Diabetes Prevalence Measure Definition

August 2024

Prepared for:
Administration for Community Living

MITRE | Center for Transforming Health

Operator of the CMS Alliance to Modernize Healthcare (The Health FFRDC)

A Federally Funded Research and Development Center

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Acknowledgments

This measure was collaboratively developed by MITRE and the Chesapeake Regional Information System for our Patients (CRISP). We would like to thank the CRISP team for their time and contributions to the development of this diabetes prevalence measure.

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1 Introduction

1.1 Purpose

This document describes a method for measuring diabetes prevalence among a general population and within populations that received clinical intervention or health-related services and programs. This document is intended for health information exchanges (HIEs) or organizations holding data from clinical settings who are interested in measuring diabetes prevalence.

This work is part of an Administration for Community Living (ACL) sponsored project, the Community and Clinical Data Initiative (CODI) Maryland pilot.[1] This measure was collaboratively developed by MITRE and the Chesapeake Regional Information System for our Patients (CRISP), the HIE in Maryland, and will function as a standalone measure and provide a foundation for the assessment of diabetes control.

1.2 Background Research

MITRE reviewed fourteen published diabetes measurement articles to identify candidate measurement approaches for consideration. Appendix A summarizes findings from relevant diabetes literature, which provided diabetes identification approaches that informed measure development. The literature review identified 3 primary approaches to measuring diabetes: SUrveillance, PREvention, and ManagEment of Diabetes Mellitus (SUPREME-DM), Healthcare Effectiveness Data and Information Set (HEDIS), and Centers for Medicare and Medicaid Services (CMS) National Quality Forum (NQF).

1.3 Assumptions

The assumptions for the diabetes prevalence measure include:

- Since the measure focuses on identifying people with diabetes in a population and provides a foundation for the assessment of diabetes control, the measure will not differentiate diabetes by type (e.g., Type 1 versus Type 2). The measure will also not identify:
    - individuals with prediabetes
    - individuals with undiagnosed diabetes mellitus.
    - incident cases of diabetes. An incident case refers to a new occurrence of a disease or health condition within a specified period of time. Incident cases are a subset of prevalent cases.
- The measure assumes no primary data collection is required since computation of the measure only requires health data generated from routine delivery of healthcare services.
- The measure assumes that a longitudinal dataset is not required since it is cross-sectional. As a result, the measure will not measure progression of diabetes in an individual over time.
- The measure assumes that HIEs have access to basic demographic attributes, encounter information, and diagnostic codes in the form of International Classification of

[1] This and other resources available at https://mitre.github.io/codi/

Disease revision 10 (ICD-10) codes received from a HIE participant (i.e., a healthcare provider organization that shares data with a HIE.)

- The measure assumes that HIEs implementing this measure may have to translate aspects of the measure definition based on their systems and data availability since each HIE receives different types and formats of health data through various mechanisms.
    - For instance, HIEs may have to interpret the concept of a clinical service or an encounter and what evidence is present in the clinical data they receive. Although a Continuity of Care Document (CCD) suggests that an encounter occurred, it is not itself evidence of an encounter; however, a HIE may accept a CCD as evidence that a clinical service was received.
- The measure assumes that some individuals in a population of interest may lack sufficient clinical data to be included in the measure calculation. Lacking clinical data may indicate that a person did not receive any healthcare during the measurement period or that clinical data has not been shared with the HIE in a usable way. Thus, HIEs will need to determine criteria to select individuals with sufficient clinical data for the measure calculation.
- The measure assumes that patient matching and deduplication will be conducted either as an ongoing effort, or prior to the calculation of this measure by the HIE.

2 Measure Description

The diabetes prevalence measure identifies the proportion of individuals from a population of interest with a diabetes diagnosis among adults (18 years or older) who received a clinical service from an HIE participant within a measurement period.[2]

There are two intended aims of the diabetes prevalence measure.

1. Identify the burden of diabetes mellitus among an adult population of interest within a designated period of time.
2. Support calculation of related diabetes measures that require identifying a population of individuals with diabetes mellitus for whom other measures can be assessed (e.g., diabetes control among individuals diagnoses with diabetes).

2.1 Key Definitions

The following terms are used in the measure description as defined below.

- **Evidence of Receiving a Clinical Service**: A clinical service is generally assumed to be provided at an encounter (i.e., hospitalization or ambulatory visit). However, HIEs must infer what occurred during an encounter since a complete record of a healthcare encounter is not usually shared. A HIE may define evidence of receiving a clinical service in different ways; for example, evidence of an encounter (such as an HL7 Version 2[3] Admission, Discharge, and Transfer message or a CCD[4])) with at least one diagnostic code.

[2] An HIE participant is a healthcare provider organization that shares data with an HIE.

[3] HL7 V2 Specification: https://www.hl7.org/implement/standards/product_brief.cfm?product_id=185

[4] HL7 Clinical Document Architecture: https://www.hl7.org/implement/standards/product_brief.cfm?product_id=7

For multi-day encounters that start before or extend beyond the measurement period, a HIE must consider whether to assess the receipt of clinical services at either the beginning or at the end of the encounter. The end date of the encounter may be preferred as diagnosis data may be more available at discharge.

- **Indication of Diabetes Unrelated to Pregnancy**: Defined as individuals with one or more instances of the ICD-10 diagnostic codes indicating diabetes (E10, E11, and E13) and not a code indicating diabetes due to pregnancy (O24).[5]

2.2 Source Data

The minimum clinical data necessary to compute diabetes prevalence are described in Appendix B in the context of the CODI Data Model.

2.3 Data Quality

The quality of the clinical data used to calculate diabetes prevalence should be assessed regularly to improve the accuracy and reliability of the results. Users are encouraged to assess data quality based on completeness, accuracy and stability, among others. Users should set their own measurement benchmarks and targets for this measure as appropriate for their data sources.

2.4 Selecting a Measurement Period

Users must define a measurement period to calculate prevalence; the measurement period is the time period during which diabetes prevalence will be calculated and assessed and also the time period used to select clinical data.

In defining a measurement period, users may consider their analytic goals, the data available to participating HIEs, and the information needs of HIE data-sharing partners like community-based organizations. Users may decide to align the measurement period to similar work (e.g., the reporting period for care quality measures) for comparability and validation.

A 12-month measurement period is recommended to compute diabetes prevalence. Longer measurement periods may be beneficial in some circumstances and extending the measurement period can increase the size of the population included in the denominator. Users are cautioned that applying an abbreviated measurement period that is less than a year could introduce bias.

Important in the selection of a measurement period is the recognition that individuals seek and consume healthcare in non-standard and non-random patterns, meaning that people seek and receive healthcare at different frequencies, and some are totally disengaged from the healthcare system. That means that no measurement period can be designed to capture everyone and users should carefully consider healthcare utilization patterns when creating a measurement period.

2.5 Selecting a Population of Interest

Users must define the population of interest—the group for whom diabetes prevalence will be calculated. The population of interest may be defined based on the demographic, clinical, and/or

[5] Individuals who had an ICD-10 code indicating malnutrition-related diabetes mellitus (Lontchi-Yimagou et al., 2022) (E12), diabetes due underlying conditions (E08), or drug-induced diabetes (E09) are not included.

other characteristics required for reporting. For instance, a defined population may be all participants that received services from a community-based organization. Selecting the population of interest is the first step in calculating diabetes prevalence (see calculation logic below).

2.6 Calculating Age

Users must calculate individual age as part of this measure. Individuals must have only one age calculated based on a single date in the measurement period to determine if they meet the denominator's exclusion criteria. There are several ways that age can be calculated, but a consistent approach should be used for all individuals.

The recommended approach is to calculate an individual's age on the first day of the measurement period as follows:

$$Age = [Start\ Date\ of\ Measurement\ Period] - [Date\ of\ Birth]$$

2.7 Defining the Denominator

Individuals in the denominator are those during the measurement period who:

- are in the defined population of interest,
- are 18 years or older,[6] and
- have evidence of receiving at least one clinical service during the measurement period.

2.7.1 Denominator Exclusions

While not required, users may elect to further refine their denominator by implementing one or more additional criteria, like excluding individuals who died during the measurement period.

2.8 Calculating the Numerator

Individuals in the numerator are those who have an indication of diabetes unrelated to pregnancy, defined as individuals with one or more ICD-10 diagnostic codes indicating diabetes (E10, E11, and E13) and not a code indicating diabetes due to pregnancy (O24).[7] The population diagnosed with diabetes should be calculated as a proportion of the denominator.

[6] Individuals under the age of 18 are excluded from the denominator to limit the influence of type 1 diabetes mellitus.

[7] Individuals who had an ICD-10 code indicating malnutrition-related diabetes mellitus (E12), diabetes due underlying conditions (E08), or drug-induced diabetes (E09) are not included in the numerator as these are rare types of secondary diabetes. This is consistent with the eCQM Value Set Authority code sets available at: VSAC Diabetes Value set: https://vsac.nlm.nih.gov/valueset/2.16.840.1.113883.3.464.1003.1272/expansion/Latest

2.9 Specifying the Calculation Logic

The diabetes prevalence measure calculation logic is described below; see Appendix C for the calculation logic diagram. This logic should be applied after the population of interest and measurement period have been defined and patient matching and linkage has been completed.

1. Is the individual 18 years or older? (Y/N)
    - If no, exclude.
    - If yes, proceed to next step.
2. Did the individual have evidence of at least one clinical service in the measurement period? (Y/N)
    - If no, exclude.
    - If yes, include the individual in the denominator.
3. Did the individual have one or more ICD-10 diagnostic codes indicating diabetes (E10, E11, and E13) and not an ICD-10 code indicating diabetes mellitus during or due to pregnancy (O24) in the measurement period? (Y/N)
    - If no, classify as “Does not have diabetes” in the numerator. Calculate as proportion of denominator.
    - If yes, classify as “Has diabetes” in the numerator. Calculate as proportion of denominator.

3 Limitations

This measure has the following limitations:

- Data from healthcare providers that do not share data with the HIE are not included. As a result, the measure cannot evaluate the burden of diabetes for individuals unengaged with the healthcare system since the measure can only use data accessible by the implementing HIE.
- The denominator may be incomplete because laboratory and medication data are not used to infer a new or existing diagnosis of diabetes mellitus where one was not documented explicitly in the record using diagnostic codes.

Appendix A Background Research Findings

This appendix summarizes findings from relevant diabetes literature, which provided diabetes identification approaches that informed measure development.

Table A-1. Diabetes Prevalence Measurements of Interest

ID	Title	Summary	Measurement	Inclusion and Exclusion Criteria
1	Construction of a Multisite DataLink Using Electronic Health Records for the Identification, Surveillance, Prevention, and Management of Diabetes Mellitus: The SUPREME-DM Project[8]	The SUPREME-DM Project aims to identify the number of people with diabetes using a multisite DataLink constructed from electronic health records. The study analyzed health system members with enrollment from 1/2005 through 12/2009 (five years; n=15,765,529). Of those, 1,085,947 (6.9%) met one or more diabetes criteria. Most members with diabetes (88%) met multiple criteria. Of the members with diabetes, 428,349 (39.4%) were incident cases. Data needed for this study included inpatient and outpatient diagnostic codes, laboratory test results, and pharmaceutical dispensing (fills).	The measure aims to be a complete count of individuals living with diabetes and does not differentiate between type 1 and type 2 diabetes. SUPREME-DM identifies members with diabetes based on dispensing of diabetes treatment medications, elevated laboratory values, and inpatient or outpatient diagnoses of diabetes. Identification criteria are one inpatient diagnostic code or two outpatient diagnoses on separate days; two elevated laboratory values (glucose and A1C) from the same test performed on separate days within a two-year period; or on fill for diabetes treatment medication. Value sets for International Clinical Diagnosis (ICD) 9 and 10, Logical Observation Identifiers, Names, and Codes (LOINC), and RXNORM are published with this measure. Members with only a metformin, exenatide, or thiazolidinedione dispensing were excluded to avoid including those with polycystic ovary syndrome or prediabetes.	**Inclusion Criteria:** All 15,765,529 members of participating health systems who had any enrollment from January 1, 2005, through December 31, 2009 were included in the denominator. This approach was used to establish an unbiased denominator for calculating population rates. The project aimed to capture all cases of diabetes and the earliest source of identification for new cases. All available data from January 1, 2000, through December 31, 2009, was searched to create a series of indicator variables that could identify possible diabetes. **Exclusion Criteria:** Individuals with pregnancy episodes were excluded to ensure gestational diabetes was not inadvertently captured.

[8] Nichols, G. A., Desai, J., Lafata, J. E., Lawrence, J. M., O'Connor, P. J., Pathak, R. D., ... & SUPREME-DM Study Group. (2012). Construction of a multisite DataLink using electronic health records for the identification, surveillance, prevention, and management of diabetes mellitus: the SUPREME-DM project. *Preventing chronic disease*, *9*.

ID	Title	Summary	Measurement	Inclusion and Exclusion Criteria
2	2024 Quality Rating System Measure Technical Specific2024 Quality Rating System Measure Technical Specifications (cms.gov)[9] (See page 130)	The Healthcare Effectiveness Data and Information Set (HEDIS) includes a measure for "Hemoglobin A1c Control for Patients with Diabetes," which includes a specification to identify patients with diabetes and an additional specification to assess control. The algorithm that identifies individuals with diabetes may be applied to diabetes identification in the prevalence numerator.	HEDIS outlines two strategies to identify members with diabetes: diagnostic codes from claims/encounters and medication dispenses. Both methods must be used by the organization, but a member only needs to be identified by one method to be included in the measure. Members are identified as having diabetes during a measurement year or the year prior. Diagnostic codes from claims/encounters: diabetes is identified by one or more acute inpatient encounter with a diabetes diagnostic code, one acute inpatient discharge with a diabetes diagnosis, or at least two outpatient visits, observation visits, telephone visits, e-visits, emergency department visits, nonacute inpatient encounters or discharges, on different dates, with a diabetes diagnosis. Value sets for ICD-10 and Current Procedural Terminology (CPT) are published with this measure. Medication dispenses: Diabetes is identified by pharmacy dispensing records for hypoglycemics/antihyperglycemics or insulin during the measurement year or the year prior.	**Inclusion criteria:** Any member (18-75) who had a claim or qualifying encounter in the measurement year were included in the denominator. **Exclusion criteria:** Members who died, who were receiving palliative care, or who were in hospice or using hospice services at any time during the measurement year are excluded. Members ³66 years with indication of frailty and advanced illness, or who are receiving dementia medications are excluded. Members with no diabetes diagnosis during the measurement year or the year prior but have been diagnosed with polycystic ovarian syndrome, gestational diabetes, or steroid-induced diabetes during the same period are also excluded from the measure.

[9] HEDIS Measure Definition: https://www.cms.gov/files/document/2024-qrs-measure-technical-specifications.pdf

ID	Title	Summary	Measurement	Inclusion and Exclusion Criteria
3	Quality ID #1 (NQF 0059): Diabetes: Hemoglobin A1c (HbA1c) Poor Control (>9%) (cms.gov)[10]	Centers for Medicare and Medicaid Services (CMS) requires that healthcare systems track a battery of electronic clinical quality metrics (eCQMs) including a measure for diabetes control among patients with diabetes. eCQMs are computed at the practice or provider level and are submitted a minimum of once per performance period for patients with diabetes seen during the performance period. The most recent quality data code submitted will be used for performance calculation. The algorithm that identifies individuals with diabetes may be applied to diabetes identification in the prevalence numerator.	National Quality Forum (NQF) 0059 identifies patients with diabetes by one or more diagnostic codes for diabetes and one or more procedure codes that identified specific types of visits from which diagnostic codes may be used. Value sets for NQF 0059 diagnostic codes have been published for ICD and Systematized Nomenclature of Human Medicine (SNOMED). Diabetes diagnostic codes (ICD-10) include E10 (type 1 diabetes), E11 (type 2 diabetes), E12 (malnutrition-related diabetes), E13 (other specified diabetes mellitus), and selected O24 (diabetes mellitus in pregnancy and childbirth) codes that do not include gestational diabetes.	**Inclusion Criteria:** Patients (18-75) who had a claim or qualifying encounter in the measurement year are included in the denominator. **Exclusion Criteria:** Patients who were receiving palliative care for any part of the measurement period are excluded. Patients who were ³66 years by the end of the measurement period with an indication of frailty for any part of the measurement period who also meet any of the following advanced illness criteria are excluded from the measure: Patients with advanced illness with two outpatient encounters during the measurement period or the year prior, or advanced illness with one inpatient encounter during the measurement period or the year prior, or patients taking dementia medications during the measurement period or the year prior.

[10] eCQM Measure Definition: https://ecqi.healthit.gov/sites/default/files/ecqm/measures/CMS122v12.html#toc

Appendix B CODI Data Model Attributes Required to Compute Diabetes Prevalence

This appendix defines the data attributes needed to compute the diabetes prevalence measure organized by the CODI Data Model tables; attributes are identified in ALL CAPS as they are defined in the CODI Data Model Data Dictionary.[11] If you are not using the CODI Data Model, you will need to map the fields from your source system to the attributes defined below.

The following attributes from the DEMOGRAPHICS table are required to calculate age. Notably, patient identifiers needed to match or link patients are stored in the DEMOGRAPHICS table but are not listed below. This measure definition assumes that patient matching or linkage has already occurred.

Table B-1. DEMOGRAPHICS Table Data Elements for Measure Calculations

Attribute Name	Format	Value Set	Definition	Example Inputs	Measure Calculation Use
PATID	Char	None	Arbitrary person-level identifier. Used to link across tables.		Primary Key
BIRTH_DATE	MM/DD/YYYY	None	Date of birth. Needed for the calculation of age.	12/09/1949	Age Calculation

[11] Available at https://mitre.github.io/codi/

The ENCOUNTER table stores information about clinical encounters. The following attributes can provide evidence of a documented clinical encounter.

Table B-2. ENCOUNTER Table Data Elements for Measure Calculations

Attribute Name	Format	Value Set	Definition	Example Inputs	Measure Calculation Use
ENCOUNTERID	Char	None	Arbitrary encounter-level identifier used to link across tables.		Primary Key
PATID	Char	None	Arbitrary person-level identifier used to link across tables.		Foreign Key
ADMIT_DATE	MM/DD/YYYY	None	Encounter or admission date.	02/24/2024	Denominator: Evidence of documented clinical services
DISCHARGE_DATE	MM/DD/YYYY	None	Discharge date.	02/24/2024	Denominator: Evidence of documented clinical services

The CONDITION table stores information about a patient's diagnosed and self-reported health conditions and diseases. The patient's medical history and current state may both be represented. The following attributes may provide evidence of a diabetes diagnosis.

Table B-3. CONDITION Table Data Elements for Measure Calculations

Attribute Name	Format	Value Set	Definition	Example Inputs	Measure Calculation Use
CONDITIONID	Char	None	Arbitrary identifier used to link across tables.		Primary Key
PATID	Char	None	Arbitrary person-level identifier used to link across tables.		Foreign Key
CONDITION	seven-character, alphanumeric	ICD-10	Some codes will contain leading zeroes, and different levels of decimal precision may also be present. This field is a character field, not numeric, to accommodate these coding conventions. Please populate the exact value of this diagnosis code, but remove any source-specific suffixes and prefixes. (Description updated in v3.1.)	E10.42	Numerator: Evidence of diabetes diagnosis
CONDITION_TYPE	CHAR	CONDITION_TYPE_TYPE	Condition code type.	10 for ICD-10	numerator: Evidence of diabetes diagnosis

The DIAGNOSIS table stores diagnosis codes that indicate the results of diagnostic processes and medical coding within healthcare delivery. The following attributes may provide evidence of a diabetes diagnosis.

Table B-4. DIAGNOSIS Table Data Elements for Measure Calculations

Attribute Name	Format	Value Set	Definition	Example Inputs	Measure Calculation Use
DIAGNOSISID	Char	None	Arbitrary identifier used to link across tables.		Primary Key
PATID	Char	None	Arbitrary person-level identifier used to link across tables.		Foreign Key
DX	seven-character, alphanumeric	ICD-10	Some codes will contain leading zeroes, and different levels of decimal precision may also be present. This field is a character field, not numeric, to accommodate these coding conventions. Please populate the exact value of this diagnosis code but remove any source-specific suffixes and prefixes. (Description updated in v3.1.)	E10.42	Numerator: Evidence of diabetes diagnosis
DX_TYPE	Char	DX_TYPE	Diagnostic code type.	10 for ICD-10	Numerator: Evidence of diabetes diagnosis

Appendix C Diabetes Prevalence Measure Calculation Logic Flow Chart