.9	26,011	100%	<0.00	
2			61.7 +/- 16.7	476,110	100%	1	0.469
1	2106-3	White		17,165	66.0%	<0.00	
2				282,423	59.3%	1	0.138
1	1002-5	American Indian or Alaska Native		123	0.5%	0.003	0.018
2				1,701	0.4%		
1	UNK	Unknown Race		2,772	10.7%	<0.00	0.035
2				55,979	11.8%	1	
1	2076-8	Native Hawaiian or Other Pacific Islander		105	0.4%	<0.00	0.075
2				4,943	1.0%	1	
1	UN	Unknown Ethnicity		5,078	19.5%	<0.00	0.156
2				124,092	26.1%	1	
1	2186-5	Not Hispanic or Latino		18,384	70.7%	<0.00	0.142
2				304,990	64.1%	1	
1	2135-2	Hispanic or Latino		2,549	9.8%	0.682	0.003
2				47,028	9.9%		
1	2054-5	Black or African American		4,436	17.1%	<0.00	0.077
2				95,352	20.0%	1	
1	2028-9	Asian		619	2.4%	<0.00	0.098
2				19,593	4.1%	1	
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to		468	1.8%	<0.00	0.048
2	Z65	socioeconomic and psychosocial circumstances		5,762	1.2%	1	
1	E66	Overweight and obesity		10,477	40.3%	<0.00	0.493
2				87,968	18.5%	1	

1	Z68.3	Body mass index [BMI] 30-39, adult	1,815 17,667	7.0% 3.7%	<0.00 1	0.146
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,154 18,645	8.3% 3.9%	<0.00 1	0.183
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	56 1,000	0.2% 0.2%	0.857	0.001
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	50 959	0.2% 0.2%	0.747	0.002
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	87 1,140	0.3% 0.2%	0.003	0.018
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	107 1,266	0.4% 0.3%	<0.00 1	0.025
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	119 1,376	0.5% 0.3%	<0.00 1	0.028
1	F10	Alcohol related disorders	197 6,405	0.8% 1.3%	<0.00 1	0.058
1	Z80	Family history of primary malignant neoplasm	1,430 11,367	5.5% 2.4%	<0.00 1	0.160
1	Z15.0	Genetic susceptibility to malignant neoplasm	18 100	0.1% 0.0%	<0.00 1	0.023
1	Z12	Encounter for screening for malignant neoplasms	7,877 65,044	30.3% 13.7%	<0.00 1	0.410
1	Z85	Personal history of malignant neoplasm	593 14,844	2.3% 3.1%	<0.00 1	0.052
1	Z98.84	Bariatric surgery status	474 3,408	1.8% 0.7%	<0.00 1	0.099
1	F17	Nicotine dependence	1,905 39,400	7.3% 8.3%	<0.00 1	0.035
1	E66.0	Obesity due to excess calories	5,392 39,813	20.7% 8.4%	<0.00 1	0.356
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	82 1,919	0.3% 0.4%	0.029	0.015

1	E66.3	Overweight	535	2.1%	<0.00	
2			3,181	0.7%	1	0.120
1	E66.8	Other obesity	134	0.5%	<0.00	
2			702	0.1%	1	0.064
1	E66.9	Obesity, unspecified	7,879	30.3%	<0.00	
2			61,596	12.9%	1	0.431
1	Z72.0	Tobacco use	572	2.2%	<0.00	
2			5,857	1.2%	1	0.075
1	Z79.89	Hormone	137	0.5%	<0.00	
2	0	replacement therapy	1,374	0.3%	1	0.037
1	Z92.23	Personal history of estrogen therapy	10	0.0%	0.233	0.007
2			124	0.0%		
1	Z80.3	Family history of malignant neoplasm of breast	736	2.8%	<0.00	
2			5,122	1.1%	1	0.127
1	E28.2	Polycystic ovarian syndrome	979	3.8%	<0.00	
2			2,780	0.6%	1	0.219
1	Z80.41	Family history of malignant neoplasm of ovary	104	0.4%	<0.00	
2			554	0.1%	1	0.056
1	D27	Benign neoplasm of ovary	95	0.4%	<0.00	
2			902	0.2%	1	0.033

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	14,271	54.9%	<0.00	
2	A		93,949	19.7%	1	0.780
1	A10B	Sulfonylureas	6,822	26.2%	<0.00	
2	B		56,352	11.8%	1	0.373
1	A10B	Alpha glucosidase inhibitors	112	0.4%	<0.00	
2	F		784	0.2%	1	0.049
1	A10B	Thiazolidinediones	1,834	7.1%	<0.00	
2	G		15,689	3.3%	1	0.170
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	4,637	17.8%	<0.00	
2	H		20,235	4.3%	1	0.444
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	2,219	8.5%	<0.00	
2	K		2,614	0.5%	1	0.391
1	A10B	Other blood glucose lowering drugs, excl. insulins	297	1.1%	<0.00	
2	X		3,287	0.7%	1	0.047

1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,345	5.2%	<0.00	
2			5,117	1.1%	1	0.237

Group 1 (N = 25,739) and group 2 (N = 25,739) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.0 +/- 11.9	25,739	100%	0.081
2			54.8 +/- 13.9	25,739	100%	0.015
1	2106-3	White		16,960	65.9%	<0.00
2				17,436	67.7%	1
1	1002-5	American Indian or		123	0.5%	0.323
2		Alaska Native		108	0.4%	0.009
1	UNK	Unknown Race		2,754	10.7%	0.052
2				2,619	10.2%	0.017
1	2076-8	Native Hawaiian or		105	0.4%	0.092
2		Other Pacific		82	0.3%	0.015
1		Islander				
1	UN	Unknown Ethnicity		5,052	19.6%	0.103
2				4,906	19.1%	0.014
1	2186-5	Not Hispanic or		18,163	70.6%	0.074
2		Latino		18,347	71.3%	0.016
1	2135-2	Hispanic or Latino		2,524	9.8%	0.572
2				2,486	9.7%	0.005
1	2054-5	Black or African		4,396	17.1%	0.104
2		American		4,258	16.5%	0.014
1	2028-9	Asian		615	2.4%	0.024
2				539	2.1%	0.020

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		461	1.8%	0.143	0.013
2	Z65		418	1.6%		
1	E66	Overweight and obesity	10,260	39.9%	0.517	0.006
2			10,332	40.1%		
1	Z68.3	Body mass index [BMI] 30-39, adult	1,779	6.9%	<0.00	0.035
2			1,559	6.1%	1	

1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,100	8.2%	0.003	0.026
2			1,922	7.5%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	56	0.2%	0.560	0.005
2			50	0.2%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	50	0.2%	0.441	0.007
2			58	0.2%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	87	0.3%	0.149	0.013
2			69	0.3%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	106	0.4%	0.128	0.013
2			85	0.3%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	118	0.5%	0.061	0.016
2			91	0.4%		
1	F10	Alcohol related disorders	197	0.8%	0.025	0.020
2			155	0.6%		
1	Z80	Family history of primary malignant neoplasm	1,396	5.4%	0.003	0.027
2			1,245	4.8%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	17	0.1%	0.178	0.012
2			10	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	7,694	29.9%	<0.001	0.035
2			7,284	28.3%	1	
1	Z85	Personal history of malignant neoplasm	590	2.3%	0.014	0.022
2			509	2.0%		
1	Z98.84	Bariatric surgery status	459	1.8%	0.920	0.001
2			456	1.8%		
1	F17	Nicotine dependence	1,889	7.3%	0.003	0.026
2			1,719	6.7%		
1	E66.0	Obesity due to excess calories	5,262	20.4%	0.844	0.002
2			5,280	20.5%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	81	0.3%	0.417	0.007
2			71	0.3%		
1	E66.3	Overweight	512	2.0%	0.113	0.014
2			463	1.8%		

1	E66.8	Other obesity	127	0.5%	0.900	0.001
2			129	0.5%		
1	E66.9	Obesity, unspecified	7,706	29.9%	0.265	0.010
2			7,822	30.4%		
1	Z72.0	Tobacco use	562	2.2%	0.359	0.008
2			532	2.1%		
1	Z79.89	Hormone	134	0.5%	0.094	0.015
2	0	replacement therapy	108	0.4%		
1	Z92.23	Personal history of	10	0.0%	1	<0.001
2		estrogen therapy	10	0.0%		
1	Z80.3	Family history of malignant neoplasm of breast	720	2.8%	0.021	0.020
2			636	2.5%		
1	E28.2	Polycystic ovarian syndrome	938	3.6%	0.380	0.008
2			901	3.5%		
1	Z80.41	Family history of malignant neoplasm of ovary	99	0.4%	0.338	0.008
2			86	0.3%		
1	D27	Benign neoplasm of ovary	94	0.4%	0.104	0.014
2			73	0.3%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	14,003	54.4%	0.062	0.016
2	A		14,214	55.2%		
1	A10B	Sulfonylureas	6,697	26.0%	0.489	0.006
2	B		6,766	26.3%		
1	A10B	Alpha glucosidase inhibitors	109	0.4%	0.363	0.008
2	F		96	0.4%		
1	A10B	Thiazolidinediones	1,797	7.0%	0.639	0.004
2	G		1,770	6.9%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	4,445	17.3%	0.709	0.003
2	H		4,477	17.4%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,970	7.7%	<0.001	0.042
2	K		1,690	6.6%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	292	1.1%	0.706	0.003
2	X		283	1.1%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,292	5.0%	0.135	0.013
2			1,219	4.7%		

eTable 10. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to pancreatic cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	55.9 +/- 11.7	48,983	100%	<0.00	
2			61.8 +/- 15.9	1,044,745	100%	1	0.420
1	2106-3	White		32,592	66.5%	<0.00	
2				633,989	60.7%	1	0.122
1	1002-5	American Indian or Alaska Native		199	0.4%	0.004	
2				3,443	0.3%	0.013	
1	UNK	Unknown Race		7,099	14.5%	<0.00	
2				142,470	13.6%	1	0.025
1	F	Female		26,011	53.1%	<0.00	
2				476,110	45.6%	1	0.151
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	<0.00	
2				10,677	1.0%	1	0.071
1	UN	Unknown Gender		2,252	4.6%	<0.00	
2				27,321	2.6%	1	0.106
1	2186-5	Not Hispanic or Latino		33,188	67.8%	<0.00	
2				659,375	63.1%	1	0.098
1	2135-2	Hispanic or Latino		4,151	8.5%	<0.00	
2				94,136	9.0%	1	0.019
1	2054-5	Black or African American		6,265	12.8%	<0.00	
2				178,267	17.1%	1	0.120
1	M	Male		20,720	42.3%	<0.00	
2				541,314	51.8%	1	0.191
1	2028-9	Asian		1,204	2.5%	<0.00	
2				41,822	4.0%	1	0.087
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and		686	1.4%	<0.00	
2	Z65			12,021	1.2%	1	0.022

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	F10	Alcohol related disorders	563	1.1%	<0.00	0.115
2			28,538	2.7%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	0.366
2			69,998	6.7%	1	

1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150 3,643	0.3% 0.3%	0.118	0.007
1	E66.3	Overweight	1,010 6,796	2.1% 0.7%	<0.00 1	0.122
1	E66.8	Other obesity	235 1,298	0.5% 0.1%	<0.00 1	0.065
1	E66.9	Obesity, unspecified	13,805 118,555	28.2% 11.3%	<0.00 1	0.433
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10 256	0.0% 0.0%	0.571	0.003
1	B96.8 2 1	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	254 3,973	0.5% 0.4%	<0.00 1	0.021
1	Z80.0	Family history of malignant neoplasm of digestive organs	784 6,889	1.6% 0.7%	<0.00 1	0.089
1	B18	Chronic viral hepatitis	260 12,879	0.5% 1.2%	<0.00 1	0.075
1	K86.1	Other chronic pancreatitis	75 8,232	0.2% 0.8%	<0.00 1	0.093
1	B16	Acute hepatitis B	55 1,537	0.1% 0.1%	0.048	0.010
1	B18.1	Chronic viral hepatitis B without delta-agent	48 1,611	0.1% 0.2%	0.002	0.016
1	Z72.0	Tobacco use	1,064 13,876	2.2% 1.3%	<0.00 1	0.064
1	D13.6	Benign neoplasm of pancreas	10 360	0.0% 0.0%	0.099	0.008

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B 2 A	Biguanides	27,075 199,802	55.3% 19.1%	<0.00 1	0.806
1	A10B 2 B	Sulfonylureas	14,077 125,703	28.7% 12.0%	<0.00 1	0.424
1	A10B 2 F	Alpha glucosidase inhibitors	229 1,718	0.5% 0.2%	<0.00 1	0.054

1	A10B	Thiazolidinediones	4,107	8.4%	<0.00		0.213
2	G		35,435	3.4%	1		
1	A10B	Dipeptidyl peptidase	9,485	19.4%	<0.00		0.481
2	H	4 (DPP-4) inhibitors	44,595	4.3%	1		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,808	9.8%	<0.00		0.423
2	K		6,447	0.6%	1		
1	A10B	Other blood glucose lowering drugs, excl. insulins	614	1.3%	<0.00		0.059
2	X		7,048	0.7%	1		

Group 1 (N = 48,490) and group 2 (N = 48,490) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	55.9 +/- 11.7	48,490	100%	0.154	0.009
2			56.0 +/- 13.1	48,490	100%		
1	2106-3	White		32,268	66.5%	<0.00	
2				33,234	68.5%	1	0.043
1	1002-5	American Indian or Alaska Native		197	0.4%	0.352	0.006
2				179	0.4%		
1	UNK	Unknown Race		6,991	14.4%	0.002	0.020
2				6,652	13.7%		
1	F	Female		25,736	53.1%	<0.00	
2				26,279	54.2%	1	0.022
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	0.001	0.021
2				145	0.3%		
1	UN	Unknown Gender		2,179	4.5%	0.026	0.014
2				2,038	4.2%		
1	2186-5	Not Hispanic or Latino		32,860	67.8%	0.001	0.022
2				33,363	68.8%		
1	2135-2	Hispanic or Latino		4,119	8.5%	0.034	0.014
2				3,937	8.1%		
1	2054-5	Black or African American		6,223	12.8%	0.003	0.019
2				5,922	12.2%		
1	M	Male		20,575	42.4%	0.009	0.017
2				20,173	41.6%		
1	2028-9	Asian		1,199	2.5%	<0.00	
2				1,036	2.1%	1	0.022

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		679	1.4%		
2	Z65		566	1.2%	0.001	0.021
1	E66	Overweight and obesity	18,013 17,981	37.1% 37.1%	0.832	0.001
1	Z68.3	Body mass index [BMI] 30-39, adult	4,063 3,633	8.4% 7.5%	<0.001	0.033
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,789 3,390	7.8% 7.0%	<0.001	0.031
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156 150	0.3% 0.3%	0.731	0.002
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171 149	0.4% 0.3%	0.218	0.008
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	284 233	0.6% 0.5%	0.025	0.014
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	334 283	0.7% 0.6%	0.039	0.013
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	386 351	0.8% 0.7%	0.196	0.008
1	F10	Alcohol related disorders	562 460	1.2% 0.9%	0.001	0.021
1	Z80	Family history of primary malignant neoplasm	1,995 1,859	4.1% 3.8%	0.025	0.014
1	Z15.0	Genetic susceptibility to malignant neoplasm	22 17	0.0% 0.0%	0.423	0.005
1	Z12	Encounter for screening for malignant neoplasms	11,955 11,588	24.7% 23.9%	0.006	0.018
1	Z85	Personal history of malignant neoplasm	1,230 1,109	2.5% 2.3%	0.011	0.016

1	Z98.84	Bariatric surgery status	613 551	1.3% 1.1%	0.068	0.012
1	E66.0	Obesity due to excess calories	8,924 8,803	18.4% 18.2%	0.315	0.006
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	149 137	0.3% 0.3%	0.477	0.005
1	E66.3	Overweight	980 907	2.0% 1.9%	0.090	0.011
1	E66.8	Other obesity	223 196	0.5% 0.4%	0.186	0.008
1	E66.9	Obesity, unspecified	13,488 13,624	27.8% 28.1%	0.331	0.006
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10 10	0.0% 0.0%	1	<0.001
1	B96.8 2 1	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	252 220	0.5% 0.5%	0.140	0.009
1	Z80.0	Family history of malignant neoplasm of digestive organs	763 659	1.6% 1.4%	0.005	0.018
1	B18	Chronic viral hepatitis	260 217	0.5% 0.4%	0.048	0.013
1	K86.1	Other chronic pancreatitis	75 105	0.2% 0.2%	0.025	0.014
1	B16 2	Acute hepatitis B	54 34	0.1% 0.1%	0.033	0.014
1	B18.1 2	Chronic viral hepatitis B without delta-agent	48 23	0.1% 0.0%	0.003	0.019
1	Z72.0	Tobacco use	1,047 959	2.2% 2.0%	0.047	0.013
1	D13.6	Benign neoplasm of pancreas	10 11	0.0% 0.0%	0.827	0.001

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B		26,585	54.8%		
2	A	Biguanides	27,020	55.7%	0.005	0.018

1	A10B	Sulfonylureas	13,771	28.4%	0.143	0.009
2	B		13,977	28.8%		
1	A10B	Alpha glucosidase	221	0.5%		
2	F	inhibitors	192	0.4%	0.153	0.009
1	A10B	Thiazolidinediones	4,030	8.3%	0.262	0.007
2	G		4,127	8.5%		
1	A10B	Dipeptidyl peptidase	9,110	18.8%		
2	H	4 (DPP-4) inhibitors	9,241	19.1%	0.283	0.007
1	A10B	Sodium-glucose co-	4,335	8.9%	<0.00	
2	K	transporter 2 (SGLT2) inhibitors	3,863	8.0%	1	0.035
1	A10B	Other blood glucose	607	1.3%		
2	X	lowering drugs, excl.	545	1.1%	0.066	0.012
		insulins				

eTable 11. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to thyroid cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	55.9 +/- 11.7	48,983	100%	<0.00	
2			61.8 +/- 15.9	1,044,745	100%	1	0.420
1	2106-3	White		32,592	66.5%	<0.00	
2				633,989	60.7%	1	0.122
1	1002-5	American Indian or Alaska Native		199	0.4%	0.004	
2				3,443	0.3%	0.013	
1	UNK	Unknown Race		7,099	14.5%	<0.00	
2				142,470	13.6%	1	0.025
1	F	Female		26,011	53.1%	<0.00	
2				476,110	45.6%	1	0.151
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	<0.00	
2				10,677	1.0%	1	0.071
1	UN	Unknown Gender		2,252	4.6%	<0.00	
2				27,321	2.6%	1	0.106
1	2186-5	Not Hispanic or Latino		33,188	67.8%	<0.00	
2				659,375	63.1%	1	0.098
1	2135-2	Hispanic or Latino		4,151	8.5%	<0.00	
2				94,136	9.0%	1	0.019
1	2054-5	Black or African American		6,265	12.8%	<0.00	
2				178,267	17.1%	1	0.120
1	M	Male		20,720	42.3%	<0.00	
2				541,314	51.8%	1	0.191
1	2028-9	Asian		1,204	2.5%	<0.00	
2				41,822	4.0%	1	0.087
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and		686	1.4%	<0.00	
2	Z65			12,021	1.2%	1	0.022

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	0.366
2			69,998	6.7%	1	
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150	0.3%	0.118	0.007
2			3,643	0.3%		

1	E66.3	Overweight	1,010	2.1%	<0.00	
2			6,796	0.7%	1	0.122
1	E66.8	Other obesity	235	0.5%	<0.00	
2			1,298	0.1%	1	0.065
1	E66.9	Obesity, unspecified	13,805	28.2%	<0.00	
2			118,555	11.3%	1	0.433
1	D34	Benign neoplasm of thyroid gland	65	0.1%	<0.00	
2			765	0.1%	1	0.019

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
Hereditary neuroendocrine tumor disorders (eg, medullary thyroid carcinoma, parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)						
1	10278	carcinoma,	0	0%	--	--
2	53	parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)	0	0%		
1	1001	Radiation	138	0.3%	<0.00	
2			7,649	0.7%	1	0.063

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
Biguanides						
1	A10B		27,075	55.3%	<0.00	
2	A		199,802	19.1%	1	0.806
Sulfonylureas						
1	A10B		14,077	28.7%	<0.00	
2	B		125,703	12.0%	1	0.424
Alpha glucosidase inhibitors						
1	A10B		229	0.5%	<0.00	
2	F		1,718	0.2%	1	0.054
Thiazolidinediones						
1	A10B		4,107	8.4%	<0.00	
2	G		35,435	3.4%	1	0.213
Dipeptidyl peptidase 4 (DPP-4) inhibitors						
1	A10B		9,485	19.4%	<0.00	
2	H		44,595	4.3%	1	0.481
Sodium-glucose co-transporter 2 (SGLT2) inhibitors						
1	A10B		4,808	9.8%	<0.00	
2	K		6,447	0.6%	1	0.423
Other blood glucose lowering drugs, excl. insulins						
1	A10B		614	1.3%	<0.00	
2	X		7,048	0.7%	1	0.059

Group 1 (N = 48,527) and group 2 (N = 48,527) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.9 +/- 11.7	48,527	100%	
2			56.0 +/- 13.0	48,527	100%	
1	2106-3	White		32,294	66.5%	<0.00
2				33,289	68.6%	1
1	1002-5	American Indian or Alaska Native		197	0.4%	0.092
2				165	0.3%	0.011
1	UNK	Unknown Race		6,995	14.4%	<0.00
2				6,615	13.6%	1
1	F	Female		25,749	53.1%	
2				26,218	54.0%	0.019
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	0.028
2				163	0.3%	0.014
1	UN	Unknown Gender		2,183	4.5%	
2				2,043	4.2%	0.028
1	2186-5	Not Hispanic or Latino		32,880	67.8%	0.002
2				33,324	68.7%	0.020
1	2135-2	Hispanic or Latino		4,125	8.5%	
2				3,889	8.0%	0.006
1	2054-5	Black or African American		6,231	12.8%	0.077
2				6,048	12.5%	0.011
1	M	Male		20,595	42.4%	
2				20,266	41.8%	0.032
1	2028-9	Asian		1,196	2.5%	<0.00
2				985	2.0%	1
						0.029

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		682	1.4%	<0.00	
2	Z65		560	1.2%	1	0.022
1	E66	Overweight and obesity	18,048	37.2%		
2			18,155	37.4%	0.478	0.005

1	Z68.3	Body mass index [BMI] 30-39, adult	4,070	8.4%	<0.00	0.023
2			3,762	7.8%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,792	7.8%	<0.00	0.027
2			3,443	7.1%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156	0.3%	0.775	0.002
2			151	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.4%	0.957	<0.001
2			172	0.4%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	285	0.6%	0.005	0.018
2			222	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	335	0.7%	0.019	0.015
2			277	0.6%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	385	0.8%	0.101	0.011
2			341	0.7%		
1	Z80	Family history of primary malignant neoplasm	1,997	4.1%	0.105	0.010
2			1,898	3.9%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	22	0.0%	0.055	0.012
2			11	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	11,975	24.7%	0.005	0.018
2			11,599	23.9%		
1	Z85	Personal history of malignant neoplasm	1,232	2.5%	<0.00	0.027
2			1,034	2.1%	1	
1	Z98.84	Bariatric surgery status	614	1.3%	0.954	<0.001
2			616	1.3%		
1	E66.0	Obesity due to excess calories	8,948	18.4%	0.486	0.004
2			8,864	18.3%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	147	0.3%	0.816	0.001
2			151	0.3%		
1	E66.3	Overweight	982	2.0%	0.009	0.017
2			870	1.8%		
1	E66.8	Other obesity	226	0.5%	0.011	0.016
2			175	0.4%		

1	E66.9	Obesity, unspecified	13,514	27.8%	0.017	0.015
2			13,850	28.5%		
1	D34	Benign neoplasm of thyroid gland	62	0.1%	0.580	0.004
2			56	0.1%		
Procedure						
Group			Mean ± SD	Patients	% of Group	P-Value
Hereditary neuroendocrine tumor disorders (eg, medullary thyroid carcinoma, parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)						
1	10278	carcinoma,		0	0%	--
2	53	parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)		0	0%	--
1	1001	Radiation		138	0.3%	0.320
2				155	0.3%	0.006
Medication						
Group			Mean ± SD	Patients	% of Group	P-Value
1	A10B	Biguanides		26,621	54.9%	0.036
2	A			26,945	55.5%	0.013
1	A10B	Sulfonylureas		13,798	28.4%	0.010
2	B			14,163	29.2%	0.017
1	A10B	Alpha glucosidase inhibitors		222	0.5%	0.074
2	F			186	0.4%	0.011
1	A10B	Thiazolidinediones		4,033	8.3%	0.243
2	G			4,134	8.5%	0.007
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors		9,131	18.8%	0.501
2	H			9,213	19.0%	0.004
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors		4,366	9.0%	<0.001
2	K			3,968	8.2%	0.029
1	A10B	Other blood glucose lowering drugs, excl. insulins		607	1.3%	0.092
2	X			550	1.1%	0.011

eTable 12. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to meningioma for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	55.9 +/- 11.7	48,983	100%	<0.00	
2			61.8 +/- 15.9	1,044,745	100%	1	0.420
1	2106-3	White		32,592	66.5%	<0.00	
2				633,989	60.7%	1	0.122
1	1002-5	American Indian or Alaska Native		199	0.4%	0.004	
2				3,443	0.3%	0.013	
1	UNK	Unknown Race		7,099	14.5%	<0.00	
2				142,470	13.6%	1	0.025
1	F	Female		26,011	53.1%	<0.00	
2				476,110	45.6%	1	0.151
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	<0.00	
2				10,677	1.0%	1	0.071
1	UN	Unknown Gender		2,252	4.6%	<0.00	
2				27,321	2.6%	1	0.106
1	2186-5	Not Hispanic or Latino		33,188	67.8%	<0.00	
2				659,375	63.1%	1	0.098
1	2135-2	Hispanic or Latino		4,151	8.5%	<0.00	
2				94,136	9.0%	1	0.019
1	2054-5	Black or African American		6,265	12.8%	<0.00	
2				178,267	17.1%	1	0.120
1	M	Male		20,720	42.3%	<0.00	
2				541,314	51.8%	1	0.191
1	2028-9	Asian		1,204	2.5%	<0.00	
2				41,822	4.0%	1	0.087
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and		686	1.4%	<0.00	
2	Z65			12,021	1.2%	1	0.022

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	0.366
2			69,998	6.7%	1	
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150	0.3%	0.118	0.007
2			3,643	0.3%		

1	E66.3	Overweight	1,010	2.1%	<0.00	
2			6,796	0.7%	1	0.122
1	E66.8	Other obesity	235	0.5%	<0.00	
2			1,298	0.1%	1	0.065
1	E66.9	Obesity, unspecified	13,805	28.2%	<0.00	
2			118,555	11.3%	1	0.433
1	Z79.89	Hormone replacement therapy	147	0.3%	<0.00	
2	0		1,533	0.1%	1	0.032
1	Z92.23	Personal history of estrogen therapy	10	0.0%	0.116	0.006
2			128	0.0%		
1	D32	Benign neoplasm of meninges	90	0.2%	<0.00	
2			3,214	0.3%	1	0.025
1	S00-S09	Injuries to the head	2,121	4.3%	<0.00	
2			58,791	5.6%	1	0.060
1	Z80.3	Family history of malignant neoplasm of breast	804	1.6%	<0.00	
2			5,952	0.6%	1	0.103

Procedure

Group	Mean ± SD	Patients	% of Group	P-Value	SMD	
1		138	0.3%	<0.00		
2	1001	Radiation	7,649	0.7%	1	0.063

Medication

Group	Mean ± SD	Patients	% of Group	P-Value	SMD	
1	A10B	Biguanides	27,075	55.3%	<0.00	
2	A		199,802	19.1%	1	0.806
1	A10B	Sulfonylureas	14,077	28.7%	<0.00	
2	B		125,703	12.0%	1	0.424
1	A10B	Alpha glucosidase inhibitors	229	0.5%	<0.00	
2	F		1,718	0.2%	1	0.054
1	A10B	Thiazolidinediones	4,107	8.4%	<0.00	
2	G		35,435	3.4%	1	0.213
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,485	19.4%	<0.00	
2	H		44,595	4.3%	1	0.481
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,808	9.8%	<0.00	
2	K		6,447	0.6%	1	0.423
1	A10B	Other blood glucose lowering drugs, excl. insulins	614	1.3%	<0.00	
2	X		7,048	0.7%	1	0.059

1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,436	2.9%	<0.00	0.185
2			5,500	0.5%	1	

Group 1 (N = 48,518) and group 2 (N = 48,518) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.9 +/- 11.7	48,518	100%	0.361
2			56.0 +/- 13.2	48,518	100%	
1	2106-3	White		32,296	66.6%	<0.00
2				33,257	68.5%	1
1	1002-5	American Indian or Alaska Native		197	0.4%	0.300
2				177	0.4%	
1	UNK	Unknown Race		6,995	14.4%	0.001
2				6,626	13.7%	
1	F	Female		25,736	53.0%	0.001
2				26,259	54.1%	
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	0.007
2				154	0.3%	
1	UN	Unknown Gender		2,182	4.5%	0.010
2				2,018	4.2%	
1	2186-5	Not Hispanic or Latino		32,879	67.8%	0.019
2				33,219	68.5%	
1	2135-2	Hispanic or Latino		4,118	8.5%	0.669
2				4,081	8.4%	
1	2054-5	Black or African American		6,222	12.8%	0.003
2				5,915	12.2%	
1	M	Male		20,600	42.5%	0.020
2				20,241	41.7%	
1	2028-9	Asian		1,195	2.5%	0.006
2				1,067	2.2%	

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances		681	1.4%	0.002
2	Z65			570	1.2%	

1	E66	Overweight and obesity	18,033	37.2%	0.889	0.001
2			18,054	37.2%		
1	Z68.3	Body mass index [BMI] 30-39, adult	4,068	8.4%	<0.001	0.028
2			3,696	7.6%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,789	7.8%	<0.001	0.029
2			3,420	7.0%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156	0.3%	0.352	0.006
2			140	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.4%	0.317	0.006
2			153	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	283	0.6%	0.043	0.013
2			237	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	334	0.7%	0.077	0.011
2			290	0.6%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	386	0.8%	0.238	0.008
2			354	0.7%		
1	Z80	Family history of primary malignant neoplasm	1,995	4.1%	0.016	0.016
2			1,848	3.8%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	23	0.0%	0.024	0.015
2			10	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	11,961	24.7%	0.011	0.016
2			11,622	24.0%		
1	Z85	Personal history of malignant neoplasm	1,232	2.5%	0.002	0.020
2			1,084	2.2%		
1	Z98.84	Bariatric surgery status	614	1.3%	0.160	0.009
2			566	1.2%		
1	E66.0	Obesity due to excess calories	8,936	18.4%	0.642	0.003
2			8,880	18.3%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	149	0.3%	0.036	0.013
2			115	0.2%		
1	E66.3	Overweight	981	2.0%	0.030	0.014
2			888	1.8%		

1	E66.8	Other obesity	222	0.5%	0.499	0.004
2			208	0.4%		
1	E66.9	Obesity, unspecified	13,501	27.8%	0.506	0.004
2			13,594	28.0%		
1	Z79.89	Hormone	146	0.3%	0.180	0.009
2	0	replacement therapy	124	0.3%		
1	Z92.23	Personal history of estrogen therapy	10	0.0%	0.532	0.004
2			13	0.0%		
1	D32	Benign neoplasm of meninges	90	0.2%	0.397	0.005
2			79	0.2%		
1	S00-		2,108	4.3%	<0.00	
2	S09	Injuries to the head	1,800	3.7%	1	0.032
1	Z80.3	Family history of malignant neoplasm of breast	783	1.6%	0.354	0.006
2			747	1.5%		

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	1001	Radiation	138	0.3%	0.006	0.018
2			96	0.2%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	26,612	54.8%	0.006	0.018
2	A		27,037	55.7%		
1	A10B	Sulfonylureas	13,794	28.4%	0.036	0.013
2	B		14,089	29.0%		
1	A10B	Alpha glucosidase inhibitors	221	0.5%	0.092	0.011
2	F		187	0.4%		
1	A10B	Thiazolidinediones	4,037	8.3%	0.262	0.007
2	G		4,134	8.5%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,126	18.8%	0.831	0.001
2	H		9,152	18.9%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,364	9.0%	<0.00	
2	K		3,874	8.0%	1	0.036
1	A10B	Other blood glucose lowering drugs, excl. insulins	606	1.2%	0.663	0.003
2	X		591	1.2%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,385	2.9%	0.028	0.014
2			1,273	2.6%		

eTable 13. Characteristics of the GLP-1RA/no insulin group and insulin/no GLP-1RA group before and after matched for covariates related to multiple myeloma for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 48,983) and group 2 (N = 1,044,745) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index 55.9 +/- 11.7 61.8 +/- 15.9	48,983 1,044,745	100% 100%	<0.00 1	0.420	
1	2106-3	White American Indian or Alaska Native	32,592 199 3,443	66.5% 0.4% 0.3%	<0.00 0.004	0.122	
1	UNK	Unknown Race Female	7,099 142,470	14.5% 13.6%	<0.00 1	0.025	
1	F	Female Native Hawaiian or Other Pacific Islander	26,011 476,110	53.1% 45.6%	<0.00 1	0.151	
1	2076-8	Unknown Gender Not Hispanic or Latino	2,252 27,321	4.6% 2.6%	<0.00 1	0.106	
1	2186-5	Not Hispanic or Latino	33,188 659,375	67.8% 63.1%	<0.00 1	0.098	
1	2135-2	Hispanic or Latino Black or African American	4,151 94,136	8.5% 9.0%	<0.00 1	0.019	
1	2054-5	Black or African American	6,265 178,267	12.8% 17.1%	<0.00 1	0.120	
1	M	Male Asian	20,720 41,822	42.3% 2.5%	<0.00 1	0.191	
1	2028-9	Asian	1,204 41,822	4.0%	<0.00 1	0.087	
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to socioeconomic and	686 12,021	1.4% 1.2%	<0.00 1	0.022	

psychosocial circumstances						
1	E66	Overweight and obesity	18,401	37.6%	<0.00	0.504
2			166,445	15.9%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	4,204	8.6%	<0.00	0.183
2			43,128	4.1%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,886	7.9%	<0.00	0.208
2			33,396	3.2%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	157	0.3%	0.563	0.003
2			3,510	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.3%	0.957	<0.001
2			3,632	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	288	0.6%	<0.00	0.026
2			4,209	0.4%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	344	0.7%	<0.00	0.036
2			4,508	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	398	0.8%	<0.00	0.044
2			4,843	0.5%	1	
1	Z80	Family history of primary malignant neoplasm	2,042	4.2%	<0.00	0.136
2			19,398	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	24	0.0%	<0.00	0.019
2			156	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	12,272	25.1%	<0.00	0.402
2			105,217	10.1%	1	
1	Z85	Personal history of malignant neoplasm	1,239	2.5%	<0.00	0.066
2			38,294	3.7%	1	
1	Z98.84	Bariatric surgery status	632	1.3%	<0.00	0.085
2			5,136	0.5%	1	
1	E66.0	Obesity due to excess calories	9,157	18.7%	<0.00	0.366
2			69,998	6.7%	1	
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	150	0.3%	0.118	0.007
2			3,643	0.3%		

1	E66.3	Overweight	1,010	2.1%	<0.00		
2			6,796	0.7%	1	0.122	
1	E66.8	Other obesity	235	0.5%	<0.00		
2			1,298	0.1%	1	0.065	
1	E66.9	Obesity, unspecified	13,805	28.2%	<0.00		
2			118,555	11.3%	1	0.433	
		Family history of other malignant neoplasms of lymphoid, hematopoietic and related tissues					
1	Z80.7		20	0.0%		0.206	0.005
2			319	0.0%			
1	D47.2	Monoclonal gammopathy	96	0.2%		0.016	0.012
2			2,627	0.3%			
1	C90.3	Solitary plasmacytoma	10	0.0%	<0.00		
2			50	0.0%	1	0.014	
1	D45	Polycythemia vera	82	0.2%		0.030	0.009
2			1,367	0.1%			
1	D46	Myelodysplastic syndromes	19	0.0%	<0.00		
2			2,139	0.2%	1	0.048	
		Other neoplasms of uncertain behavior of lymphoid, hematopoietic and related tissue					
1	D47		281	0.6%		0.001	0.016
2			7,366	0.7%			

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B		27,075	55.3%	<0.00	
2	A	Biguanides	199,802	19.1%	1	0.806
1	A10B		14,077	28.7%	<0.00	
2	B	Sulfonylureas	125,703	12.0%	1	0.424
1	A10B		229	0.5%	<0.00	
2	F	Alpha glucosidase inhibitors	1,718	0.2%	1	0.054
1	A10B		4,107	8.4%	<0.00	
2	G	Thiazolidinediones	35,435	3.4%	1	0.213
1	A10B		9,485	19.4%	<0.00	
2	H	Dipeptidyl peptidase 4 (DPP-4) inhibitors	44,595	4.3%	1	0.481
1	A10B		4,808	9.8%	<0.00	
2	K	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	6,447	0.6%	1	0.423

1	A10B	Other blood glucose lowering drugs, excl. insulins	614	1.3%	<0.00	
2	X		7,048	0.7%	1	0.059

Group 1 (N = 48,527) and group 2 (N = 48,527) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	55.9 +/- 11.7	48,527	100%	0.057
2			56.1 +/- 13.0	48,527	100%	
1	2106-3	White		32,296	66.6%	<0.00
2				33,417	68.9%	1
1	1002-5	American Indian or Alaska Native		197	0.4%	0.011
2				150	0.3%	
1	UNK	Unknown Race		6,995	14.4%	<0.00
2				6,585	13.6%	1
1	F	Female		25,751	53.1%	0.013
2				26,135	53.9%	
1	2076-8	Native Hawaiian or Other Pacific Islander		205	0.4%	0.002
2				147	0.3%	
1	UN	Unknown Gender		2,183	4.5%	0.015
2				2,029	4.2%	
1	2186-5	Not Hispanic or Latino		32,881	67.8%	0.002
2				33,326	68.7%	
1	2135-2	Hispanic or Latino		4,122	8.5%	0.023
2				3,926	8.1%	
1	2054-5	Black or African American		6,230	12.8%	0.003
2				5,926	12.2%	
1	M	Male		20,593	42.4%	0.135
2				20,363	42.0%	
1	2028-9	Asian		1,197	2.5%	<0.00
2				1,015	2.1%	1

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to		682	1.4%	0.005
2	Z65	socioeconomic and psychosocial circumstances		582	1.2%	0.018

1	E66	Overweight and obesity	18,046	37.2%	0.770	0.002
2			18,090	37.3%		
1	Z68.3	Body mass index [BMI] 30-39, adult	4,072	8.4%	<0.001	0.025
2			3,739	7.7%		
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,794	7.8%	<0.001	0.029
2			3,424	7.1%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	156	0.3%	0.218	0.008
2			135	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	171	0.4%	0.545	0.004
2			160	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	284	0.6%	0.010	0.017
2			226	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	334	0.7%	0.036	0.013
2			282	0.6%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	385	0.8%	0.002	0.020
2			305	0.6%		
1	Z80	Family history of primary malignant neoplasm	1,997	4.1%	0.004	0.018
2			1,823	3.8%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	22	0.0%	0.086	0.011
2			12	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	11,973	24.7%	0.003	0.019
2			11,574	23.9%		
1	Z85	Personal history of malignant neoplasm	1,232	2.5%	<0.001	0.024
2			1,052	2.2%		
1	Z98.84	Bariatric surgery status	614	1.3%	0.178	0.009
2			568	1.2%		
1	E66.0	Obesity due to excess calories	8,943	18.4%	0.791	0.002
2			8,911	18.4%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	147	0.3%	0.566	0.004
2			157	0.3%		
1	E66.3	Overweight	984	2.0%	0.002	0.020
2			850	1.8%		

1	E66.8	Other obesity	226	0.5%	0.011	0.016
2			175	0.4%		
1	E66.9	Obesity, unspecified	13,515	27.9%	0.189	0.008
2			13,699	28.2%		
		Family history of other malignant neoplasms of lymphoid, hematopoietic and related tissues				
1	Z80.7		19	0.0%	0.873	0.001
2			20	0.0%		
1	D47.2	Monoclonal gammopathy	96	0.2%	0.053	0.012
2			71	0.1%		
1	C90.3	Solitary plasmacytoma	10	0.0%	1	<0.001
2			10	0.0%		
1	D45	Polycythemia vera	79	0.2%	0.874	0.001
2			81	0.2%		
1	D46	Myelodysplastic syndromes	19	0.0%	0.002	0.020
2			43	0.1%		
		Other neoplasms of uncertain behavior of lymphoid, hematopoietic and related tissue				
1	D47		278	0.6%	0.077	0.011
2			238	0.5%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	26,622	54.9%	0.006	0.017
2	A		27,044	55.7%		
1	A10B	Sulfonylureas	13,797	28.4%	0.027	0.014
2	B		14,109	29.1%		
1	A10B	Alpha glucosidase inhibitors	222	0.5%	0.031	0.014
2	F		179	0.4%		
1	A10B	Thiazolidinediones	4,037	8.3%	0.487	0.004
2	G		4,097	8.4%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	9,133	18.8%	0.092	0.011
2	H		9,339	19.2%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	4,366	9.0%	<0.001	0.033
2	K		3,914	8.1%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	606	1.2%	0.319	0.006
2	X		572	1.2%		

eTable 14. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to esophageal cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.001
2			60.1 +/- 14.0	856,160	100%	0.080
1	2106-3	White		21,231	65.6%	<0.001
2				515,868	60.3%	0.111
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	0.010
1	UNK	Unknown Race		4,272	13.2%	<0.001
2				119,036	13.9%	0.021
1	F	Female		17,278	53.4%	<0.001
2				399,923	46.7%	0.134
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	0.020
1	UN	Unknown Gender		1,670	5.2%	<0.001
2				19,592	2.3%	0.152
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.001
2				528,686	61.8%	0.151
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.001
2				91,303	10.7%	0.084
1	2054-5	Black or African American		5,107	15.8%	<0.001
2				141,606	16.5%	0.021
1	M	Male		13,417	41.5%	<0.001
2				436,645	51.0%	0.192
1	2028-9	Asian		681	2.1%	<0.001
2				35,540	4.2%	0.118
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and		422	1.3%	0.107
2	Z65			10,310	1.2%	0.009

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	F10	Alcohol related disorders	460	1.4%	<0.00	0.076
2			21,150	2.5%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	F17	Nicotine dependence	2,399	7.4%	<0.00	0.059
2			77,335	9.0%	1	

1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00	
2			56,178	6.6%	1	0.361
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00	
2			2,051	0.2%	1	0.069
1	E66.3	Overweight	535	1.7%	<0.00	
2			7,794	0.9%	1	0.066
1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
1	Z72.0	Tobacco use	588	1.8%	<0.00	
2			11,927	1.4%	1	0.034
1	K21	Gastro-esophageal reflux disease	6,710	20.7%	<0.00	
2			115,166	13.5%	1	0.194
1	K22.7	Barrett's esophagus	244	0.8%	<0.00	
2			3,863	0.5%	1	0.039
1	K22.0	Achalasia of cardia	30	0.1%	0.001	0.016
2			433	0.1%		
1	D69.4	Evans syndrome	0	0%		
2	1		18	0.0%	0.409	0.006
1	D50.1	Sideropenic dysphagia	57	0.2%	<0.00	
2			573	0.1%	1	0.031
1	S27.81	Injury of esophagus (thoracic part)	10	0.0%	<0.00	
2			33	0.0%	1	0.021
1	C34	Malignant neoplasm of bronchus and lung	99	0.3%	<0.00	
2			4,460	0.5%	1	0.034
1	C06	Malignant neoplasm of other and unspecified parts of mouth	10	0.0%		
2			451	0.1%	0.091	0.011
1	C32	Malignant neoplasm of larynx	13	0.0%		
2			741	0.1%	0.005	0.018
1	B97.7	Papillomavirus as the cause of diseases classified elsewhere	56	0.2%	<0.00	
2			908	0.1%	1	0.018
1	R87.8	High risk human papillomavirus (HPV) DNA test positive from female genital organs	59	0.2%	<0.00	
2	1		928	0.1%	1	0.019

1	Z80.0	Family history of malignant neoplasm of digestive organs	413	1.3%	<0.00	
2			6,255	0.7%	1	0.055
1	D10	Benign neoplasm of mouth and pharynx	38	0.1%	0.619	0.003
2			1,091	0.1%		
1	D13.0	Benign neoplasm of esophagus	10	0.0%	0.176	0.007
2			171	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	
2	B		69,045	8.1%	1	0.269
1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	
2	F		876	0.1%	1	0.057
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	
2	G		20,400	2.4%	1	0.183
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	
2	H		17,113	2.0%	1	0.370
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00	
2	K		3,371	0.4%	1	0.312
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00	
2	X		3,839	0.4%	1	0.146
1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	
2			159,901	18.7%	1	0.560

Group 1 (N = 32,263) and group 2 (N = 32,263) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,263	100%	
2			59.0 +/- 13.2	32,263	100%	0.721
1	2106-3	White		21,161	65.6%	<0.00
2				21,731	67.4%	1
1	1002-5	American Indian or Alaska Native	98	0.3%	0.887	0.001
2			100	0.3%		
1	UNK	Unknown Race	4,255	13.2%	0.375	0.007
2			4,179	13.0%		
1	F	Female	17,209	53.3%	0.038	0.016
2			17,472	54.2%		

1	2076-8	Native Hawaiian or Other Pacific Islander	172	0.5%	0.161	0.011
2			147	0.5%		
1	UN	Unknown Gender	1,656	5.1%	0.478	0.006
2			1,696	5.3%		
1	2186-5	Not Hispanic or Latino	22,225	68.9%	0.004	0.023
2			22,564	69.9%		
1	2135-2	Hispanic or Latino	2,651	8.2%	0.019	0.018
2			2,490	7.7%		
1	2054-5	Black or African American	5,092	15.8%	0.001	0.027
2			4,779	14.8%		
1	M	Male	13,398	41.5%	0.015	0.019
2			13,095	40.6%		
1	2028-9	Asian	681	2.1%	0.010	0.020
2			590	1.8%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances	419	1.3%	0.003	0.023
2	Z65		339	1.1%		
1	E66	Overweight and obesity	11,341	35.2%	0.433	0.006
2			11,246	34.9%		
1	Z68.3	Body mass index [BMI] 30-39, adult	3,247	10.1%	0.763	0.002
2			3,224	10.0%		
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,969	9.2%	0.065	0.015
2			2,835	8.8%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	118	0.4%	0.463	0.006
2			107	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	149	0.5%	0.036	0.017
2			115	0.4%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	207	0.6%	0.169	0.011
2			180	0.6%		

1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	261	0.8%	0.175	0.011
2			231	0.7%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	297	0.9%	0.080	0.014
2			256	0.8%		
1	F10	Alcohol related disorders	459	1.4%	<0.001	0.039
2			323	1.0%		
1	Z80	Family history of primary malignant neoplasm	1,205	3.7%	0.073	0.014
2			1,120	3.5%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	0.194	0.010
2			11	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	6,177	19.1%	<0.001	0.050
2			5,550	17.2%	1	
1	Z85	Personal history of malignant neoplasm	1,106	3.4%	0.141	0.012
2			1,039	3.2%		
1	Z98.84	Bariatric surgery status	520	1.6%	0.827	0.002
2			527	1.6%		
1	F17	Nicotine dependence	2,388	7.4%	<0.001	0.037
2			2,081	6.5%	1	
1	E66.0	Obesity due to excess calories	5,847	18.1%	0.759	0.002
2			5,817	18.0%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	227	0.7%	0.361	0.007
2			208	0.6%		
1	E66.3	Overweight	529	1.6%	0.105	0.013
2			478	1.5%		
1	E66.8	Other obesity	190	0.6%	1	<0.001
2			190	0.6%		
1	E66.9	Obesity, unspecified	8,097	25.1%	0.181	0.011
2			7,950	24.6%		
1	Z72.0	Tobacco use	584	1.8%	0.019	0.019
2			507	1.6%		
1	K21	Gastro-esophageal reflux disease	6,661	20.6%	0.004	0.023
2			6,366	19.7%		
1	K22.7	Barrett's esophagus	243	0.8%	0.580	0.004
2			231	0.7%		
1	K22.0	Achalasia of cardia	30	0.1%	0.207	0.010
2			21	0.1%		

1	D69.4	Evans syndrome	0	0%		
2	1		10	0.0%	0.002	0.025
1	D50.1	Sideropenic dysphagia	56	0.2%		
2			51	0.2%	0.629	0.004
1	S27.81	Injury of esophagus (thoracic part)	10	0.0%		
2			10	0.0%	1	<0.001
1	C34	Malignant neoplasm of bronchus and lung	99	0.3%		
2			91	0.3%	0.561	0.005
1	C06	Malignant neoplasm of other and unspecified parts of mouth	10	0.0%		
2			11	0.0%	0.827	0.002
1	C32	Malignant neoplasm of larynx	13	0.0%		
2			10	0.0%	0.532	0.005
1	B97.7	Papillomavirus as the cause of diseases classified elsewhere	56	0.2%		
2			37	0.1%	0.049	0.016
1	R87.8	High risk human papillomavirus (HPV) DNA test	58	0.2%		
2	1	positive from female genital organs	50	0.2%	0.441	0.006
1	Z80.0	Family history of malignant neoplasm of digestive organs	408	1.3%		
2			356	1.1%	0.058	0.015
1	D10	Benign neoplasm of mouth and pharynx	38	0.1%		
2			17	0.1%	0.005	0.022
1	D13.0	Benign neoplasm of esophagus	10	0.0%		
2			10	0.0%	1	<0.001

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Sulfonylureas	5,424	16.8%		
2	B		5,348	16.6%	0.422	0.006
1	A10B	Alpha glucosidase inhibitors	124	0.4%		
2	F		116	0.4%	0.605	0.004
1	A10B	Thiazolidinediones	1,930	6.0%		
2	G		1,906	5.9%	0.689	0.003
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,465	10.7%		
2	H		3,384	10.5%	0.301	0.008

1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,747	5.4%	0.017	0.019
2	K		1,612	5.0%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	658	2.0%	0.118	0.012
2	X		603	1.9%		
1	A10A	INSULINS AND ANALOGUES	14,037	43.5%	0.446	0.006
2			13,941	43.2%		

eTable 15. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to breast cancer for the study populations of women (age 55 and older) with T2D and no history of any OAC

Group 1 (N = 10,497) and group 2 (N = 245,112) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	65.1 +/- 6.8	10,497	100%	<0.00	
2			66.2 +/- 7.2	245,112	100%	1	0.155
1	2106-3	White		7,228	68.9%	<0.00	
2				148,499	60.6%	1	0.174
1	1002-5	American Indian or Alaska Native		25	0.2%	0.148	
2				782	0.3%	0.015	
1	UNK	Unknown Race		883	8.4%	<0.00	
2				27,764	11.3%	1	0.098
1	2076-8	Native Hawaiian or Other Pacific Islander		43	0.4%	0.015	
2				1,458	0.6%	0.026	
1	UN	Unknown Ethnicity		2,019	19.2%	<0.00	
2				65,536	26.7%	1	0.179
1	2186-5	Not Hispanic or Latino		7,582	72.2%	<0.00	
2				155,608	63.5%	1	0.188
1	2135-2	Hispanic or Latino		896	8.5%	<0.00	
2				23,968	9.8%	1	0.043
1	2054-5	Black or African American		1,881	17.9%	0.055	
2				45,751	18.7%	0.019	
1	2028-9	Asian		178	1.7%	<0.00	
2				11,425	4.7%	1	0.170
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
		Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		135	1.3%	0.001	0.032	
2	Z65		2,329	1.0%			
1	E66	Overweight and obesity	3,810	36.3%	<0.00	0.442	
2			42,178	17.2%	1		

1	Z68.3	Body mass index [BMI] 30-39, adult	859 8,046	8.2% 3.3%	<0.00 1	0.212
1	Z68.4	Body mass index [BMI] 40 or greater, adult	948 6,215	9.0% 2.5%	<0.00 1	0.281
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	30 448	0.3% 0.2%	0.017	0.021
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	44 450	0.4% 0.2%	<0.00 1	0.043
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	42 567	0.4% 0.2%	0.001	0.030
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	51 611	0.5% 0.2%	<0.00 1	0.039
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	51 743	0.5% 0.3%	0.001	0.029
1	F10	Alcohol related disorders	67 2,158	0.6% 0.9%	0.009	0.028
1	Z80	Family history of primary malignant neoplasm	527 6,537	5.0% 2.7%	<0.00 1	0.123
1	Z15.0	Genetic susceptibility to malignant neoplasm	10 52	0.1% 0.0%	<0.00 1	0.031
1	Z12	Encounter for screening for malignant neoplasms	2,745 48,467	26.2% 19.8%	<0.00 1	0.152
1	Z85	Personal history of malignant neoplasm	369 6,840	3.5% 2.8%	<0.00 1	0.041
1	Z98.84	Bariatric surgery status	212 1,194	2.0% 0.5%	<0.00 1	0.138
1	E66.0	Obesity due to excess calories	1,970 15,667	18.8% 6.4%	<0.00 1	0.380
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	85 642	0.8% 0.3%	<0.00 1	0.075
1	E66.3	Overweight	169 2,054	1.6% 0.8%	<0.00 1	0.070

1	E66.8	Other obesity	61	0.6%	<0.00	
2			308	0.1%	1	0.077
1	E66.9	Obesity, unspecified	2,717	25.9%	<0.00	
2			31,871	13.0%	1	0.330
1	O92.7	Other and unspecified disorders of lactation	0	0%	0.513	0.009
2			10	0.0%		
1	Z79.89	Hormone replacement therapy	62	0.6%	0.014	0.023
2	0		1,053	0.4%		
1	Z92.23	Personal history of estrogen therapy	10	0.1%	0.013	0.020
2			105	0.0%		
1	Z98.82	Breast implant status	10	0.1%	<0.00	
2			69	0.0%	1	0.027
1	Z80.3	Family history of malignant neoplasm of breast	253	2.4%	<0.00	
2			3,111	1.3%	1	0.085
1	R92	Abnormal and inconclusive findings on diagnostic imaging of breast	663	6.3%	<0.00	
2			13,119	5.4%	1	0.041
1	D24	Benign neoplasm of breast	57	0.5%	0.875	0.002
2			1,303	0.5%		
1	N60	Benign mammary dysplasia	228	2.2%	0.253	0.011
2			4,931	2.0%		
1	N62	Hypertrophy of breast	30	0.3%	0.286	0.010
2			574	0.2%		
1	N63	Unspecified lump in breast	351	3.3%	0.571	0.006
2			7,951	3.2%		
1	N64	Other disorders of breast	425	4.0%	<0.00	
2			7,633	3.1%	1	0.050
1	N61	Inflammatory disorders of breast	43	0.4%	0.030	0.020
2			716	0.3%		
1	D05	Carcinoma in situ of breast	14	0.1%	0.541	0.006
2			386	0.2%		
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	C1789	Prosthesis, breast (implantable)	10	0.1%	<0.00	
2			10	0.0%	1	0.041

1	58300	Insertion of intrauterine device (IUD)	10 61	0.1% 0.0%	<0.00 1	0.029
1	1001	Radiation	28 902	0.3% 0.4%	0.092	0.018

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	4,577 42,173	43.6% 17.2%	<0.00 1	0.599
1	A10B	Sulfonylureas	1,853 19,472	17.7% 7.9%	<0.00 1	0.294
1	A10B	Alpha glucosidase inhibitors	35 272	0.3% 0.1%	<0.00 1	0.047
1	A10B	Thiazolidinediones	643 5,777	6.1% 2.4%	<0.00 1	0.188
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	1,273 5,583	12.1% 2.3%	<0.00 1	0.388
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	569 907	5.4% 0.4%	<0.00 1	0.305
1	A10B	Other blood glucose lowering drugs, excl. insulins	229 1,121	2.2% 0.5%	<0.00 1	0.152
1	HS200	CONTRACEPTIVE SYSTEMIC	189 2,971	1.8% 1.2%	<0.00 1	0.048

Group 1 (N = 10,419) and group 2 (N = 10,419) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	65.2 +/- 6.8 65.0 +/- 6.8	10,419 10,419	100% 100%	0.069 0.025
1	2106-3	White		7,159 7,326	68.7% 70.3%	0.012 0.035
1	1002-5	American Indian or Alaska Native		25 29	0.2% 0.3%	0.586 0.008
1	UNK	Unknown Race		881 825	8.5% 7.9%	0.157 0.020

1	2076-8	Native Hawaiian or Other Pacific Islander	43	0.4%	0.430	0.011
2			36	0.3%		
1	UN	Unknown Ethnicity	2,016	19.3%	0.032	0.030
2			1,895	18.2%		
1	2186-5	Not Hispanic or Latino	7,515	72.1%	0.005	0.039
2			7,696	73.9%		
1	2135-2	Hispanic or Latino	888	8.5%	0.131	0.021
2			828	7.9%		
1	2054-5	Black or African American	1,875	18.0%	0.197	0.018
2			1,804	17.3%		
1	2028-9	Asian	178	1.7%	0.247	0.016
2			157	1.5%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
Persons with potential health hazards related to socioeconomic and psychosocial circumstances						
1	Z55-		132	1.3%	0.755	0.004
2	Z65		127	1.2%		
1	E66	Overweight and obesity	3,757 3,796	36.1% 36.4%	0.574	0.008
1	Z68.3	Body mass index [BMI] 30-39, adult	840 844	8.1% 8.1%	0.919	0.001
1	Z68.4	Body mass index [BMI] 40 or greater, adult	921 874	8.8% 8.4%	0.246	0.016
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	30 23	0.3% 0.2%	0.336	0.013
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	42 41	0.4% 0.4%	0.912	0.002
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	40 44	0.4% 0.4%	0.662	0.006
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	50 47	0.5% 0.5%	0.760	0.004

1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	51	0.5%	0.350	0.013
2			42	0.4%		
1	F10	Alcohol related disorders	65	0.6%	0.044	0.028
2			44	0.4%		
1	Z80	Family history of primary malignant neoplasm	512	4.9%	0.006	0.038
2			429	4.1%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	10	0.1%	1	<0.001
2			10	0.1%		
1	Z12	Encounter for screening for malignant neoplasms	2,695	25.9%	<0.001	0.051
2			2,467	23.7%	1	
1	Z85	Personal history of malignant neoplasm	365	3.5%	0.121	0.021
2			325	3.1%		
1	Z98.84	Bariatric surgery status	200	1.9%	0.920	0.001
2			202	1.9%		
1	E66.0	Obesity due to excess calories	1,930	18.5%	0.972	<0.001
2			1,928	18.5%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	81	0.8%	0.874	0.002
2			79	0.8%		
1	E66.3	Overweight	165	1.6%	0.737	0.005
2			159	1.5%		
1	E66.8	Other obesity	58	0.6%	0.854	0.003
2			60	0.6%		
1	E66.9	Obesity, unspecified	2,678	25.7%	0.716	0.005
2			2,701	25.9%		
1	O92.7	Other and unspecified disorders of lactation	0	0%	--	--
2			0	0%		
1	Z79.89	Hormone replacement therapy	59	0.6%	0.779	0.004
2	0		56	0.5%		
1	Z92.23	Personal history of estrogen therapy	10	0.1%	1	<0.001
2			10	0.1%		
1	Z98.82	Breast implant status	10	0.1%	1	<0.001
2			10	0.1%		
1	Z80.3	Family history of malignant neoplasm of breast	246	2.4%	0.057	0.026
2			206	2.0%		

1	R92	Abnormal and inconclusive findings on diagnostic imaging of breast	653	6.3%	<0.001	0.051
2			530	5.1%	1	
1	D24	Benign neoplasm of breast	57	0.5%	0.379	0.012
2			48	0.5%		
1	N60	Benign mammary dysplasia	225	2.2%	0.006	0.038
2			171	1.6%		
1	N62	Hypertrophy of breast	29	0.3%	0.685	0.006
2			26	0.2%		
1	N63	Unspecified lump in breast	344	3.3%	0.001	0.048
2			260	2.5%		
1	N64	Other disorders of breast	414	4.0%	0.018	0.033
2			350	3.4%		
1	N61	Inflammatory disorders of breast	41	0.4%	0.238	0.016
2			31	0.3%		
1	D05	Carcinoma in situ of breast	13	0.1%	0.531	0.009
2			10	0.1%		
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	C1789	Prosthesis, breast (implantable)	10	0.1%	1	<0.001
2			10	0.1%		
1	58300	Insertion of intrauterine device (IUD)	10	0.1%	1	<0.001
2			10	0.1%		
1	1001	Radiation	28	0.3%	0.680	0.006
2			25	0.2%		
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	4,506	43.2%	0.502	0.009
2			4,458	42.8%		
1	A10B	Sulfonylureas	1,814	17.4%	0.770	0.004
2	B		1,830	17.6%		
1	A10B	Alpha glucosidase inhibitors	35	0.3%	0.714	0.005
2	F		32	0.3%		
1	A10B	Thiazolidinediones	624	6.0%	0.274	0.015
2	G		662	6.4%		

1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	1,220	11.7%	0.966	0.001
2	H		1,222	11.7%		
1	A10B	Sodium-glucose co- transporter 2 (SGLT2) inhibitors	496	4.8%	0.022	0.032
2	K		428	4.1%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	222	2.1%	0.962	0.001
2	X		223	2.1%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	187	1.8%	0.336	0.013
2			169	1.6%		

eTable 16. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to colorectal cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.001
2			60.1 +/- 14.0	856,160	100%	
1	2106-3	White		21,231	65.6%	<0.001
2				515,868	60.3%	
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	
1	UNK	Unknown Race		4,272	13.2%	<0.001
2				119,036	13.9%	
1	F	Female		17,278	53.4%	<0.001
2				399,923	46.7%	
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	
1	UN	Unknown Gender		1,670	5.2%	<0.001
2				19,592	2.3%	
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.001
2				528,686	61.8%	
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.001
2				91,303	10.7%	
1	2054-5	Black or African American		5,107	15.8%	<0.001
2				141,606	16.5%	
1	M	Male		13,417	41.5%	<0.001
2				436,645	51.0%	
1	2028-9	Asian		681	2.1%	<0.001
2				35,540	4.2%	
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and		422	1.3%	0.107
2	Z65			10,310	1.2%	

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	F10	Alcohol related disorders	460	1.4%	<0.00	0.076
2			21,150	2.5%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	F17	Nicotine dependence	2,399	7.4%	<0.00	0.059
2			77,335	9.0%	1	

1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00		0.361
2			56,178	6.6%	1		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00		0.069
2			2,051	0.2%	1		
1	E66.3	Overweight	535	1.7%	<0.00		0.066
2			7,794	0.9%	1		
1	E66.8	Other obesity	193	0.6%	<0.00		0.078
2			1,084	0.1%	1		
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00		0.307
2			113,380	13.2%	1		
1	K50	Crohn's disease [regional enteritis]	149	0.5%	<0.00		0.038
2			2,039	0.2%	1		
1	K51	Ulcerative colitis	126	0.4%	<0.00		0.020
2			2,339	0.3%	1		
1	K63.5	Polyp of colon	1,321	4.1%	<0.00		0.020
2			31,663	3.7%	1		
1	Z72.0	Tobacco use	588	1.8%	<0.00		0.034
2			11,927	1.4%	1		
1	Z83.71	Family history of colonic polyps	48	0.1%	<0.00		0.023
2			606	0.1%	1		
1	E84	Cystic fibrosis	10	0.0%			0.326
2			362	0.0%			0.006
1	Q85.8	Other phakomatoses, not elsewhere classified	10	0.0%		0.011	0.012
2			117	0.0%			
1	Z80.0	Family history of malignant neoplasm of digestive organs	413	1.3%	<0.00		0.055
2			6,255	0.7%	1		
1	D12	Benign neoplasm of colon, rectum, anus and anal canal	1,692	5.2%	<0.00		0.047
2			36,157	4.2%	1		

Procedure

Group		Mean \pm SD	Patients	% of Group	P-Value	SMD
1	10222	Colonoscopy, flexible	1,885	5.8%	<0.00	0.062
2	31		38,210	4.5%	1	

Medication

Group		Mean \pm SD	Patients	% of Group	P-Value	SMD

1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	0.560
2			159,901	18.7%	1	
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	0.269
2	B		69,045	8.1%	1	
1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	0.057
2	F		876	0.1%	1	
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	0.183
2	G		20,400	2.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	0.370
2	H		17,113	2.0%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00	0.312
2	K		3,371	0.4%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00	0.146
2	X		3,839	0.4%	1	

Group 1 (N = 32,275) and group 2 (N = 32,275) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,275	100%	0.287
2			58.9 +/- 13.2	32,275	100%	
1	2106-3	White		21,169	65.6%	<0.00
2				21,665	67.1%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.887
2				100	0.3%	
1	UNK	Unknown Race		4,258	13.2%	0.157
2				4,137	12.8%	
1	F	Female		17,215	53.3%	0.076
2				17,440	54.0%	
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.161
2				147	0.5%	
1	UN	Unknown Gender		1,658	5.1%	0.125
2				1,745	5.4%	
1	2186-5	Not Hispanic or Latino		22,237	68.9%	0.001
2				22,623	70.1%	
1	2135-2	Hispanic or Latino		2,652	8.2%	0.002
2				2,443	7.6%	

1	2054-5	Black or African American	5,093	15.8%	0.015	0.019
2			4,870	15.1%		
1	M	Male	13,402	41.5%	0.013	0.020
2			13,090	40.6%		
1	2028-9	Asian	681	2.1%	0.056	0.015
2			613	1.9%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		419	1.3%	0.004	0.022
2	Z65		341	1.1%		
1	E66	Overweight and obesity	11,353 11,321	35.2% 35.1%	0.792	0.002
1	Z68.3	Body mass index [BMI] 30-39, adult	3,252 3,157	10.1% 9.8%	0.211	0.010
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,976 2,889	9.2% 9.0%	0.233	0.009
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119 95	0.4% 0.3%	0.100	0.013
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150 126	0.5% 0.4%	0.148	0.011
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209 203	0.6% 0.6%	0.767	0.002
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264 265	0.8% 0.8%	0.965	<0.001
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299 275	0.9% 0.9%	0.314	0.008
1	F10	Alcohol related disorders	458 339	1.4% 1.1%	<0.001 1	0.033
1	Z80	Family history of primary malignant neoplasm	1,208 1,125	3.7% 3.5%	0.080	0.014

1	Z15.0	Genetic susceptibility to malignant neoplasm	18 10	0.1% 0.0%	0.130	0.012
1	Z12	Encounter for screening for malignant neoplasms	6,177 5,545	19.1% 17.2%	<0.00 1	0.051
1	Z85	Personal history of malignant neoplasm	1,108 1,059	3.4% 3.3%	0.284	0.008
1	Z98.84	Bariatric surgery status	519 503	1.6% 1.6%	0.614	0.004
1	F17	Nicotine dependence	2,390 2,101	7.4% 6.5%	<0.00 1	0.035
1	E66.0	Obesity due to excess calories	5,854 5,858	18.1% 18.2%	0.967	<0.001
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	227 224	0.7% 0.7%	0.887	0.001
1	E66.3	Overweight	530 434	1.6% 1.3%	0.002	0.025
1	E66.8	Other obesity	191 172	0.6% 0.5%	0.317	0.008
1	E66.9	Obesity, unspecified	8,109 7,992	25.1% 24.8%	0.287	0.008
1	K50	Crohn's disease [regional enteritis]	147 131	0.5% 0.4%	0.336	0.008
1	K51	Ulcerative colitis	126 103	0.4% 0.3%	0.128	0.012
1	K63.5	Polyp of colon	1,307 1,060	4.0% 3.3%	<0.00 1	0.041
1	Z72.0	Tobacco use	583 511	1.8% 1.6%	0.028	0.017
1	Z83.71	Family history of colonic polyps	46 52	0.1% 0.2%	0.544	0.005
1	E84	Cystic fibrosis	10 15	0.0% 0.0%	0.317	0.008
1	Q85.8	Other phakomatoses, not elsewhere classified	10 10	0.0% 0.0%	1	<0.001
1	Z80.0	Family history of malignant neoplasm of digestive organs	408 355	1.3% 1.1%	0.054	0.015

1	D12	Benign neoplasm of colon, rectum, anus and anal canal	1,675	5.2%	<0.00	
2			1,345	4.2%	1	0.048
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	10222	Colonoscopy, flexible	1,869	5.8%	<0.00	
2	31		1,530	4.7%	1	0.047
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,048	43.5%	0.116	0.012
2			13,850	42.9%		
1	A10B	Sulfonylureas	5,426	16.8%	0.186	0.010
2	B		5,301	16.4%		
1	A10B	Alpha glucosidase inhibitors	124	0.4%	1	<0.001
2	F		124	0.4%		
1	A10B	Thiazolidinediones	1,931	6.0%	0.817	0.002
2	G		1,945	6.0%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,474	10.8%	0.261	0.009
2	H		3,386	10.5%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,756	5.4%	0.019	0.019
2	K		1,623	5.0%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	660	2.0%	0.846	0.002
2	X		667	2.1%		

eTable 17. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to endometrial cancer for the study populations of women with T2D and no history of any OAC

Group 1 (N = 17,278) and group 2 (N = 399,923) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	57.7 +/- 12.8	17,278	100%	<0.00
2			60.0 +/- 14.7	399,923	100%	1
1	2106-3	White		11,336	65.6%	<0.00
2				231,828	58.0%	1
1	1002-5	American Indian or Alaska Native		59	0.3%	0.334
2				1,552	0.4%	0.008
1	UNK	Unknown Race		1,563	9.0%	<0.00
2				49,384	12.3%	1
1	2076-8	Native Hawaiian or Other Pacific Islander		80	0.5%	<0.00
2				2,869	0.7%	1
1	UN	Unknown Ethnicity		3,145	18.2%	<0.00
2				103,904	26.0%	1
1	2186-5	Not Hispanic or Latino		12,481	72.2%	<0.00
2				247,896	62.0%	1
1	2135-2	Hispanic or Latino		1,652	9.6%	<0.00
2				48,123	12.0%	1
1	2054-5	Black or African American		3,476	20.1%	0.723
2				80,016	20.0%	0.003
1	2028-9	Asian		311	1.8%	<0.00
2				17,483	4.4%	1
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to		270	1.6%	0.003
2	Z65	socioeconomic and psychosocial circumstances		5,204	1.3%	0.022
1	E66	Overweight and obesity		6,461	37.4%	<0.00
2				78,874	19.7%	1
						0.399

1	Z68.3	Body mass index [BMI] 30-39, adult	1,360 13,007	7.9% 3.3%	<0.00 1	0.203
1	Z68.4	Body mass index [BMI] 40 or greater, adult	1,671 12,991	9.7% 3.2%	<0.00 1	0.264
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	39 643	0.2% 0.2%	0.039	0.015
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	52 616	0.3% 0.2%	<0.00 1	0.031
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	59 760	0.3% 0.2%	<0.00 1	0.029
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	69 862	0.4% 0.2%	<0.00 1	0.033
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	76 1,029	0.4% 0.3%	<0.00 1	0.031
1	Z80	Family history of primary malignant neoplasm	821 9,798	4.8% 2.4%	<0.00 1	0.124
1	Z15.0	Genetic susceptibility to malignant neoplasm	15 91	0.1% 0.0%	<0.00 1	0.027
1	Z12	Encounter for screening for malignant neoplasms	4,113 71,089	23.8% 17.8%	<0.00 1	0.149
1	Z85	Personal history of malignant neoplasm	492 9,342	2.8% 2.3%	<0.00 1	0.032
1	Z98.84	Bariatric surgery status	378 2,056	2.2% 0.5%	<0.00 1	0.145
1	E66.0	Obesity due to excess calories	3,456 31,701	20.0% 7.9%	<0.00 1	0.354
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	132 1,060	0.8% 0.3%	<0.00 1	0.070
1	E66.3	Overweight	280 3,619	1.6% 0.9%	<0.00 1	0.064
1	E66.8	Other obesity	118 574	0.7% 0.1%	<0.00 1	0.084

1	E66.9	Obesity, unspecified	4,568	26.4%	<0.00	
2			59,095	14.8%	1	0.291
1	Z72.3	Lack of physical exercise	10	0.1%	0.110	0.011
2			138	0.0%		
1	Z72.4	Inappropriate diet and eating habits	30	0.2%	<0.00	
2			73	0.0%	1	0.050
1	Z79.89	Hormone replacement therapy	85	0.5%	<0.00	
2	0		1,319	0.3%	1	0.025
1	Z92.23	Personal history of estrogen therapy	10	0.1%	0.030	0.014
2			115	0.0%		
1	E28.2	Polycystic ovarian syndrome	264	1.5%	<0.00	
2			3,504	0.9%	1	0.060
1	Z80.41	Family history of malignant neoplasm of ovary	50	0.3%	<0.00	
2			568	0.1%	1	0.032
1	Z80.49	Family history of malignant neoplasm of other genital organs	27	0.2%	<0.00	
2			261	0.1%	1	0.027
1	N85.0	Endometrial hyperplasia	94	0.5%	<0.00	
2			1,487	0.4%	1	0.026
1	D25	Leiomyoma of uterus	470	2.7%	0.026	0.017
2			9,804	2.5%		
1	D26	Other benign neoplasms of uterus	20	0.1%	0.703	0.003
2			505	0.1%		
1	D27	Benign neoplasm of ovary	39	0.2%	0.871	0.001
2			879	0.2%		
1	Z80.3	Family history of malignant neoplasm of breast	390	2.3%	<0.00	
2			4,796	1.2%	1	0.081

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	58300	Insertion of intrauterine device (IUD)	122	0.7%	<0.00	
2			1,090	0.3%	1	0.062
1	1001	Radiation	43	0.2%	0.047	0.016
2			1,352	0.3%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
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1	A10A	INSULINS AND ANALOGUES	7,387	42.8%	<0.00	0.558
2			72,077	18.0%	1	
1	A10B	Sulfonylureas	2,808	16.3%	<0.00	0.261
2	B		31,308	7.8%	1	
1	A10B	Alpha glucosidase inhibitors	60	0.3%	<0.00	0.050
2	F		436	0.1%	1	
1	A10B	Thiazolidinediones	974	5.6%	<0.00	0.172
2	G		9,195	2.3%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	1,906	11.0%	<0.00	0.374
2	H		7,852	2.0%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	918	5.3%	<0.00	0.305
2	K		1,296	0.3%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	349	2.0%	<0.00	0.142
2	X		1,821	0.5%	1	
1	HS200	CONTRACEPTIVE S,SYSTEMIC	718	4.2%	<0.00	0.084
2			10,566	2.6%	1	
1	10324	tamoxifen	17	0.1%	0.246	0.008
2			295	0.1%		

Group 1 (N = 17,168) and group 2 (N = 17,168) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	57.8 +/- 12.8	17,168	100%	0.118
2			57.5 +/- 13.8	17,168	100%	
1	2106-3	White		11,256	65.6%	0.001
2				11,549	67.3%	0.036
1	1002-5	American Indian or Alaska Native		59	0.3%	0.926
2				58	0.3%	0.001
1	UNK	Unknown Race		1,559	9.1%	0.298
2				1,504	8.8%	0.011
1	2076-8	Native Hawaiian or Other Pacific Islander		80	0.5%	0.937
2				79	0.5%	0.001
1	UN	Unknown Ethnicity		3,140	18.3%	0.044
2				2,997	17.5%	0.022
1	2186-5	Not Hispanic or Latino		12,387	72.2%	0.001
2				12,659	73.7%	0.036

1	2135-2	Hispanic or Latino	1,641	9.6%	0.016	0.026
2			1,512	8.8%		
1	2054-5	Black or African American	3,454	20.1%	0.071	0.019
2			3,321	19.3%		
1	2028-9	Asian	310	1.8%	0.025	0.024
2			257	1.5%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		268	1.6%	0.151	0.015
2	Z65		236	1.4%		
1	E66	Overweight and obesity	6,388 6,343	37.2% 36.9%	0.615	0.005
1	Z68.3	Body mass index [BMI] 30-39, adult	1,331 1,299	7.8% 7.6%	0.516	0.007
1	Z68.4	Body mass index [BMI] 40 or greater, adult	1,636 1,580	9.5% 9.2%	0.300	0.011
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	38 24	0.2% 0.1%	0.075	0.019
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	51 42	0.3% 0.2%	0.350	0.010
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	58 56	0.3% 0.3%	0.851	0.002
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	66 56	0.4% 0.3%	0.364	0.010
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	75 58	0.4% 0.3%	0.140	0.016
1	Z80	Family history of primary malignant neoplasm	798 716	4.6% 4.2%	0.031	0.023

1	Z15.0	Genetic susceptibility to malignant neoplasm	15 11	0.1% 0.1%	0.433	0.008
1	Z12	Encounter for screening for malignant neoplasms	4,054 3,674	23.6% 21.4%	<0.001	0.053
1	Z85	Personal history of malignant neoplasm	488 435	2.8% 2.5%	0.077	0.019
1	Z98.84	Bariatric surgery status	365 352	2.1% 2.1%	0.624	0.005
1	E66.0	Obesity due to excess calories	3,402 3,400	19.8% 19.8%	0.978	<0.001
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	131 111	0.8% 0.6%	0.197	0.014
1	E66.3	Overweight	274 235	1.6% 1.4%	0.082	0.019
1	E66.8	Other obesity	112 113	0.7% 0.7%	0.947	0.001
1	E66.9	Obesity, unspecified	4,514 4,433	26.3% 25.8%	0.319	0.011
1	Z72.3	Lack of physical exercise	10 10	0.1% 0.1%	1	<0.001
1	Z72.4	Inappropriate diet and eating habits	25 30	0.1% 0.2%	0.500	0.007
1	Z79.89	Hormone replacement therapy	83 67	0.5% 0.4%	0.190	0.014
1	Z92.23	Personal history of estrogen therapy	10 10	0.1% 0.1%	1	<0.001
1	E28.2	Polycystic ovarian syndrome	260 243	1.5% 1.4%	0.445	0.008
1	Z80.41	Family history of malignant neoplasm of ovary	47 45	0.3% 0.3%	0.835	0.002
1	Z80.49	Family history of malignant neoplasm of other genital organs	27 21	0.2% 0.1%	0.386	0.009
1	N85.0	Endometrial hyperplasia	93 85	0.5% 0.5%	0.548	0.006
1	D25	Leiomyoma of uterus	465 400	2.7% 2.3%	0.025	0.024

1	D26	Other benign neoplasms of uterus	20	0.1%	0.505	0.007
2			16	0.1%		
1	D27	Benign neoplasm of ovary	38	0.2%	0.133	0.016
2			26	0.2%		

1	Z80.3	Family history of malignant neoplasm of breast	380	2.2%	0.036	0.023
2			325	1.9%		

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	58300	Insertion of intrauterine device (IUD)	118	0.7%	0.792	0.003
2			114	0.7%		
1	1001	Radiation	43	0.3%	0.578	0.006
2			38	0.2%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	7,290	42.5%	0.686	0.004
2			7,253	42.2%		
1	A10B	Sulfonylureas	2,753	16.0%	0.941	0.001
2	B		2,748	16.0%		
1	A10B	Alpha glucosidase inhibitors	59	0.3%	0.570	0.006
2	F		53	0.3%		
1	A10B	Thiazolidinediones	949	5.5%	0.340	0.010
2	G		909	5.3%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	1,827	10.6%	0.650	0.005
2	H		1,853	10.8%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	817	4.8%	0.021	0.025
2	K		728	4.2%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	328	1.9%	0.639	0.005
2	X		340	2.0%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	704	4.1%	0.023	0.024
2			623	3.6%		
1	10324	tamoxifen	17	0.1%	0.862	0.002
2			16	0.1%		

eTable 18. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to gallbladder cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.00
2			60.1 +/- 14.0	856,160	100%	1
1	2106-3	White		21,231	65.6%	<0.00
2				515,868	60.3%	1
1	UNK	Unknown Race		4,272	13.2%	<0.00
2				119,036	13.9%	1
1	F	Female		17,278	53.4%	<0.00
2				399,923	46.7%	1
1	UN	Unknown Gender		1,670	5.2%	<0.00
2				19,592	2.3%	1
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.00
2				528,686	61.8%	1
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.00
2				91,303	10.7%	1
1	2054-5	Black or African American		5,107	15.8%	<0.00
2				141,606	16.5%	1
1	M	Male		13,417	41.5%	<0.00
2				436,645	51.0%	1
1	2028-9	Asian		681	2.1%	<0.00
2				35,540	4.2%	1
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to		422	1.3%	
2	Z65	socioeconomic and psychosocial circumstances		10,310	1.2%	0.107
1	E66	Overweight and obesity		11,418	35.3%	<0.00
2				149,974	17.5%	1
1	Z68.3	Body mass index [BMI] 30-39, adult		3,285	10.1%	<0.00
2				32,977	3.9%	1

1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012 23,535	9.3% 2.7%	<0.00 1	0.278
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119 2,293	0.4% 0.3%	0.001	0.018
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150 2,433	0.5% 0.3%	<0.00 1	0.029
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209 2,942	0.6% 0.3%	<0.00 1	0.043
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264 3,317	0.8% 0.4%	<0.00 1	0.055
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299 3,753	0.9% 0.4%	<0.00 1	0.059
1	F10	Alcohol related disorders	460 21,150	1.4% 2.5%	<0.00 1	0.076
1	Z80	Family history of primary malignant neoplasm	1,222 16,133	3.8% 1.9%	<0.00 1	0.114
1	Z15.0	Genetic susceptibility to malignant neoplasm	18 140	0.1% 0.0%	<0.00 1	0.021
1	Z12	Encounter for screening for malignant neoplasms	6,223 114,996	19.2% 13.4%	<0.00 1	0.157
1	Z85	Personal history of malignant neoplasm	1,111 23,231	3.4% 2.7%	<0.00 1	0.042
1	Z98.84	Bariatric surgery status	534 2,989	1.6% 0.3%	<0.00 1	0.131
1	F17	Nicotine dependence	2,399 77,335	7.4% 9.0%	<0.00 1	0.059
1	E66.0	Obesity due to excess calories	5,910 56,178	18.3% 6.6%	<0.00 1	0.361
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230 2,051	0.7% 0.2%	<0.00 1	0.069
1	E66.3	Overweight	535 7,794	1.7% 0.9%	<0.00 1	0.066

1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
1	Z72.0	Tobacco use	588	1.8%	<0.00	
2			11,927	1.4%	1	0.034
1	K80	Cholelithiasis	871	2.7%	<0.00	
2			17,909	2.1%	1	0.039
1	K82.8	Other specified diseases of gallbladder	129	0.4%	<0.00	
2			2,130	0.2%	1	0.026
1	Q44.4	Choledochal cyst	10	0.0%	0.119	0.008
2			160	0.0%		
1	Q44.5	Other congenital malformations of bile ducts	10	0.0%	0.684	0.002
2			232	0.0%		
1	K82.4	Cholesterosis of gallbladder	55	0.2%	0.006	0.014
2			998	0.1%		
1	K83.0	Primary sclerosing cholangitis	10	0.0%	<0.00	
2	1		36	0.0%	1	0.020
1	A01.0	Typhoid fever	10	0.0%	<0.00	
2			17	0.0%	1	0.023
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%	0.032	0.010
2			133	0.0%		
1	D13.5	Benign neoplasm of extrahepatic bile ducts	12	0.0%	0.944	<0.001
2			311	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	0.560
2			159,901	18.7%	1	
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	0.269
2	B		69,045	8.1%	1	
1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	0.057
2	F		876	0.1%	1	
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	0.183
2	G		20,400	2.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	0.370
2	H		17,113	2.0%	1	

1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00	
2	K		3,371	0.4%	1	0.312
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00	
2	X		3,839	0.4%	1	0.146

Group 1 (N = 32,261) and group 2 (N = 32,261) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,261	100%	0.493
2			58.9 +/- 13.3	32,261	100%	
1	2106-3	White		21,159	65.6%	<0.00
2				21,672	67.2%	1
1	UNK	Unknown Race		4,253	13.2%	0.237
2				4,152	12.9%	
1	F	Female		17,211	53.3%	0.134
2				17,401	53.9%	
1	UN	Unknown Gender		1,654	5.1%	0.210
2				1,725	5.3%	
1	2186-5	Not Hispanic or Latino		22,225	68.9%	0.011
2				22,522	69.8%	
1	2135-2	Hispanic or Latino		2,653	8.2%	0.032
2				2,505	7.8%	
1	2054-5	Black or African American		5,095	15.8%	0.002
2				4,817	14.9%	
1	M	Male		13,396	41.5%	0.037
2				13,135	40.7%	
1	2028-9	Asian		681	2.1%	0.011
2				591	1.8%	

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to		420	1.3%	0.021
2	Z65	socioeconomic and psychosocial circumstances		356	1.1%	
1	E66	Overweight and obesity		11,341	35.2%	0.863
2				11,362	35.2%	

1	Z68.3	Body mass index [BMI] 30-39, adult	3,255 3,223	10.1% 10.0%	0.675	0.003
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,967 2,840	9.2% 8.8%	0.081	0.014
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119 112	0.4% 0.3%	0.645	0.004
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	149 117	0.5% 0.4%	0.049	0.015
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209 174	0.6% 0.5%	0.073	0.014
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	263 243	0.8% 0.8%	0.372	0.007
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	298 314	0.9% 1.0%	0.516	0.005
1	F10	Alcohol related disorders	459 356	1.4% 1.1%	<0.00 1	0.029
1	Z80	Family history of primary malignant neoplasm	1,210 1,076	3.8% 3.3%	0.004	0.022
1	Z15.0	Genetic susceptibility to malignant neoplasm	18 19	0.1% 0.1%	0.869	0.001
1	Z12	Encounter for screening for malignant neoplasms	6,177 5,562	19.1% 17.2%	<0.00 1	0.049
1	Z85	Personal history of malignant neoplasm	1,106 1,050	3.4% 3.3%	0.220	0.010
1	Z98.84	Bariatric surgery status	517 571	1.6% 1.8%	0.099	0.013
1	F17	Nicotine dependence	2,392 2,115	7.4% 6.6%	<0.00 1	0.034
1	E66.0	Obesity due to excess calories	5,850 5,854	18.1% 18.1%	0.967	<0.001
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	228 213	0.7% 0.7%	0.474	0.006

1	E66.3	Overweight	531	1.6%		
2			473	1.5%	0.065	0.015
1	E66.8	Other obesity	191	0.6%		
2			189	0.6%	0.918	0.001
1	E66.9	Obesity, unspecified	8,099	25.1%		
2			8,093	25.1%	0.957	<0.001
1	Z72.0	Tobacco use	585	1.8%		
2			477	1.5%	0.001	0.026
1	K80	Cholelithiasis	866	2.7%		
2			758	2.3%	0.007	0.021
1	K82.8	Other specified diseases of gallbladder	127	0.4%		
2			118	0.4%	0.565	0.005
1	Q44.4	Choledochal cyst	10	0.0%		
2			10	0.0%	1	<0.001
1	Q44.5	Other congenital malformations of bile ducts	10	0.0%		
2			10	0.0%	1	<0.001
1	K82.4	Cholesterolosis of gallbladder	55	0.2%		
2			46	0.1%	0.370	0.007
1	K83.0	Primary sclerosing cholangitis	10	0.0%		
2	1		10	0.0%	1	<0.001
1	A01.0	Typhoid fever	10	0.0%		
2			10	0.0%	1	<0.001
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%		
2			10	0.0%	1	<0.001
1	D13.5	Benign neoplasm of extrahepatic bile ducts	12	0.0%		
2			10	0.0%	0.670	0.003

Medication

Group		Mean \pm SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,038	43.5%		
2			13,911	43.1%	0.313	0.008
1	A10B	Sulfonylureas	5,421	16.8%		
2	B		5,369	16.6%	0.583	0.004
1	A10B	Alpha glucosidase inhibitors	122	0.4%		
2	F		114	0.4%	0.602	0.004
1	A10B	Thiazolidinediones	1,932	6.0%		
2	G		1,896	5.9%	0.549	0.005

1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,467	10.7%	0.483	0.006
2	H		3,412	10.6%		
1	A10B	Sodium-glucose co- transporter 2 (SGLT2) inhibitors	1,746	5.4%	0.003	0.024
2	K		1,578	4.9%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	657	2.0%	0.845	0.002
2	X		650	2.0%		

eTable 19. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to stomach cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.001
2			60.1 +/- 14.0	856,160	100%	
1	2106-3	White		21,231	65.6%	<0.001
2				515,868	60.3%	
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	
1	UNK	Unknown Race		4,272	13.2%	<0.001
2				119,036	13.9%	
1	F	Female		17,278	53.4%	<0.001
2				399,923	46.7%	
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	
1	UN	Unknown Gender		1,670	5.2%	<0.001
2				19,592	2.3%	
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.001
2				528,686	61.8%	
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.001
2				91,303	10.7%	
1	2054-5	Black or African American		5,107	15.8%	<0.001
2				141,606	16.5%	
1	M	Male		13,417	41.5%	<0.001
2				436,645	51.0%	
1	2028-9	Asian		681	2.1%	<0.001
2				35,540	4.2%	
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and		422	1.3%	0.107
2	Z65			10,310	1.2%	

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	F10	Alcohol related disorders	460	1.4%	<0.00	0.076
2			21,150	2.5%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	F17	Nicotine dependence	2,399	7.4%	<0.00	0.059
2			77,335	9.0%	1	

1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00	
2			56,178	6.6%	1	0.361
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00	
2			2,051	0.2%	1	0.069
1	E66.3	Overweight	535	1.7%	<0.00	
2			7,794	0.9%	1	0.066
1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
1	Z72.0	Tobacco use	588	1.8%	<0.00	
2			11,927	1.4%	1	0.034
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%		
2			133	0.0%	0.032	0.010
1	B96.8	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	141	0.4%		
2	1		3,386	0.4%	0.259	0.006
1	D13.1	Benign neoplasm of stomach	163	0.5%	<0.00	
2			2,312	0.3%	1	0.038
1	K31.7	Polyp of stomach and duodenum	216	0.7%	<0.00	
2			2,635	0.3%	1	0.052
1	D51.0	Vitamin B12 deficiency anemia due to intrinsic factor deficiency	103	0.3%	<0.00	
2			1,532	0.2%	1	0.028
1	Z80.0	Family history of malignant neoplasm of digestive organs	413	1.3%	<0.00	
2			6,255	0.7%	1	0.055
1	D83	Common variable immunodeficiency	21	0.1%	<0.00	
2			206	0.0%	1	0.019
1	B27	Infectious mononucleosis	30	0.1%	<0.00	
2			409	0.0%	1	0.017

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	10073	Excision Procedures	10	0.0%	<0.00	
2	52	on the Stomach	76	0.0%	1	0.016

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1 A10A	INSULINS AND ANALOGUES		14,131 159,901	43.7% 18.7%	<0.00 1	0.560
1 A10B	Sulfonylureas		5,464 69,045	16.9% 8.1%	<0.00 1	0.269
1 A10B	Alpha glucosidase inhibitors		124 876	0.4% 0.1%	<0.00 1	0.057
1 A10B	Thiazolidinediones		1,960 20,400	6.1% 2.4%	<0.00 1	0.183
1 A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors		3,547 17,113	11.0% 2.0%	<0.00 1	0.370
1 A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors		1,839 3,371	5.7% 0.4%	<0.00 1	0.312
1 A10B	Other blood glucose lowering drugs, excl. insulins		672 3,839	2.1% 0.4%	<0.00 1	0.146

Group 1 (N = 32,268) and group 2 (N = 32,268) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1 AI	Age at Index	59.0 +/- 12.4 58.8 +/- 13.3	32,268 32,268	100% 100%	0.025	0.018
1 2106-3	White		21,162 21,585	65.6% 66.9%	<0.00 1	0.028
1 1002-5	American Indian or Alaska Native		98 103	0.3% 0.3%	0.724	0.003
1 UNK	Unknown Race		4,259 4,178	13.2% 12.9%	0.344	0.007
1 F	Female		17,213 17,550	53.3% 54.4%	0.008	0.021
1 2076-8	Native Hawaiian or Other Pacific Islander		172 165	0.5% 0.5%	0.702	0.003
1 UN	Unknown Gender		1,659 1,684	5.1% 5.2%	0.657	0.003
1 2186-5	Not Hispanic or Latino		22,225 22,662	68.9% 70.2%	<0.00 1	0.029

1	2135-2	Hispanic or Latino	2,654	8.2%	0.007	0.021
2			2,468	7.6%		
1	2054-5	Black or African American	5,092	15.8%	0.017	0.019
2			4,873	15.1%		
1	M	Male	13,396	41.5%	0.004	0.023
2			13,034	40.4%		
1	2028-9	Asian	681	2.1%	0.005	0.022
2			582	1.8%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
	Persons with potential health hazards related to socioeconomic and psychosocial circumstances					
1	Z55-		419	1.3%	0.001	0.026
2	Z65		328	1.0%		
1	E66	Overweight and obesity	11,344 11,249	35.2% 34.9%	0.433	0.006
1	Z68.3	Body mass index [BMI] 30-39, adult	3,252 3,141	10.1% 9.7%	0.144	0.012
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,970 2,850	9.2% 8.8%	0.099	0.013
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119 96	0.4% 0.3%	0.116	0.012
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150 109	0.5% 0.3%	0.011	0.020
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209 179	0.6% 0.6%	0.127	0.012
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	263 224	0.8% 0.7%	0.076	0.014
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299 250	0.9% 0.8%	0.036	0.017
1	F10	Alcohol related disorders	459 352	1.4% 1.1%	<0.001	0.030

1	Z80	Family history of primary malignant neoplasm	1,210	3.7%	0.011	0.020
2			1,090	3.4%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	1	<0.001
2			18	0.1%		
1	Z12	Encounter for screening for malignant neoplasms	6,175	19.1%	<0.00	0.048
2			5,575	17.3%	1	
1	Z85	Personal history of malignant neoplasm	1,105	3.4%	0.237	0.009
2			1,051	3.3%		
1	Z98.84	Bariatric surgery status	519	1.6%	0.755	0.002
2			529	1.6%		
1	F17	Nicotine dependence	2,392	7.4%	<0.00	0.031
2			2,137	6.6%	1	
1	E66.0	Obesity due to excess calories	5,850	18.1%	0.690	0.003
2			5,811	18.0%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	228	0.7%	0.208	0.010
2			202	0.6%		
1	E66.3	Overweight	531	1.6%	0.041	0.016
2			467	1.4%		
1	E66.8	Other obesity	190	0.6%	0.400	0.007
2			174	0.5%		
1	E66.9	Obesity, unspecified	8,103	25.1%	0.555	0.005
2			8,038	24.9%		
1	Z72.0	Tobacco use	585	1.8%	0.004	0.023
2			491	1.5%		
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10	0.0%	1	<0.001
2			10	0.0%		
1	B96.8	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	141	0.4%	0.004	0.022
2	1		97	0.3%		
1	D13.1	Benign neoplasm of stomach	163	0.5%	0.092	0.013
2			134	0.4%		
1	K31.7	Polyp of stomach and duodenum	213	0.7%	0.175	0.011
2			186	0.6%		
1	D51.0	Vitamin B12 deficiency anemia	103	0.3%	0.216	0.010
2			86	0.3%		

due to intrinsic factor deficiency						
1	Z80.0	Family history of malignant neoplasm of digestive organs	409 345	1.3% 1.1%	0.019	0.018
1	D83	Common variable immunodeficiency	21 18	0.1% 0.1%	0.631	0.004
1	B27	Infectious mononucleosis	30 28	0.1% 0.1%	0.793	0.002
Procedure						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	10073	Excision Procedures	10	0.0%	1	<0.001
2	52	on the Stomach	10	0.0%		
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,042 13,998	43.5% 43.4%	0.727	0.003
1	A10B	Sulfonylureas	5,424 5,277	16.8% 16.4%	0.120	0.012
1	A10B	Alpha glucosidase inhibitors	124 110	0.4% 0.3%	0.359	0.007
2	G	Thiazolidinediones	1,932 1,926	6.0% 6.0%	0.921	0.001
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,470 3,356	10.8% 10.4%	0.145	0.011
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,751 1,614	5.4% 5.0%	0.015	0.019
1	X	Other blood glucose lowering drugs, excl. insulins	660 664	2.0% 2.1%	0.912	0.001

eTable 20. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to kidney cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.001
2			60.1 +/- 14.0	856,160	100%	
1	2106-3	White	21,231	65.6%	<0.001	0.111
2			515,868	60.3%		
1	1002-5	American Indian or Alaska Native	98	0.3%	0.092	0.010
2			3,080	0.4%		
1	UNK	Unknown Race	4,272	13.2%	<0.001	0.021
2			119,036	13.9%		
1	F	Female	17,278	53.4%	<0.001	0.134
2			399,923	46.7%		
1	2076-8	Native Hawaiian or Other Pacific Islander	172	0.5%	0.001	0.020
2			5,884	0.7%		
1	UN	Unknown Gender	1,670	5.2%	<0.001	0.152
2			19,592	2.3%		
1	2186-5	Not Hispanic or Latino	22,299	68.9%	<0.001	0.151
2			528,686	61.8%		
1	2135-2	Hispanic or Latino	2,660	8.2%	<0.001	0.084
2			91,303	10.7%		
1	2054-5	Black or African American	5,107	15.8%	<0.001	0.021
2			141,606	16.5%		
1	M	Male	13,417	41.5%	<0.001	0.192
2			436,645	51.0%		
1	2028-9	Asian	681	2.1%	<0.001	0.118
2			35,540	4.2%		
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and	422	1.3%	0.107	0.009
2	Z65		10,310	1.2%		

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	I10	Essential (primary) hypertension	19,775	61.1%	<0.00	0.259
2			413,462	48.3%	1	
1	F17	Nicotine dependence	2,399	7.4%	<0.00	0.059
2			77,335	9.0%	1	

1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00		0.361
2			56,178	6.6%	1		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00		0.069
2			2,051	0.2%	1		
1	E66.3	Overweight	535	1.7%	<0.00		0.066
2			7,794	0.9%	1		
1	E66.8	Other obesity	193	0.6%	<0.00		0.078
2			1,084	0.1%	1		
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00		0.307
2			113,380	13.2%	1		
1	Z72.0	Tobacco use	588	1.8%	<0.00		0.034
2			11,927	1.4%	1		
1	Z80.51	Family history of malignant neoplasm of kidney	12	0.0%		0.002	0.014
2			129	0.0%			
1	N18	Chronic kidney disease (CKD)	6,496	20.1%	<0.00		0.504
2			35,429	4.1%	1		
1	N19	Unspecified kidney failure	530	1.6%	<0.00		0.133
2			2,836	0.3%	1		
1	Z99.2	Dependence on renal dialysis	548	1.7%	<0.00		0.167
2			979	0.1%	1		
1	N17-	Acute kidney failure and chronic kidney disease	7,323	22.6%	<0.00		0.466
2	N19		56,470	6.6%	1		
1	Q85.8	Von Hippel-Lindau syndrome	0	0%		0.539	0.005
2	3		10	0.0%			
1	Q85.1	Tuberous sclerosis	0	0%		0.237	0.009
2			37	0.0%			
1	D57.1	Sickle-cell disease without crisis	10	0.0%		0.783	0.002
2			289	0.0%			
1	D30.0	Benign neoplasm of kidney	33	0.1%	<0.00		0.026
2			301	0.0%	1		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	0.560
2			159,901	18.7%	1	
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	0.269
2	B		69,045	8.1%	1	

1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	0.057
2	F		876	0.1%	1	
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	0.183
2	G		20,400	2.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	0.370
2	H		17,113	2.0%	1	
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00	0.312
2	K		3,371	0.4%	1	
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00	0.146
2	X		3,839	0.4%	1	
1	161	acetaminophen	10,835	33.5%	<0.00	0.123
2			238,323	27.8%	1	

Group 1 (N = 32,162) and group 2 (N = 32,162) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,162	100%	0.912
2			59.0 +/- 13.7	32,162	100%	
1	2106-3	White		21,094	65.6%	<0.00
2				21,683	67.4%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.777
2				102	0.3%	
1	UNK	Unknown Race		4,244	13.2%	0.018
2				4,043	12.6%	
1	F	Female		17,170	53.4%	0.150
2				17,352	54.0%	
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.291
2				153	0.5%	
1	UN	Unknown Gender		1,648	5.1%	0.424
2				1,693	5.3%	
1	2186-5	Not Hispanic or Latino		22,153	68.9%	<0.00
2				22,767	70.8%	1
1	2135-2	Hispanic or Latino		2,642	8.2%	<0.00
2				2,283	7.1%	1
1	2054-5	Black or African American		5,076	15.8%	0.016
2				4,856	15.1%	

1	M	Male	13,344	41.5%	0.069	0.014
2			13,117	40.8%		
1	2028-9	Asian	677	2.1%	0.006	0.022
2			581	1.8%		
Diagnosis						
Group			Mean ± SD	Patients	% of Group	P-Value
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances		417	1.3%	0.092
2	Z65			370	1.2%	0.013
1	E66	Overweight and obesity	11,266 11,139	35.0% 34.6%	0.293	0.008
1	Z68.3	Body mass index [BMI] 30-39, adult	3,223 3,159	10.0% 9.8%	0.399	0.007
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,929 2,900	9.1% 9.0%	0.690	0.003
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	118 96	0.4% 0.3%	0.132	0.012
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	148 121	0.5% 0.4%	0.099	0.013
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	207 159	0.6% 0.5%	0.012	0.020
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	259 249	0.8% 0.8%	0.656	0.004
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	296 283	0.9% 0.9%	0.587	0.004
1	Z80	Family history of primary malignant neoplasm	1,195 1,136	3.7% 3.5%	0.213	0.010
1	Z15.0	Genetic susceptibility to malignant neoplasm	18 13	0.1% 0.0%	0.369	0.007

1	Z12	Encounter for screening for malignant neoplasms	6,128	19.1%	<0.00	
2			5,534	17.2%	1	0.048
1	Z85	Personal history of malignant neoplasm	1,096	3.4%	0.039	0.016
2			1,003	3.1%		
1	Z98.84	Bariatric surgery status	510	1.6%	0.899	0.001
2			506	1.6%		
1	I10	Essential (primary) hypertension	19,593	60.9%	<0.00	
2			19,079	59.3%	1	0.033
1	F17	Nicotine dependence	2,384	7.4%	<0.00	
2			2,112	6.6%	1	0.033
1	E66.0	Obesity due to excess calories	5,798	18.0%	0.712	0.003
2			5,762	17.9%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	226	0.7%	0.068	0.014
2			189	0.6%		
1	E66.3	Overweight	529	1.6%	0.105	0.013
2			478	1.5%		
1	E66.8	Other obesity	190	0.6%	0.290	0.008
2			170	0.5%		
1	E66.9	Obesity, unspecified	8,037	25.0%	0.333	0.008
2			7,931	24.7%		
1	Z72.0	Tobacco use	579	1.8%	0.028	0.017
2			507	1.6%		
1	Z80.51	Family history of malignant neoplasm of kidney	12	0.0%	0.670	0.003
2			10	0.0%		
1	N18	Chronic kidney disease (CKD)	6,366	19.8%	0.649	0.004
2			6,320	19.7%		
1	N19	Unspecified kidney failure	510	1.6%	0.567	0.005
2			492	1.5%		
1	Z99.2	Dependence on renal dialysis	514	1.6%	0.236	0.009
2			477	1.5%		
1	N17-	Acute kidney failure and chronic kidney disease	7,189	22.4%	0.426	0.006
2	N19		7,105	22.1%		
1	Q85.8	Von Hippel-Lindau syndrome	0	0%	--	--
2	3		0	0%		
1	Q85.1	Tuberous sclerosis	0	0%	--	--
2			0	0%		
1	D57.1	Sickle-cell disease without crisis	10	0.0%	0.827	0.002
2			11	0.0%		

1	D30.0	Benign neoplasm of kidney	33	0.1%	0.102	0.013
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	13,947 13,899	43.4% 43.2%	0.702	0.003
1	A10B	Sulfonylureas	5,373 5,299	16.7% 16.5%	0.433	0.006
1	A10B	Alpha glucosidase inhibitors	120 100	0.4% 0.3%	0.177	0.011
1	A10B	Thiazolidinediones	1,907 1,800	5.9% 5.6%	0.070	0.014
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,406 3,241	10.6% 10.1%	0.033	0.017
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,696 1,560	5.3% 4.9%	0.014	0.019
1	A10B	Other blood glucose lowering drugs, excl. insulins	650 569	2.0% 1.8%	0.019	0.018
1	161	acetaminophen	10,744 10,591	33.4% 32.9%	0.200	0.010

eTable 21. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to liver cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.00
2			60.1 +/- 14.0	856,160	100%	1
1	2106-3	White		21,231	65.6%	<0.00
2				515,868	60.3%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	0.010
1	UNK	Unknown Race		4,272	13.2%	<0.00
2				119,036	13.9%	1
1	F	Female		17,278	53.4%	<0.00
2				399,923	46.7%	1
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	0.020
1	UN	Unknown Gender		1,670	5.2%	<0.00
2				19,592	2.3%	1
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.00
2				528,686	61.8%	1
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.00
2				91,303	10.7%	1
1	2054-5	Black or African American		5,107	15.8%	<0.00
2				141,606	16.5%	1
1	M	Male		13,417	41.5%	<0.00
2				436,645	51.0%	1
1	2028-9	Asian		681	2.1%	<0.00
2				35,540	4.2%	1
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and				
2	Z65		422	1.3%	0.107	0.009
			10,310	1.2%		

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	F10	Alcohol related disorders	460	1.4%	<0.00	0.076
2			21,150	2.5%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	E88.81	Metabolic syndrome and other insulin resistance	705	2.2%	<0.00	0.098
2			8,208	1.0%	1	

		Disorders of				
1	E78	lipoprotein	18,042	55.7%	<0.00	
2		metabolism and	341,946	39.9%	1	0.320
		other lipidemias				
1	I10	Essential (primary)	19,775	61.1%	<0.00	
2		hypertension	413,462	48.3%	1	0.259
1	K75.8	Nonalcoholic	305	0.9%	<0.00	
2	1	steatohepatitis	1,860	0.2%	1	0.096
		(NASH)				
1	F17	Nicotine dependence	2,399	7.4%	<0.00	
2			77,335	9.0%	1	0.059
1	E66.0	Obesity due to	5,910	18.3%	<0.00	
2		excess calories	56,178	6.6%	1	0.361
1	E66.2	Morbid (severe)	230	0.7%	<0.00	
2		obesity with alveolar	2,051	0.2%	1	0.069
		hypoventilation				
1	E66.3	Overweight	535	1.7%	<0.00	
2			7,794	0.9%	1	0.066
1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
1	Z72.0	Tobacco use	588	1.8%	<0.00	
2			11,927	1.4%	1	0.034
1	Z72.3	Lack of physical	20	0.1%		
2		exercise	251	0.0%	0.001	0.015
1	Z72.4	Inappropriate diet	43	0.1%	<0.00	
2		and eating habits	118	0.0%	1	0.044
1	B18	Chronic viral	352	1.1%		
2		hepatitis	7,813	0.9%	0.001	0.018
1	K74	Fibrosis and	681	2.1%	<0.00	
2		cirrhosis of liver	7,900	0.9%	1	0.097
1	K76.0	Fatty (change of)	1,474	4.6%	<0.00	
2		liver, not elsewhere	21,684	2.5%	1	0.110
		classified				
1	K74.3	Primary biliary	28	0.1%	<0.00	
2		cirrhosis	287	0.0%	1	0.022
1	E83.11	Hereditary	24	0.1%	<0.00	
2	0	hemochromatosis	266	0.0%	1	0.019
1	E70.21	Tyrosinemia	10	0.0%	<0.00	
2			46	0.0%	1	0.019

1	E88.01	Alpha-1-antitrypsin deficiency	15	0.0%	<0.00	
2			104	0.0%	1	0.020
1	E80.1	Porphyria cutanea tarda	10	0.0%	<0.00	
2			20	0.0%	1	0.022
1	E74.0	Glycogen storage disease	10	0.0%	<0.00	
2			60	0.0%	1	0.017
1	E83.00	Disorder of copper metabolism, unspecified	10	0.0%	<0.00	
2			61	0.0%	1	0.017
1	T64	Toxic effect of aflatoxin and other mycotoxin food contaminants	10	0.0%	0.031	0.010
2			132	0.0%		
1	D13.4	Benign neoplasm of liver	16	0.0%	0.199	0.007
2			305	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	
2			159,901	18.7%	1	0.560
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	
2	B		69,045	8.1%	1	0.269
1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	
2	F		876	0.1%	1	0.057
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	
2	G		20,400	2.4%	1	0.183
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	
2	H		17,113	2.0%	1	0.370
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00	
2	K		3,371	0.4%	1	0.312
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00	
2	X		3,839	0.4%	1	0.146
1	A14A	ANABOLIC STEROIDS	17	0.1%	0.629	0.003
2			399	0.0%		

Group 1 (N = 32,267) and group 2 (N = 32,267) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD

1	AI	Age at Index	59.0 +/- 12.4	32,267	100%	0.088	0.013
2			58.8 +/- 13.4	32,267	100%		
1	2106-3	White		21,161	65.6%	<0.001	0.035
2				21,688	67.2%	1	
1	1002-5	American Indian or Alaska Native		98	0.3%	0.887	0.001
2				100	0.3%		
1	UNK	Unknown Race		4,256	13.2%	0.211	0.010
2				4,149	12.9%		
1	F	Female		17,218	53.4%	0.240	0.009
2				17,367	53.8%		
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.957	<0.001
2				173	0.5%		
1	UN	Unknown Gender		1,658	5.1%	0.098	0.013
2				1,752	5.4%		
1	2186-5	Not Hispanic or Latino		22,227	68.9%	<0.001	0.032
2				22,704	70.4%	1	
1	2135-2	Hispanic or Latino		2,652	8.2%	0.002	0.025
2				2,438	7.6%		
1	2054-5	Black or African American		5,095	15.8%	0.003	0.023
2				4,824	15.0%		
1	M	Male		13,391	41.5%	0.052	0.015
2				13,148	40.7%		
1	2028-9	Asian		681	2.1%	0.008	0.021
2				588	1.8%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to	417	1.3%	0.025	0.018
2	Z65	socioeconomic and psychosocial circumstances	355	1.1%		
1	E66	Overweight and obesity	11,344	35.2%	0.504	0.005
2			11,263	34.9%		
1	Z68.3	Body mass index [BMI] 30-39, adult	3,251	10.1%	0.804	0.002
2			3,270	10.1%		
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,968	9.2%	0.108	0.013
2			2,851	8.8%		

1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	118	0.4%	0.043	0.016
2			89	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	149	0.5%	0.057	0.015
2			118	0.4%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	208	0.6%	0.064	0.015
2			172	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	262	0.8%	0.175	0.011
2			232	0.7%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	298	0.9%	0.804	0.002
2			292	0.9%		
1	F10	Alcohol related disorders	460	1.4%	<0.001	0.033
2			343	1.1%	1	
1	Z80	Family history of primary malignant neoplasm	1,207	3.7%	0.012	0.020
2			1,089	3.4%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	0.369	0.007
2			13	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	6,179	19.1%	<0.001	0.055
2			5,497	17.0%	1	
1	Z85	Personal history of malignant neoplasm	1,106	3.4%	0.011	0.020
2			992	3.1%		
1	Z98.84	Bariatric surgery status	519	1.6%	0.950	<0.001
2			521	1.6%		
1	E88.81	Metabolic syndrome and other insulin resistance	695	2.2%	0.048	0.016
2			624	1.9%		
1	E78	Disorders of lipoprotein metabolism and other lipidemias	17,957	55.7%	<0.001	0.032
2			17,449	54.1%	1	
1	I10	Essential (primary) hypertension	19,692	61.0%	<0.001	0.036
2			19,128	59.3%	1	
1	K75.8	Nonalcoholic steatohepatitis (NASH)	293	0.9%	0.622	0.004
2	1		305	0.9%		

1	F17	Nicotine dependence	2,394	7.4%	<0.00	
2			2,074	6.4%	1	0.039
1	E66.0	Obesity due to excess calories	5,852	18.1%	0.894	0.001
2			5,865	18.2%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	227	0.7%	0.887	0.001
2			224	0.7%		
1	E66.3	Overweight	534	1.7%	0.012	0.020
2			456	1.4%		
1	E66.8	Other obesity	189	0.6%	0.759	0.002
2			195	0.6%		
1	E66.9	Obesity, unspecified	8,104	25.1%	0.206	0.010
2			7,965	24.7%		
1	Z72.0	Tobacco use	584	1.8%	0.033	0.017
2			514	1.6%		
1	Z72.3	Lack of physical exercise	20	0.1%	0.068	0.014
2			10	0.0%		
1	Z72.4	Inappropriate diet and eating habits	42	0.1%	0.018	0.019
2			23	0.1%		
1	B18	Chronic viral hepatitis	350	1.1%	0.054	0.015
2			301	0.9%		
1	K74	Fibrosis and cirrhosis of liver	666	2.1%	0.697	0.003
2			652	2.0%		
1	K76.0	Fatty (change of) liver, not elsewhere classified	1,454	4.5%	0.004	0.023
2			1,304	4.0%		
1	K74.3	Primary biliary cirrhosis	27	0.1%	0.438	0.006
2			33	0.1%		
1	E83.11	Hereditary hemochromatosis	24	0.1%	0.354	0.007
2	0		18	0.1%		
1	E70.21	Tyrosinemia	10	0.0%	1	<0.001
2			10	0.0%		
1	E88.01	Alpha-1-antitrypsin deficiency	14	0.0%	0.853	0.001
2			15	0.0%		
1	E80.1	Porphyria cutanea tarda	10	0.0%	1	<0.001
2			10	0.0%		
1	E74.0	Glycogen storage disease	10	0.0%	1	<0.001
2			10	0.0%		
1	E83.00	Disorder of copper metabolism, unspecified	10	0.0%	1	<0.001
2			10	0.0%		

1	T64	Toxic effect of aflatoxin and other mycotoxin food contaminants	10	0.0%	1	<0.001
2	D13.4	Benign neoplasm of liver	16	0.0%	0.715	0.003
Medication						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,044 14,092	43.5% 43.7%	0.703	0.003
1	A10B	Sulfonylureas	5,425 5,258	16.8% 16.3%	0.077	0.014
1	A10B	Alpha glucosidase inhibitors	122 123	0.4% 0.4%	0.949	0.001
2	G	Thiazolidinediones	1,933 1,850	6.0% 5.7%	0.164	0.011
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,476 3,326	10.8% 10.3%	0.054	0.015
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,749 1,559	5.4% 4.8%	0.001	0.027
1	X	Other blood glucose lowering drugs, excl. insulins	656 644	2.0% 2.0%	0.737	0.003
1	A14A	ANABOLIC STEROIDS	17 25	0.1% 0.1%	0.217	0.010

eTable 22. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to ovarian cancer for the study populations of women with T2D and no history of any OAC

Group 1 (N = 17,278) and group 2 (N = 399,923) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	57.7 +/- 12.8	17,278	100%	<0.001
2			60.0 +/- 14.7	399,923	100%	
1	2106-3	White		11,336	65.6%	<0.001
2				231,828	58.0%	
1	1002-5	American Indian or Alaska Native		59	0.3%	0.334
2				1,552	0.4%	
1	UNK	Unknown Race		1,563	9.0%	<0.001
2				49,384	12.3%	
1	2076-8	Native Hawaiian or Other Pacific Islander		80	0.5%	<0.001
2				2,869	0.7%	
1	UN	Unknown Ethnicity		3,145	18.2%	<0.001
2				103,904	26.0%	
1	2186-5	Not Hispanic or Latino		12,481	72.2%	<0.001
2				247,896	62.0%	
1	2135-2	Hispanic or Latino		1,652	9.6%	<0.001
2				48,123	12.0%	
1	2054-5	Black or African American		3,476	20.1%	0.723
2				80,016	20.0%	
1	2028-9	Asian		311	1.8%	<0.001
2				17,483	4.4%	
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
		Persons with potential health hazards related to socioeconomic and psychosocial circumstances				
1	Z55-		270	1.6%	0.003	0.022
2	Z65		5,204	1.3%		
1	E66	Overweight and obesity	6,461	37.4%	<0.001	0.399
2			78,874	19.7%		

1	Z68.3	Body mass index [BMI] 30-39, adult	1,360 13,007	7.9% 3.3%	<0.00 1	0.203
1	Z68.4	Body mass index [BMI] 40 or greater, adult	1,671 12,991	9.7% 3.2%	<0.00 1	0.264
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	39 643	0.2% 0.2%	0.039	0.015
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	52 616	0.3% 0.2%	<0.00 1	0.031
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	59 760	0.3% 0.2%	<0.00 1	0.029
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	69 862	0.4% 0.2%	<0.00 1	0.033
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	76 1,029	0.4% 0.3%	<0.00 1	0.031
1	F10	Alcohol related disorders	128 4,677	0.7% 1.2%	<0.00 1	0.044
1	Z80	Family history of primary malignant neoplasm	821 9,798	4.8% 2.4%	<0.00 1	0.124
1	Z15.0	Genetic susceptibility to malignant neoplasm	15 91	0.1% 0.0%	<0.00 1	0.027
1	Z12	Encounter for screening for malignant neoplasms	4,113 71,089	23.8% 17.8%	<0.00 1	0.149
1	Z85	Personal history of malignant neoplasm	492 9,342	2.8% 2.3%	<0.00 1	0.032
1	Z98.84	Bariatric surgery status	378 2,056	2.2% 0.5%	<0.00 1	0.145
1	F17	Nicotine dependence	1,246 31,324	7.2% 7.8%	0.003	0.024
1	E66.0	Obesity due to excess calories	3,456 31,701	20.0% 7.9%	<0.00 1	0.354
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	132 1,060	0.8% 0.3%	<0.00 1	0.070

1	E66.3	Overweight	280	1.6%	<0.00	
2			3,619	0.9%	1	0.064
1	E66.8	Other obesity	118	0.7%	<0.00	
2			574	0.1%	1	0.084
1	E66.9	Obesity, unspecified	4,568	26.4%	<0.00	
2			59,095	14.8%	1	0.291
1	Z72.0	Tobacco use	334	1.9%	<0.00	
2			4,947	1.2%	1	0.056
1	Z79.89	Hormone	85	0.5%	<0.00	
2	0	replacement therapy	1,319	0.3%	1	0.025
1	Z92.23	Personal history of estrogen therapy	10	0.1%	0.030	0.014
2			115	0.0%		
1	Z80.3	Family history of malignant neoplasm of breast	390	2.3%	<0.00	
2			4,796	1.2%	1	0.081
1	E28.2	Polycystic ovarian syndrome	264	1.5%	<0.00	
2			3,504	0.9%	1	0.060
1	Z80.41	Family history of malignant neoplasm of ovary	50	0.3%	<0.00	
2			568	0.1%	1	0.032
1	D27	Benign neoplasm of ovary	39	0.2%	0.871	0.001
2			879	0.2%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	145	0.8%	<0.00	
2	A		9,080	2.3%	1	0.116
1	A10B	Sulfonylureas	2,808	16.3%	<0.00	
2	B		31,308	7.8%	1	0.261
1	A10B	Alpha glucosidase inhibitors	60	0.3%	<0.00	
2	F		436	0.1%	1	0.050
1	A10B	Thiazolidinediones	974	5.6%	<0.00	
2	G		9,195	2.3%	1	0.172
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	1,906	11.0%	<0.00	
2	H		7,852	2.0%	1	0.374
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	918	5.3%	<0.00	
2	K		1,296	0.3%	1	0.305
1	A10B	Other blood glucose lowering drugs, excl. insulins	349	2.0%	<0.00	
2	X		1,821	0.5%	1	0.142

1	HS200	CONTRACEPTIVE S,SYSTEMIC	718	4.2%	<0.00	0.084
2			10,566	2.6%	1	

Group 1 (N = 17,197) and group 2 (N = 17,197) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	57.8 +/- 12.8	17,197	100%	0.072	0.019
2			57.5 +/- 13.7	17,197	100%		
1	2106-3	White		11,276	65.6%	0.005	0.031
2				11,525	67.0%		
1	1002-5	American Indian or Alaska Native		59	0.3%	0.445	0.008
2				51	0.3%		
1	UNK	Unknown Race		1,560	9.1%	0.041	0.022
2				1,453	8.4%		
1	2076-8	Native Hawaiian or Other Pacific Islander		80	0.5%	0.628	0.005
2				74	0.4%		
1	UN	Unknown Ethnicity		3,140	18.3%	0.015	0.026
2				2,967	17.3%		
1	2186-5	Not Hispanic or Latino		12,416	72.2%	0.002	0.033
2				12,670	73.7%		
1	2135-2	Hispanic or Latino		1,641	9.5%	0.133	0.016
2				1,560	9.1%		
1	2054-5	Black or African American		3,459	20.1%	0.318	0.011
2				3,385	19.7%		
1	2028-9	Asian		311	1.8%	0.567	0.006
2				297	1.7%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to		269	1.6%	0.096	0.018
2	Z65	socioeconomic and psychosocial circumstances		232	1.3%		
1	E66	Overweight and obesity		6,398	37.2%	0.421	0.009
2				6,326	36.8%		
1	Z68.3	Body mass index [BMI] 30-39, adult		1,331	7.7%	0.405	0.009
2				1,290	7.5%		

1	Z68.4	Body mass index [BMI] 40 or greater, adult	1,643	9.6%	0.686	0.004
2			1,621	9.4%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	38	0.2%	0.101	0.018
2			25	0.1%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	50	0.3%	0.760	0.003
2			47	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	58	0.3%	0.705	0.004
2			54	0.3%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	64	0.4%	0.524	0.007
2			57	0.3%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	75	0.4%	0.871	0.002
2			77	0.4%		
1	F10	Alcohol related disorders	126	0.7%	0.007	0.029
2			87	0.5%		
1	Z80	Family history of primary malignant neoplasm	802	4.7%	0.118	0.017
2			742	4.3%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	15	0.1%	0.317	0.011
2			10	0.1%		
1	Z12	Encounter for screening for malignant neoplasms	4,067	23.6%	<0.001	0.040
2			3,779	22.0%	1	
1	Z85	Personal history of malignant neoplasm	487	2.8%	0.126	0.017
2			441	2.6%		
1	Z98.84	Bariatric surgery status	364	2.1%	0.911	0.001
2			367	2.1%		
1	F17	Nicotine dependence	1,237	7.2%	0.018	0.026
2			1,126	6.5%		
1	E66.0	Obesity due to excess calories	3,409	19.8%	0.302	0.011
2			3,333	19.4%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	130	0.8%	0.526	0.007
2			120	0.7%		
1	E66.3	Overweight	276	1.6%	0.730	0.004
2			268	1.6%		

1	E66.8	Other obesity	116	0.7%	0.111	0.017
2			93	0.5%		
1	E66.9	Obesity, unspecified	4,520	26.3%	0.104	0.018
2			4,388	25.5%		
1	Z72.0	Tobacco use	330	1.9%	0.158	0.015
2			295	1.7%		
1	Z79.89	Hormone	83	0.5%	0.138	0.016
2	0	replacement therapy	65	0.4%		
1	Z92.23	Personal history of	10	0.1%	1	<0.001
2		estrogen therapy	10	0.1%		
1	Z80.3	Family history of malignant neoplasm of breast	381	2.2%	0.177	0.015
2			345	2.0%		
1	E28.2	Polycystic ovarian syndrome	263	1.5%	0.324	0.011
2			241	1.4%		
1	Z80.41	Family history of malignant neoplasm of ovary	48	0.3%	0.755	0.003
2			45	0.3%		
1	D27	Benign neoplasm of ovary	39	0.2%	1	<0.001
2			39	0.2%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10B	Biguanides	145	0.8%	0.039	0.022
2	A		112	0.7%		
1	A10B	Sulfonylureas	2,762	16.1%	0.461	0.008
2	B		2,712	15.8%		
1	A10B	Alpha glucosidase inhibitors	59	0.3%	0.139	0.016
2	F		44	0.3%		
1	A10B	Thiazolidinediones	946	5.5%	0.377	0.010
2	G		909	5.3%		
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	1,834	10.7%	0.875	0.002
2	H		1,843	10.7%		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	847	4.9%	0.047	0.021
2	K		769	4.5%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	329	1.9%	0.233	0.013
2	X		360	2.1%		
1	HS200	CONTRACEPTIVE S,SYSTEMIC	706	4.1%	0.142	0.016
2			653	3.8%		

eTable 23. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to pancreatic cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.00
2			60.1 +/- 14.0	856,160	100%	1
1	2106-3	White		21,231	65.6%	<0.00
2				515,868	60.3%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	0.010
1	UNK	Unknown Race		4,272	13.2%	<0.00
2				119,036	13.9%	1
1	F	Female		17,278	53.4%	<0.00
2				399,923	46.7%	1
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	0.020
1	UN	Unknown Gender		1,670	5.2%	<0.00
2				19,592	2.3%	1
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.00
2				528,686	61.8%	1
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.00
2				91,303	10.7%	1
1	2054-5	Black or African American		5,107	15.8%	<0.00
2				141,606	16.5%	1
1	M	Male		13,417	41.5%	<0.00
2				436,645	51.0%	1
1	2028-9	Asian		681	2.1%	<0.00
2				35,540	4.2%	1
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and		422	1.3%	0.107
2	Z65			10,310	1.2%	0.009

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	F10	Alcohol related disorders	460	1.4%	<0.00	0.076
2			21,150	2.5%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00	0.361
2			56,178	6.6%	1	

1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230 2,051	0.7% 0.2%	<0.00 1	0.069
1	E66.3	Overweight	535 7,794	1.7% 0.9%	<0.00 1	0.066
1	E66.8	Other obesity	193 1,084	0.6% 0.1%	<0.00 1	0.078
1	E66.9	Obesity, unspecified	8,150 113,380	25.2% 13.2%	<0.00 1	0.307
1	Z72.3	Lack of physical exercise	20 251	0.1% 0.0%	0.001	0.015
1	Z72.4	Inappropriate diet and eating habits	43 118	0.1% 0.0%	<0.00 1	0.044
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10 133	0.0% 0.0%	0.032	0.010
1	B96.8 2 1	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	141 3,386	0.4% 0.4%	0.259	0.006
1	Z80.0	Family history of malignant neoplasm of digestive organs	413 6,255	1.3% 0.7%	<0.00 1	0.055
1	B18	Chronic viral hepatitis	352 7,813	1.1% 0.9%	0.001	0.018
1	K86.1	Other chronic pancreatitis	96 4,175	0.3% 0.5%	<0.00 1	0.031
1	B16 2	Acute hepatitis B	50 1,095	0.2% 0.1%	0.191	0.007
1	B18.1 2	Chronic viral hepatitis B without delta-agent	58 1,158	0.2% 0.1%	0.036	0.011
1	Z72.0 2	Tobacco use	588 11,927	1.8% 1.4%	<0.00 1	0.034
1	D13.6 2	Benign neoplasm of pancreas	10 225	0.0% 0.0%	0.616	0.003

Medication

Group	Mean \pm SD	Patients	% of Group	P-Value	SMD
1 A10A 2	INSULINS AND ANALOGUES	14,131 159,901	43.7% 18.7%	<0.00 1	0.560

1	A10B	Sulfonylureas	5,464	16.9%	<0.00		0.269
2	B		69,045	8.1%	1		
1	A10B	Alpha glucosidase	124	0.4%	<0.00		0.057
2	F	inhibitors	876	0.1%	1		
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00		0.183
2	G		20,400	2.4%	1		
1	A10B	Dipeptidyl peptidase	3,547	11.0%	<0.00		0.370
2	H	4 (DPP-4) inhibitors	17,113	2.0%	1		
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00		0.312
2	K		3,371	0.4%	1		
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00		0.146
2	X		3,839	0.4%	1		

Group 1 (N = 32,271) and group 2 (N = 32,271) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	59.0 +/- 12.4	32,271	100%	0.197	0.010
2			58.9 +/- 13.1	32,271	100%		
1	2106-3	White		21,164	65.6%	<0.00	
2				21,603	66.9%	1	0.029
1	1002-5	American Indian or Alaska Native		98	0.3%	0.368	0.007
2				111	0.3%		
1	UNK	Unknown Race		4,259	13.2%	0.861	0.001
2				4,244	13.2%		
1	F	Female		17,215	53.3%	0.043	0.016
2				17,471	54.1%		
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.440	0.006
2				158	0.5%		
1	UN	Unknown Gender		1,658	5.1%	0.121	0.012
2				1,746	5.4%		
1	2186-5	Not Hispanic or Latino		22,229	68.9%	0.003	0.023
2				22,576	70.0%		
1	2135-2	Hispanic or Latino		2,652	8.2%	0.002	0.024
2				2,444	7.6%		
1	2054-5	Black or African American		5,093	15.8%	0.005	0.022
2				4,838	15.0%		

1	M	Male	13,398	41.5%	0.006	0.022
2			13,054	40.5%		
1	2028-9	Asian	681	2.1%	0.030	0.017
2			604	1.9%		
Diagnosis						
Group			Mean ± SD	Patients	% of Group	P-Value
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances		419	1.3%	0.062
2	Z65			367	1.1%	0.015
1	E66	Overweight and obesity	11,342 11,254	35.1% 34.9%	0.468	0.006
1	Z68.3	Body mass index [BMI] 30-39, adult	3,247 3,166	10.1% 9.8%	0.287	0.008
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,972 2,933	9.2% 9.1%	0.594	0.004
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119 88	0.4% 0.3%	0.031	0.017
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150 119	0.5% 0.4%	0.058	0.015
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	208 184	0.6% 0.6%	0.224	0.010
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	262 250	0.8% 0.8%	0.594	0.004
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	298 283	0.9% 0.9%	0.532	0.005
1	F10	Alcohol related disorders	458 352	1.4% 1.1%	<0.001	0.030
1	Z80	Family history of primary malignant neoplasm	1,207 1,071	3.7% 3.3%	0.004	0.023

1	Z15.0	Genetic susceptibility to malignant neoplasm	18 15	0.1% 0.0%	0.601	0.004
1	Z12	Encounter for screening for malignant neoplasms	6,176 5,576	19.1% 17.3%	<0.001	0.048
1	Z85	Personal history of malignant neoplasm	1,108 1,055	3.4% 3.3%	0.246	0.009
1	Z98.84	Bariatric surgery status	520 546	1.6% 1.7%	0.422	0.006
1	E66.0	Obesity due to excess calories	5,853 5,900	18.1% 18.3%	0.632	0.004
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	227 207	0.7% 0.6%	0.335	0.008
1	E66.3	Overweight	531 474	1.6% 1.5%	0.070	0.014
1	E66.8	Other obesity	188 194	0.6% 0.6%	0.758	0.002
1	E66.9	Obesity, unspecified	8,094 7,929	25.1% 24.6%	0.133	0.012
1	Z72.3	Lack of physical exercise	19 21	0.1% 0.1%	0.752	0.002
1	Z72.4	Inappropriate diet and eating habits	41 54	0.1% 0.2%	0.182	0.011
1	Z85.09	Personal history of malignant neoplasm of other digestive organs	10 10	0.0% 0.0%	1	<0.001
1	B96.8	Helicobacter pylori [H. pylori] as the cause of diseases classified elsewhere	140 100	0.4% 0.3%	0.010	0.020
1	Z80.0	Family history of malignant neoplasm of digestive organs	410 336	1.3% 1.0%	0.006	0.021
1	B18	Chronic viral hepatitis	352 295	1.1% 0.9%	0.024	0.018
1	K86.1	Other chronic pancreatitis	96 60	0.3% 0.2%	0.004	0.023
1	B16	Acute hepatitis B	50 43	0.2% 0.1%	0.468	0.006

1	B18.1	Chronic viral hepatitis B without delta-agent	58	0.2%	0.705	0.003
2			54	0.2%		
1	Z72.0	Tobacco use	584	1.8%	0.017	0.019
2			506	1.6%		
1	D13.6	Benign neoplasm of pancreas	10	0.0%	1	<0.001
2			10	0.0%		

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,044 13,993	43.5% 43.4%	0.685	0.003
1	A10B	Sulfonylureas	5,422 5,287	16.8% 16.4%	0.153	0.011
1	A10B	Alpha glucosidase inhibitors	121 114	0.4% 0.4%	0.647	0.004
1	A10B	Thiazolidinediones	1,930 1,922	6.0% 6.0%	0.894	0.001
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,470 3,367	10.8% 10.4%	0.188	0.010
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,756 1,603	5.4% 5.0%	0.007	0.021
1	A10B	Other blood glucose lowering drugs, excl. insulins	656 637	2.0% 2.0%	0.594	0.004
2	X					

eTable 24. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to thyroid cancer for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.00
2			60.1 +/- 14.0	856,160	100%	1
1	2106-3	White		21,231	65.6%	<0.00
2				515,868	60.3%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	0.010
1	UNK	Unknown Race		4,272	13.2%	<0.00
2				119,036	13.9%	1
1	F	Female		17,278	53.4%	<0.00
2				399,923	46.7%	1
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	0.020
1	UN	Unknown Gender		1,670	5.2%	<0.00
2				19,592	2.3%	1
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.00
2				528,686	61.8%	1
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.00
2				91,303	10.7%	1
1	2054-5	Black or African American		5,107	15.8%	<0.00
2				141,606	16.5%	1
1	M	Male		13,417	41.5%	<0.00
2				436,645	51.0%	1
1	2028-9	Asian		681	2.1%	<0.00
2				35,540	4.2%	1
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and		422	1.3%	0.107
2	Z65			10,310	1.2%	0.009

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00	0.361
2			56,178	6.6%	1	
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00	0.069
2			2,051	0.2%	1	

1	E66.3	Overweight	535	1.7%	<0.00	
2			7,794	0.9%	1	0.066
1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
1	D34	Benign neoplasm of thyroid gland	46	0.1%	<0.00	
2			715	0.1%	1	0.017

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
Hereditary neuroendocrine tumor disorders (eg, medullary thyroid carcinoma, parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)						
1	10278	carcinoma,	0	0%	--	--
2	53	parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)	0	0%		
1	1001	Radiation	114	0.4%	<0.00	
2			4,550	0.5%	1	0.027

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
INSULINS AND ANALOGUES						
1	A10A		14,131	43.7%	<0.00	
2			159,901	18.7%	1	0.560
Sulfonylureas						
1	A10B		5,464	16.9%	<0.00	
2	B		69,045	8.1%	1	0.269
Alpha glucosidase inhibitors						
1	A10B		124	0.4%	<0.00	
2	F		876	0.1%	1	0.057
Thiazolidinediones						
1	A10B		1,960	6.1%	<0.00	
2	G		20,400	2.4%	1	0.183
Dipeptidyl peptidase 4 (DPP-4) inhibitors						
1	A10B		3,547	11.0%	<0.00	
2	H		17,113	2.0%	1	0.370
Sodium-glucose co-transporter 2 (SGLT2) inhibitors						
1	A10B		1,839	5.7%	<0.00	
2	K		3,371	0.4%	1	0.312
Other blood glucose lowering drugs, excl. insulins						
1	A10B		672	2.1%	<0.00	
2	X		3,839	0.4%	1	0.146

Group 1 (N = 32,259) and group 2 (N = 32,259) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,259	100%	
2			59.0 +/- 13.0	32,259	100%	
1	2106-3	White		21,154	65.6%	<0.00
2				21,663	67.2%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.463
2				88	0.3%	0.006
1	UNK	Unknown Race		4,259	13.2%	0.375
2				4,183	13.0%	0.007
1	F	Female		17,209	53.3%	0.340
2				17,330	53.7%	0.008
1	2076-8	Native Hawaiian or Other Pacific Islander		171	0.5%	
2				140	0.4%	0.078
1	UN	Unknown Gender		1,659	5.1%	0.085
2				1,757	5.4%	0.014
1	2186-5	Not Hispanic or Latino		22,219	68.9%	<0.00
2				22,637	70.2%	1
1	2135-2	Hispanic or Latino		2,651	8.2%	0.001
2				2,430	7.5%	0.025
1	2054-5	Black or African American		5,093	15.8%	
2				4,871	15.1%	0.016
1	M	Male		13,391	41.5%	
2				13,172	40.8%	0.080
1	2028-9	Asian		681	2.1%	0.014
2				594	1.8%	0.019

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances				
2	Z65		420	1.3%		0.001
2			328	1.0%		0.027
1	E66	Overweight and obesity				
2			11,340	35.2%		0.279
2			11,209	34.7%		0.009

1	Z68.3	Body mass index [BMI] 30-39, adult	3,247 3,163	10.1% 9.8%	0.269	0.009
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,969 2,840	9.2% 8.8%	0.076	0.014
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	118 98	0.4% 0.3%	0.173	0.011
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	149 112	0.5% 0.3%	0.022	0.018
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	207 165	0.6% 0.5%	0.029	0.017
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	261 230	0.8% 0.7%	0.160	0.011
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	296 307	0.9% 1.0%	0.653	0.004
1	Z80	Family history of primary malignant neoplasm	1,204 1,098	3.7% 3.4%	0.024	0.018
1	Z15.0	Genetic susceptibility to malignant neoplasm	18 10	0.1% 0.0%	0.130	0.012
1	Z12	Encounter for screening for malignant neoplasms	6,173 5,681	19.1% 17.6%	<0.00 1	0.039
1	Z85	Personal history of malignant neoplasm	1,106 1,049	3.4% 3.3%	0.212	0.010
1	Z98.84	Bariatric surgery status	518 504	1.6% 1.6%	0.659	0.003
1	E66.0	Obesity due to excess calories	5,849 5,756	18.1% 17.8%	0.340	0.008
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	228 189	0.7% 0.6%	0.055	0.015
1	E66.3	Overweight	532 450	1.6% 1.4%	0.008	0.021
1	E66.8	Other obesity	191 182	0.6% 0.6%	0.640	0.004

1	E66.9	Obesity, unspecified	8,095	25.1%	0.111	0.013
2			7,920	24.6%		
1	D34	Benign neoplasm of thyroid gland	45	0.1%	0.216	0.010
2			34	0.1%		
Procedure						
Group			Mean ± SD	Patients	% of Group	P-Value
1	10278	Hereditary neuroendocrine tumor disorders (eg, medullary thyroid carcinoma,		0	0%	--
2	53	parathyroid carcinoma, malignant pheochromocytoma or paraganglioma)		0	0%	--
1	1001	Radiation	114 96	0.4% 0.3%	0.213	0.010
Medication						
Group			Mean ± SD	Patients	% of Group	P-Value
1	A10A	INSULINS AND ANALOGUES		14,033 13,951	43.5% 43.2%	0.515 0.005
1	A10B	Sulfonylureas		5,417 5,341	16.8% 16.6%	0.422 0.006
2	F	Alpha glucosidase inhibitors		123 113	0.4% 0.4%	0.514 0.005
1	A10B	Thiazolidinediones		1,926 1,876	6.0% 5.8%	0.403 0.007
2	G					
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors		3,469 3,506	10.8% 10.9%	0.639 0.004
2	H					
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors		1,740 1,641	5.4% 5.1%	0.080 0.014
2	K					
1	A10B	Other blood glucose lowering drugs, excl. insulins		654 628	2.0% 1.9%	0.463 0.006
2	X					

eTable 25. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to meningioma for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching						
Demographics						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.00
2			60.1 +/- 14.0	856,160	100%	1
1	2106-3	White		21,231	65.6%	<0.00
2				515,868	60.3%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092
2				3,080	0.4%	0.010
1	UNK	Unknown Race		4,272	13.2%	<0.00
2				119,036	13.9%	1
1	F	Female		17,278	53.4%	<0.00
2				399,923	46.7%	1
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001
2				5,884	0.7%	0.020
1	UN	Unknown Gender		1,670	5.2%	<0.00
2				19,592	2.3%	1
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.00
2				528,686	61.8%	1
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.00
2				91,303	10.7%	1
1	2054-5	Black or African American		5,107	15.8%	<0.00
2				141,606	16.5%	1
1	M	Male		13,417	41.5%	<0.00
2				436,645	51.0%	1
1	2028-9	Asian		681	2.1%	<0.00
2				35,540	4.2%	1
Diagnosis						
Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and		422	1.3%	0.107
2	Z65			10,310	1.2%	0.009

psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00	0.361
2			56,178	6.6%	1	
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00	0.069
2			2,051	0.2%	1	

1	E66.3	Overweight	535	1.7%	<0.00	
2			7,794	0.9%	1	0.066
1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
1	Z79.89	Hormone replacement therapy	94	0.3%	<0.00	
2	0		1,381	0.2%	1	0.027
1	Z92.23	Personal history of estrogen therapy	10	0.0%	0.011	0.012
2	D32	Benign neoplasm of meninges	84	0.3%	0.573	0.003
2			2,087	0.2%		
1	S00-S09	Injuries to the head	1,546	4.8%	0.333	0.006
2			41,909	4.9%		
1	Z80.3	Family history of malignant neoplasm of breast	438	1.4%	<0.00	
2			5,375	0.6%	1	0.073

Procedure

Group	Mean ± SD	Patients	% of Group	P-Value	SMD	
1		114	0.4%	<0.00		
2	1001	Radiation	4,550	0.5%	1	0.027

Medication

Group	Mean ± SD	Patients	% of Group	P-Value	SMD	
1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	
2			159,901	18.7%	1	0.560
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	
2	B		69,045	8.1%	1	0.269
1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	
2	F		876	0.1%	1	0.057
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	
2	G		20,400	2.4%	1	0.183
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	
2	H		17,113	2.0%	1	0.370
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00	
2	K		3,371	0.4%	1	0.312
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00	
2	X		3,839	0.4%	1	0.146

1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,069	3.3%	<0.00	0.082
2			17,029	2.0%	1	

Group 1 (N = 32,263) and group 2 (N = 32,263) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	AI	Age at Index	59.0 +/- 12.4	32,263	100%	0.166
2			58.9 +/- 13.2	32,263	100%	
1	2106-3	White		21,158	65.6%	<0.00
2				21,735	67.4%	1
1	1002-5	American Indian or Alaska Native		98	0.3%	0.887
2				100	0.3%	
1	UNK	Unknown Race		4,255	13.2%	0.219
2				4,150	12.9%	
1	F	Female		17,216	53.4%	0.116
2				17,415	54.0%	
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.265
2				152	0.5%	
1	UN	Unknown Gender		1,655	5.1%	0.163
2				1,734	5.4%	
1	2186-5	Not Hispanic or Latino		22,224	68.9%	0.014
2				22,513	69.8%	
1	2135-2	Hispanic or Latino		2,653	8.2%	0.002
2				2,442	7.6%	
1	2054-5	Black or African American		5,095	15.8%	0.001
2				4,800	14.9%	
1	M	Male		13,392	41.5%	0.026
2				13,114	40.6%	
1	2028-9	Asian		681	2.1%	0.003
2				576	1.8%	

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	Z55-	Persons with potential health hazards related to socioeconomic and psychosocial circumstances		420	1.3%	0.086
2	Z65			372	1.2%	

1	E66	Overweight and obesity	11,346	35.2%	0.723	0.003
2			11,303	35.0%		
1	Z68.3	Body mass index [BMI] 30-39, adult	3,247	10.1%	0.170	0.011
2			3,143	9.7%		
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,968	9.2%	0.557	0.005
2			2,925	9.1%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	118	0.4%	0.132	0.012
2			96	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	149	0.5%	0.005	0.022
2			104	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	208	0.6%	0.019	0.018
2			163	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	261	0.8%	0.061	0.015
2			220	0.7%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	297	0.9%	0.149	0.011
2			263	0.8%		
1	Z80	Family history of primary malignant neoplasm	1,206	3.7%	0.029	0.017
2			1,103	3.4%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	0.194	0.010
2			11	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	6,176	19.1%	<0.00	0.050
2			5,548	17.2%	1	
1	Z85	Personal history of malignant neoplasm	1,105	3.4%	0.294	0.008
2			1,057	3.3%		
1	Z98.84	Bariatric surgery status	518	1.6%	0.197	0.010
2			560	1.7%		
1	E66.0	Obesity due to excess calories	5,856	18.2%	0.328	0.008
2			5,952	18.4%		
1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	228	0.7%	0.289	0.008
2			206	0.6%		
1	E66.3	Overweight	532	1.6%	0.014	0.019
2			455	1.4%		

1	E66.8	Other obesity	191	0.6%	0.464	0.006
2			177	0.5%		
1	E66.9	Obesity, unspecified	8,098	25.1%	0.330	0.008
2			7,991	24.8%		
1	Z79.89	Hormone	93	0.3%		
2	0	replacement therapy	70	0.2%	0.071	0.014
1	Z92.23	Personal history of estrogen therapy	10	0.0%	1	<0.001
2			10	0.0%		
1	D32	Benign neoplasm of meninges	84	0.3%	0.336	0.008
2			72	0.2%		
1	S00-		1,533	4.8%	<0.00	
2	S09	Injuries to the head	1,329	4.1%	1	0.031
1	Z80.3	Family history of malignant neoplasm of breast	431	1.3%		
2			402	1.2%	0.312	0.008

Procedure

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	1001	Radiation	114	0.4%		
2			88	0.3%	0.067	0.014

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,036	43.5%		
2			13,882	43.0%	0.221	0.010
1	A10B	Sulfonylureas	5,418	16.8%		
2	B		5,268	16.3%	0.112	0.013
1	A10B	Alpha glucosidase inhibitors	122	0.4%		
2	F		135	0.4%	0.416	0.006
1	A10B	Thiazolidinediones	1,933	6.0%		
2	G		1,861	5.8%	0.228	0.009
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,468	10.7%		
2	H		3,437	10.7%	0.693	0.003
1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,745	5.4%		
2	K		1,616	5.0%	0.022	0.018
1	A10B	Other blood glucose lowering drugs, excl. insulins	657	2.0%		
2	X		615	1.9%	0.234	0.009
1	HS200	CONTRACEPTIVE S,SYSTEMIC	1,058	3.3%		
2			923	2.9%	0.002	0.024

eTable 26. Characteristics of the GLP-1RA/no metformin group and metformin/no GLP-1RA group before and after matched for covariates related to multiple myeloma for the study populations of patients with T2D and no history of any OAC

Group 1 (N = 32,365) and group 2 (N = 856,160) characteristics before propensity score matching							
Demographics							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	59.0 +/- 12.4	32,365	100%	<0.00	
2			60.1 +/- 14.0	856,160	100%	1	0.080
1	2106-3	White		21,231	65.6%	<0.00	
2				515,868	60.3%	1	0.111
1	1002-5	American Indian or Alaska Native		98	0.3%	0.092	
2				3,080	0.4%	0.010	
1	UNK	Unknown Race		4,272	13.2%	<0.00	
2				119,036	13.9%	1	0.021
1	F	Female		17,278	53.4%	<0.00	
2				399,923	46.7%	1	0.134
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.001	
2				5,884	0.7%	0.020	
1	UN	Unknown Gender		1,670	5.2%	<0.00	
2				19,592	2.3%	1	0.152
1	2186-5	Not Hispanic or Latino		22,299	68.9%	<0.00	
2				528,686	61.8%	1	0.151
1	2135-2	Hispanic or Latino		2,660	8.2%	<0.00	
2				91,303	10.7%	1	0.084
1	2054-5	Black or African American		5,107	15.8%	<0.00	
2				141,606	16.5%	1	0.021
1	M	Male		13,417	41.5%	<0.00	
2				436,645	51.0%	1	0.192
1	2028-9	Asian		681	2.1%	<0.00	
2				35,540	4.2%	1	0.118
Diagnosis							
Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health hazards related to		422	1.3%	0.107	
2	Z65			10,310	1.2%	0.009	

socioeconomic and psychosocial circumstances						
1	E66	Overweight and obesity	11,418	35.3%	<0.00	0.411
2			149,974	17.5%	1	
1	Z68.3	Body mass index [BMI] 30-39, adult	3,285	10.1%	<0.00	0.249
2			32,977	3.9%	1	
1	Z68.4	Body mass index [BMI] 40 or greater, adult	3,012	9.3%	<0.00	0.278
2			23,535	2.7%	1	
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.001	0.018
2			2,293	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	<0.00	0.029
2			2,433	0.3%	1	
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	209	0.6%	<0.00	0.043
2			2,942	0.3%	1	
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	264	0.8%	<0.00	0.055
2			3,317	0.4%	1	
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	299	0.9%	<0.00	0.059
2			3,753	0.4%	1	
1	Z80	Family history of primary malignant neoplasm	1,222	3.8%	<0.00	0.114
2			16,133	1.9%	1	
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	<0.00	0.021
2			140	0.0%	1	
1	Z12	Encounter for screening for malignant neoplasms	6,223	19.2%	<0.00	0.157
2			114,996	13.4%	1	
1	Z85	Personal history of malignant neoplasm	1,111	3.4%	<0.00	0.042
2			23,231	2.7%	1	
1	Z98.84	Bariatric surgery status	534	1.6%	<0.00	0.131
2			2,989	0.3%	1	
1	E66.0	Obesity due to excess calories	5,910	18.3%	<0.00	0.361
2			56,178	6.6%	1	

1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	230	0.7%	<0.00	
2			2,051	0.2%	1	0.069
1	E66.3	Overweight	535	1.7%	<0.00	
2			7,794	0.9%	1	0.066
1	E66.8	Other obesity	193	0.6%	<0.00	
2			1,084	0.1%	1	0.078
1	E66.9	Obesity, unspecified	8,150	25.2%	<0.00	
2			113,380	13.2%	1	0.307
Family history of other malignant neoplasms of lymphoid, hematopoietic and related tissues						
1	Z80.7		15	0.0%	0.010	0.012
2			201	0.0%		
1	D47.2	Monoclonal gammopathy	111	0.3%	<0.00	
2			1,346	0.2%	1	0.037
1	C90.3	Solitary plasmacytoma	10	0.0%	<0.00	
2			30	0.0%	1	0.021
1	D45	Polycythemia vera	67	0.2%	0.001	0.017
2			1,167	0.1%		
1	D46	Myelodysplastic syndromes	31	0.1%	0.952	<0.001
2			811	0.1%		
Other neoplasms of uncertain behavior of lymphoid, hematopoietic and related tissue						
1	D47		234	0.7%	<0.00	
2			4,409	0.5%	1	0.027

Medication

Group		Mean \pm SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,131	43.7%	<0.00	0.560
2			159,901	18.7%	1	
1	A10B	Sulfonylureas	5,464	16.9%	<0.00	0.269
2	B		69,045	8.1%	1	
1	A10B	Alpha glucosidase inhibitors	124	0.4%	<0.00	0.057
2	F		876	0.1%	1	
1	A10B	Thiazolidinediones	1,960	6.1%	<0.00	0.183
2	G		20,400	2.4%	1	
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,547	11.0%	<0.00	0.370
2	H		17,113	2.0%	1	

1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,839	5.7%	<0.00		0.312
2	K		3,371	0.4%	1		
1	A10B	Other blood glucose lowering drugs, excl. insulins	672	2.1%	<0.00		0.146
2	X		3,839	0.4%	1		

Group 1 (N = 32,256) and group 2 (N = 32,256) characteristics after propensity score matching

Demographics

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	AI	Age at Index	59.0 +/- 12.4	32,256	100%	0.248	0.009
2			58.9 +/- 13.1	32,256	100%		
1	2106-3	White		21,155	65.6%	<0.00	
2				21,672	67.2%	1	0.034
1	1002-5	American Indian or Alaska Native		98	0.3%	1	<0.001
2				98	0.3%		
1	UNK	Unknown Race		4,252	13.2%	0.057	0.015
2				4,090	12.7%		
1	F	Female		17,214	53.4%	0.215	0.010
2				17,371	53.9%		
1	2076-8	Native Hawaiian or Other Pacific Islander		172	0.5%	0.101	0.013
2				143	0.4%		
1	UN	Unknown Gender		1,652	5.1%	0.695	0.003
2				1,674	5.2%		
1	2186-5	Not Hispanic or Latino		22,221	68.9%	0.001	0.025
2				22,596	70.1%		
1	2135-2	Hispanic or Latino		2,652	8.2%	0.005	0.022
2				2,460	7.6%		
1	2054-5	Black or African American		5,095	15.8%	0.016	0.019
2				4,873	15.1%		
1	M	Male		13,390	41.5%	0.152	0.011
2				13,211	41.0%		
1	2028-9	Asian		681	2.1%	0.210	0.010
2				636	2.0%		

Diagnosis

Group		Mean ± SD	Patients	% of Group	P-Value	SMD	
1	Z55-	Persons with potential health		419	1.3%	0.002	0.025
2	Z65			333	1.0%		

hazards related to socioeconomic and psychosocial circumstances						
1	E66	Overweight and obesity	11,336	35.1%	0.668	0.003
2			11,284	35.0%		
1	Z68.3	Body mass index [BMI] 30-39, adult	3,244	10.1%	0.263	0.009
2			3,159	9.8%		
1	Z68.4	Body mass index [BMI] 40 or greater, adult	2,968	9.2%	0.311	0.008
2			2,894	9.0%		
1	Z68.25	Body mass index [BMI] 25.0-25.9, adult	119	0.4%	0.017	0.019
2			85	0.3%		
1	Z68.26	Body mass index [BMI] 26.0-26.9, adult	150	0.5%	0.002	0.024
2			101	0.3%		
1	Z68.27	Body mass index [BMI] 27.0-27.9, adult	208	0.6%	0.016	0.019
2			162	0.5%		
1	Z68.28	Body mass index [BMI] 28.0-28.9, adult	262	0.8%	0.044	0.016
2			218	0.7%		
1	Z68.29	Body mass index [BMI] 29.0-29.9, adult	297	0.9%	0.237	0.009
2			269	0.8%		
1	Z80	Family history of primary malignant neoplasm	1,203	3.7%	0.083	0.014
2			1,121	3.5%		
1	Z15.0	Genetic susceptibility to malignant neoplasm	18	0.1%	0.194	0.010
2			11	0.0%		
1	Z12	Encounter for screening for malignant neoplasms	6,176	19.1%	<0.001	0.043
2			5,635	17.5%	1	
1	Z85	Personal history of malignant neoplasm	1,107	3.4%	0.040	0.016
2			1,014	3.1%		
1	Z98.84	Bariatric surgery status	517	1.6%	0.457	0.006
2			541	1.7%		
1	E66.0	Obesity due to excess calories	5,848	18.1%	0.706	0.003
2			5,885	18.2%		

1	E66.2	Morbid (severe) obesity with alveolar hypoventilation	227 213	0.7% 0.7%	0.503	0.005
1	E66.3	Overweight	531 466	1.6% 1.4%	0.038	0.016
1	E66.8	Other obesity	190 159	0.6% 0.5%	0.096	0.013
1	E66.9	Obesity, unspecified	8,093 8,035	25.1% 24.9%	0.598	0.004
Family history of other malignant neoplasms of lymphoid, hematopoietic and related tissues						
1	Z80.7	neoplasms of lymphoid, hematopoietic and related tissues	15 16	0.0% 0.0%	0.857	0.001
1	D47.2	Monoclonal gammopathy	110 102	0.3% 0.3%	0.582	0.004
1	C90.3	Solitary plasmacytoma	10 10	0.0% 0.0%	1	<0.001
1	D45	Polycythemia vera	64 54	0.2% 0.2%	0.357	0.007
1	D46	Myelodysplastic syndromes	31 19	0.1% 0.1%	0.090	0.013
Other neoplasms of uncertain behavior of lymphoid, hematopoietic and related tissue						
1	D47	of lymphoid, hematopoietic and related tissue	233 201	0.7% 0.6%	0.123	0.012

Medication

Group		Mean ± SD	Patients	% of Group	P-Value	SMD
1	A10A	INSULINS AND ANALOGUES	14,032 13,985	43.5% 43.4%	0.709	0.003
1	A10B	Sulfonylureas	5,412 5,332	16.8% 16.5%	0.398	0.007
1	A10B	Alpha glucosidase inhibitors	121 121	0.4% 0.4%	1	<0.001
1	A10B	Thiazolidinediones	1,930 1,898	6.0% 5.9%	0.594	0.004
1	A10B	Dipeptidyl peptidase 4 (DPP-4) inhibitors	3,465 3,454	10.7% 10.7%	0.889	0.001

1	A10B	Sodium-glucose co-transporter 2 (SGLT2) inhibitors	1,742	5.4%	0.052	0.015
2	K		1,632	5.1%		
1	A10B	Other blood glucose lowering drugs, excl. insulins	654	2.0%	0.911	0.001
2	X		650	2.0%		