Appendix

Table 1: Criteria for identifying the population with diabetes†

Criteria Group 1.	**Diagnosis or Treatment Codes**
Two or more outpatient diabetes diagnosis codes on problem list and from an outpatient visit (Type 1, Type 2, Other Diabetes, or related complications) on separate occasions *Diabetes diagnoses codes on the patient's problem list can only count as one of the two required codes.	**Outpatient Diagnosis Code List:**
	Type 1 • ICD9: 250.x1, 250.x3 • ICD10: E10.x
	Type 2 • ICD9 : 250.x0, 250.x2 • ICD10 : E11.x
	Pre-existing type 1 or type 2 diabetes mellitus, in pregnancy, childbirth and the puerperium • ICD9: 648.0x • ICD10: O24.0x (type 1), O24.1x (type 2), O24.3x (unspecified), O24.8 (Other DM)
	Other Diabetes • ICD10: E13.x
	Polyneuropathy in Diabetes • ICD9: 357.2 • ICD10: under E10 and E11 neurological complications
	Diabetic retinopathy • ICD9: 362.0x • ICD10: under E10 and E11 ophthalmic complications
	Diabetic cataract • ICD9: 366.41 • ICD10: under E10 and E11 ophthalmic complications
OR	
Criteria Group 2.	**Diagnosis or Treatment Codes**
One or more outpatient diabetes diagnosis codes on problem list or from an outpatient visit (Type 1, Type 2, Other Diabetes, orrelated complications) ***or*** inpatient DKA **AND** ([one outpatient A1C ≥ 6.5% ***or*** one c-peptide <1.1 ng/mL ***or*** one diabetes autoantibodies present ***or***an outpatient prescription for anti-diabetic medication] ***and***patient not flagged for gestational diabetes)	**Outpatient Diagnosis Code List (same as above)**
	Inpatient Setting only - Ketoacidosis (DKA) Diagnosis Codes:
	Type 1 • ICD9: 250.11 DKA, type I [juvenile type], not stated as uncontrolled • ICD9: 250.13 DKA, type I [juvenile type], uncontrolled • ICD10: E10.10 DKA without coma • ICD10: E10.11 DKA with coma

	Type 2 or Unspecified:
	• ICD9: 250.10 DKA, type II or unspecified type, not stated as uncontrolled
	• ICD9: 250.12 DKA, type II or unspecified type, uncontrolled
	• ICD10: E11.10 Type 2 without coma
	• ICD10: E11.11 Type 2 with coma
	  ○ ICD10: E13.10 Unspecified without coma
	  ○ ICD10: E13.11 Unspecified with coma

	Outpatient Rx Drug Lists for Insulin and Non-insulin (see Appendix B. excludes metformin not in combination with another antidiabetic)
	A1c ≥ 6.5 any single outpatient lab result
	C-peptide < 1.1 any single lab result (inpatient or outpatient)
	Diabetes **autoantibodies** present any single lab result (inpatient or outpatient)

† Excluding gestational diabetes (ICD9: 648.8x; ICD10 O24.4x or O24.9x), diabetes mellitus due to underlying condition (ICD10 E08), and drug or chemical induced diabetes mellitus (ICD10 E09).

Table 2. SUPREME DM Algorithm Criteria*

Type 1 DM cases:

- T1_ratio > 50% and Oral agent count <= 0 or
- T1_ratio > 50% and Glucagon count >= 1 or
- Positive autoantibodies or c-peptide result < 0.1 ng/mL

Independently of the T1DM cases found above, we ran the full study sample through SUPREME DM's criteria to classify T2DM cases (without the use of glucose):

- total_T1_cnt <= 0 or
- total_T2_cnt > 2 and (INS_OUT_COUNT <= 0 or All_ORAL_CNT<= 0) or
- total_T2_cnt > 1 and all_oral_cnt>=1 and Ins_out_count<= 0 or
- total_T2_cnt> 1 and INS_OUT_COUNT <= 0 and All_ORAL_CNT<= 0 and highest_A1c > 6.5 or All_oral_cnt>= 0 and highest_a1c > 6.5.

* Raebel MA, Schroeder, EB Goodrich G, et al. (2016) Mini-sentinel methods validating type 1 and type 2 diabetes mellitus in the mini-sentinel distributed database using the surveillance, prevention, and management of diabetes mellitus (SUPREME-DM) datalink. *Report available at* *https://www.sentinelinitiative.org/sites/default/files/Methods/Mini-Sentinel_Methods_Validating-Diabetes-Mellitus_MSDD_Using-SUPREME-DM-DataLink.pdf*.

Table 3. Variables needed to run the models:

Variable name	Variable description
AGE	patient age during study timeframe (continuous)
W_T1_PCT	Weighted ratio of T1DM to all diabetes diagnoses (continuous 1-100)
OA_USE_ONLY	Patient only takes oral agent medication (no evidence of taking insulin) (binary)
INS_USE_ONLY	Patient only uses insulin (no evidence of taking diabetes oral medication)
GL_CNT	The total number of Glucagon prescriptions found (continuous; range:
High_BMI	Patient's highest BMI value found during the timeframe (continuous)
T1_Super_FACTOR	Binary flag variable indicating that one of these was found: 1. insulin pump use, 2. celiac disease, 3. diabetic ketoacidosis, 4. hypoglycemia, 5. c-peptide < 0.1, or 6. positive diabetes autoantibodies.

Table 4. SAS Code for the Multinomial Regression Model

```
procsurveylogistic data=Development_HALF;
strataracecat female agecat SM_TYPE;
class type(ref=last) OA_USE_ONLY(ref=first) INS_USE_ONLY(ref=first) T1_Super_Factor
      (ref=first) racecat (ref=first) female (ref=first) agecat (ref=first) SM_TYPE (ref=first)
      / param=ref ;
model type (event=last) = Age W_T1_pct OA_USE_ONLY INS_USE_ONLY GL_CNT
      high_bmi T1_Super_Factor;
/ link = glogitexpb ;
weightweight;
storemodel_coeff;
odsoutputParameterEstimates=PE OddsRatios=OR;
run;
```

Note: The italicized lines were for study-specific sample weighting.
Ref=first means the reference is when a binomial factor = 0. Except for Type, in which the reference is Type 2 diabetes.

Table 5. SAS code to apply the model coefficients stored from the above procedure to USER INPUT DATA.

```
procplm restore=model_coeff;
score data=INPUT_DATA out=data_scored predicted/ ilink; run;
procsortdata=data_scoredout=validation; bypatient_ID predicted; run;
data validation1; set validation;
bypatient_ID predicted;
if last patient_ID; /* keeps the highest probability per patient */
rename _level_ =predicted_type;
keeppatient_ID type predicted_type; run;
```