AHRQ Quality Indicators

Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) Research Tool User Guide Version 1.0

https://qualityindicators.ahrq.gov/Downloads/Resources/Toolkits/SPADE_User_Guide.pdf

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Learn More: Additional Resources

This document describes how to use the AHRQ Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) Research Tool and provides a brief primer of the underlying SPADE concepts. For the full scientific rationale informing the Research Tool, specifications for how the software calculates the four pre-loaded example symptom-disease pairs, and overall rates for these pairs calculated in a multi-state sample, see *Scientific Rationale, Specifications, and Overall Rates for the AHRQ Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) Research Tool*.

For a "quick start" guide to use the SPADE Research Tool software, see the SPADE Research Tool Quick Start Guide.

Overview of Symptom-Disease Pair Analysis of Diagnostic Error (SPADE)

Symptom-Disease Pair Analysis of Diagnostic Error (SPADE)[1] is a methodology for identifying potential diagnostic safety events using administrative healthcare data (e.g., claims or discharge summaries) or electronic health record (EHR) data (Liberman & Newman-Toker, 2018). SPADE identifies acute conditions (such as stroke) that are typically preceded by a defined set of symptoms a short time period before diagnosis. The method uses these pairings to identify potential diagnostic safety events, such as hospitalizations for the acute condition that were preceded by a treat-and-release emergency department visit (ED) with the paired symptoms. The methodology offers two analytic strategies: "look-back" and "look-forward."

Look-Back Approach

The look-back approach starts with patients who have been diagnosed with a specific disease and examines their earlier clinical encounters (usually ED visits, but the tool may be extended to ambulatory care settings) to identify whether symptoms potentially indicative of that disease were present. This retrospective analysis aims to identify potentially missed diagnostic opportunities, misdiagnoses, or opportunities for improvement in the diagnostic process. For example, if a patient is hospitalized with a stroke and had presented with dizziness in the ED days earlier, it may be suggestive of a potential diagnostic safety event or a possible opportunity for improvement. Researchers, clinicians, or administrators may use this analytic approach to identify cases for in-depth review or to track trends over time.

Look-Forward Approach

The look-forward approach starts with patients presenting with a specific symptom (which may be identified in a prior Look-Back analysis) and follows them over time to determine if a serious disease or condition related to that symptom is diagnosed subsequently. For example, if a patient had a treat-and-release ED visit with symptoms possibly related to coronary artery disease (e.g., chest pain), and the patient is later hospitalized with acute myocardial infarction, this pattern may identify an opportunity for improvements in clinical process, such as improved linkage to follow-up care that may prevent further

[1] For more information on SPADE, see *Scientific Rationale, Specifications, and Overall Rates for the AHRQ Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) Research Tool*: *https://qualityindicators.ahrq.gov/Downloads/Resources/Toolkits/SPADE_Scientific_Rationale.pdf*

exacerbation of the disease process. This prospective analysis may be applied to identify instances where a serious condition was not diagnosed despite the presence of potentially related symptoms (Liberman & Newman-Toker, 2018), which allows the investigator to assess the effectiveness of initial clinical evaluations and the timeliness of subsequent diagnoses.

Overview of the SPADE Research Tool

The SPADE Research Tool is designed to accelerate research on diagnostic excellence from a population health and quality improvement perspective. Unlike exploratory applications of SPADE that identify symptom candidates, this tool provides predefined symptom lists derived from prior literature and expert review for two sets of symptom-disease pairs: (1) chest pain/dyspnea and AMI, and (2) benign dizziness and stroke. The tool applies both look-forward and look-back analyses to understand the relationship between ED visits and inpatient admissions for AMI and stroke. In the look-forward analysis, it calculates rates of inpatient admission for AMI and stroke following ED visits with possibly-related symptoms, per 10,000 ED visits with possibly-related symptoms. In the look-back analysis, it calculates rates of inpatient admissions for AMI and stroke preceded by ED visits with possibly-related symptoms, per 10,000 inpatient admissions for AMI and stroke. The tool also allows users to customize their own symptom disease pairs and implement their own look-forward and look-back analyses.

In addition to standard look-forward and look-back analyses, the SPADE Research Tool supports a risk-differenced approach for look-forward analyses. This method compares the "observed" short-term outcome rate (e.g., stroke within 30 days of an ED visit) to the "baseline" background rate of events in a longer follow-up window (e.g., strokes occurring 91–360 days after an ED visit). The difference between these two rates is interpreted as the portion of cases potentially due to diagnostic error, rather than baseline risk. To compute risk-differenced rates, the tool first calculates the "observed rate" of hospitalizations for the target condition (e.g., stroke or AMI) per 10,000 index ED visits that occur within 30 days of that ED visit (the "short-term" time window). Next, the tool calculates the "baseline" rate, which is the same rate of hospitalizations, but occurring during the "long-term" 91–360 day follow-up window and scaled to a 30-day equivalent. The risk-differenced rate is the observed rate minus the baseline rate. Positive values suggest higher-than-baseline rates of short-term hospitalizations after ED visits for potentially related symptoms, which may potentially suggest diagnostic error; negative values suggest lower-than-baseline rates of hospitalizations. Users may compare their hospital's risk-differenced rates to overall rates of the pre-defined stroke and AMI symptom-disease pairs, which were calculated in a multi-state sample, in the document, *Scientific Rationale, Specifications, and Overall Rates for the AHRQ Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) Research Tool.*

Note: Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) was developed by Johns Hopkins University (JHU) investigators and is documented in resources including their consensus-based entity (CBE)-endorsed measure, Avoid Hospitalization After Release with a Misdiagnosis—ED Stroke/Dizziness (Avoid H.A.R.M.—ED Stroke/Dizziness). AHRQ's SPADE Research Tool independently implements SPADE concepts to support research and quality improvement; it is not JHU-endorsed and may not reflect the current components of the JHU-stewarded measure.

Analytic Use of SPADE Research Tool

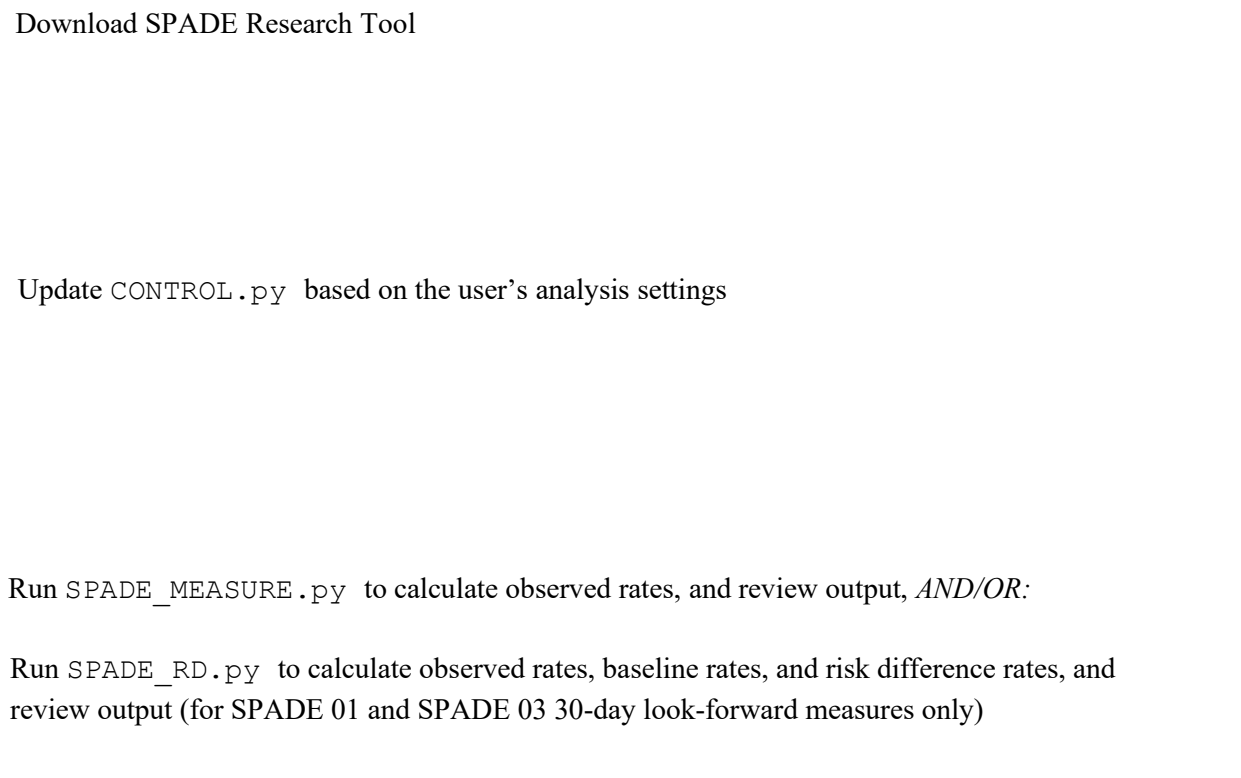
How to use SPADE Research Tool

The SPADE Research Tool consists of technical specifications, the ICD-10-CM code lists for the symptom-disease pairs, and Python scripts, which are pre-configured with default settings based on prior literature and expert input. These default settings are designed to support the analysis of acute myocardial infarction (AMI) and stroke among patients aged 18 and older. The tool includes predefined ICD-10-CM code sets to identify both the diseases and associated symptoms, and it applies standard time windows of 7 days and 30 days to assess the relationship between ED visits and inpatient admissions.

Implementing Specifications and Running the SPADE Research Tool

Figure 1 illustrates the step-by-step process for setting up and executing the SPADE Research Tool. Users begin by downloading the technical specifications and Python scripts, then configure settings, such as input/output file paths, measurement periods, and variable names, before running the analysis.

Figure 1. Workflow for using SPADE Research Tool



Workflow for using SPADE Research Tool

1. Prepare Input Data (ED and Inpatient Claims)

a. Measurement Period

Users must define the measurement period based on the availability and scope of their data. For look-forward analyses, it is important to include an additional follow-up window to capture inpatient admissions following ED visits. For example, to calculate the observed rates for look-forward analyses (e.g., SPADE 01 and SPADE 03) using SPADE_MEASURE.py, inpatient data must extend one month beyond the ED visits to fully capture subsequent inpatient admissions. If the ED data period is January 2021 through December 2022, then the inpatient data period January 2021 through January 2023 is required to ensure that the 7- or 30-day look-forward windows are captured. Similarly, for look-back analyses, if users aim to analyze inpatient data from February 2021 through January 2023 with a 30-day look-forward period, users should include ED visit data from January 2021 through January 2023.

To use the risk-differenced option (SPADE_RD.py, which calculates observed, baseline, and risk-differenced rates), inpatient data must extend one year beyond the ED visits to fully capture subsequent inpatient admissions. For example, if the ED data period is January 2021 through December 2022, then the inpatient data period January 2021 through December 2023 is required to ensure that the 360-day look-forward windows are captured for calculating the risk-differenced rates.

Note: The risk-differenced option is only available for the 30-day look-forward AMI and Stroke symptom-disease pairs (SPADE 01 and SPADE 03).

b. Clean Data

Before using the SPADE Research Tool, users are responsible for cleaning their data to ensure accuracy and consistency. As part of this process, outbound transfers should be excluded because they may lack complete follow-up information within the same dataset. Excluding these cases helps ensure that the analysis captures complete episodes of care within a single facility or health system.

2. Download SPADE Research Tool

a. Technical specifications

There are four technical specifications for the four pre-defined symptom-disease pairings: SPADE 01, SPADE 02, SPADE 03, and SPADE 04.[2] Each technical specification includes a detailed description of the measure, numerator, and denominator definitions.

- **SPADE 01** estimates the rate of Acute Myocardial Infarction (AMI) inpatient admissions following an Emergency Department (ED) visit within 7 or 30 days with symptoms possibly related to coronary artery disease, using a look-forward approach.

[2] For technical specifications, see *Scientific Rationale, Specifications, and Overall Rates for the AHRQ Symptom-Disease Pair Analysis of Diagnostic Error (SPADE) Research Tool*: *https://qualityindicators.ahrq.gov/Downloads/Resources/Toolkits/SPADE_Scientific_Rationale.pdf*

- **SPADE 02** estimates the rate of Acute Myocardial Infarction (AMI) inpatient admissions preceded by an Emergency Department (ED) visit within 7 or 30 days with symptoms possibly related to coronary artery disease, using a look-back approach.
- **SPADE 03** estimates the rate of stroke inpatient admissions following an Emergency Department (ED) visit within 7 or 30 days with symptoms of benign dizziness, using a look-forward approach.
- **SPADE 04** estimates the rate of stroke inpatient admissions preceded by an Emergency Department (ED) visit within 7 or 30 days with symptoms of benign dizziness, using a look-back approach.

b. Python programs

The SPADE Research Tool includes four key Python[3] scripts.

- **CONTROL.py** is the main configuration script that allows users to customize settings based on their analysis needs, including variable mappings and file paths for input data and output directories.
- **HELPERS.py** includes a collection of reusable functions that support data preparation, cleaning, and basic statistical summaries.
- **SPADE_MEASURE.py** calculates the SPADE observed rates by integrating functions from the other scripts.
- **SPADE_RD.py** calculates the observed, baseline, and risk-differenced rates for SPADE 01 and SPADE 03 (the stroke and AMI 30-day look-forward options).

c. Symptom-disease pairs ICD-10-CM code lists

The SPADE_DISEASE_SYMPTOM_CODES.xlsx Excel workbook contains the predefined ICD-10-CM code lists for the symptoms (observed at prior ED visits) and diseases (observed at subsequent hospital admissions) for the AMI and Stroke symptom-disease pairings included in the Research Tool. Symptoms for the AMI pairings are those potentially related to coronary artery disease (including chest pain and dyspnea), and symptoms for the stroke pairings include benign dizziness.

3. Update CONTROL.py based on the user's analysis settings

a. Default Variable Details

Users should update the default variable names to align with the file layout of their input data. Table 1 summarizes the default variable names in CONTROL.py.

[3] *Note:* users wishing to apply the tool in other programming languages may use the technical specifications including code lists to apply similar logic in other programming languages.

Table 1. SPADE Research Tool Default Variables

Data Source	Variable Name	Variable Description	Usage Note
ED and inpatient claims	PATIENT_ID	Unique patient identifier	Linkage Variable between ED and IP records.
ED and inpatient claims	Linkvar_list	Linkage variable list	Linkage variables between ED and IP records. Users can specify one or more variables to ensure accurate record linkage.
ED and inpatient claims	DAYSTOEVENT*	Days from "start date" to admission	If this variable is not available in the user's input data, the Research Tool will calculate it using admission date and discharge date.
ED claims	LOS*	Length of stay	If this variable is not available in the user's input data, the Research Tool will calculate it using admission date and discharge date.
ED and inpatient claims	ADMDT	Admission date	If DAYSTOEVENT or LOS is not available in the user's input data, the Research Tool will use the admission date.
ED and inpatient claims	DISCDT	Discharge date	If DAYSTOEVENT or LOS is not available in the user's input data, the Research Tool will use the discharge date.
ED and inpatient claims	DX1	Principal diagnosis	
ED and inpatient claims	AGE	Age	

Note: DAYSTOEVENT and LOS should be provided as a pair. If these variables are not available in the user's data, the Research Tool will use ADMDT (admission date) and DISCDT (discharge date) to calculate days between ED discharge and inpatient admission. If DAYSTOEVENT and LOS are available, the Research tool will compute the days difference as DAYSTOEVENT from inpatient data – (DAYSTOEVENT from ED data + LOS from ED data). If DAYSTOEVENT and LOS are not available, the days will be computed as ADMDT from IP data-DISCDT from ED data. For more information on DAYSTOEVENT, see the HCUP variable description at: https://hcup-us.ahrq.gov/db/vars/siddistnote.jsp?var=daystoevent

b. Input data and output locations

Users need to specify the locations and filenames of the required datasets. IP_LOC and ED_LOC should be updated to reflect the folder paths where the inpatient and ED claims data are stored, respectively. IP_FILE and ED_FILE should be replaced with the exact filenames of the inpatient and ED data files. These input files can be in standard formats such as .csv, .txt, or .sas7bdat. Users must ensure that the correct file extension is included when specifying the filenames. For the symptoms ICD-10-CM code list, users should update SYM_LOC with the folder path and SYM_FILE with the file name. OUTPUT_LOC should be set to the folder path where the SPADE analysis outputs will be saved.

4. Run SPADE_MEASURE.py and review output
   a. SPADE output file
      - **SPADE_FREQUENCY** contains a frequency table corresponding to one of the four SPADE measures, presenting the distribution of inpatient admissions over a 30-day period.
      - **SPADE_RESULT** summarizes the denominators and numerators for each measure and the calculated results, reported as a rate per 10,000. Specifically:
        - The look-forward measures are calculated as rates of inpatient admissions following an ED visit, per 10,000 preceding ED visits.
        - The look-back measures are calculated as rates of inpatient admissions preceded by an ED visit, per 10,000 inpatient admissions.
      - **Figures** The output also includes four figures, one for each SPADE measure (SPADE01-04), showing the number of inpatient admissions over a 30-day period in relation to ED visits – either following the ED visits (Look-Forward) or preceding the admission (Look-Back).
      - **SPADE_ANALYTIC FILES** contain detailed data used to calculate SPADE results.
      - **SPADE_ANALYTIC_FILE_LF** contains data based on the look-forward approach, including flag variables indicating whether a patient had an ED visit for potentially-related symptoms and the number of days between the ED discharge date and the inpatient admission date. See the data dictionary (Table A1) for details.
      - **SPADE ANALYTIC_FILE_LB** contains detailed data based on the look-back approach, including flag variables indicating whether a patient had an ED visit for potentially-related symptoms and the number of days between the ED discharge date and the inpatient admission date.
      - See the data dictionary (Table A2) for details.

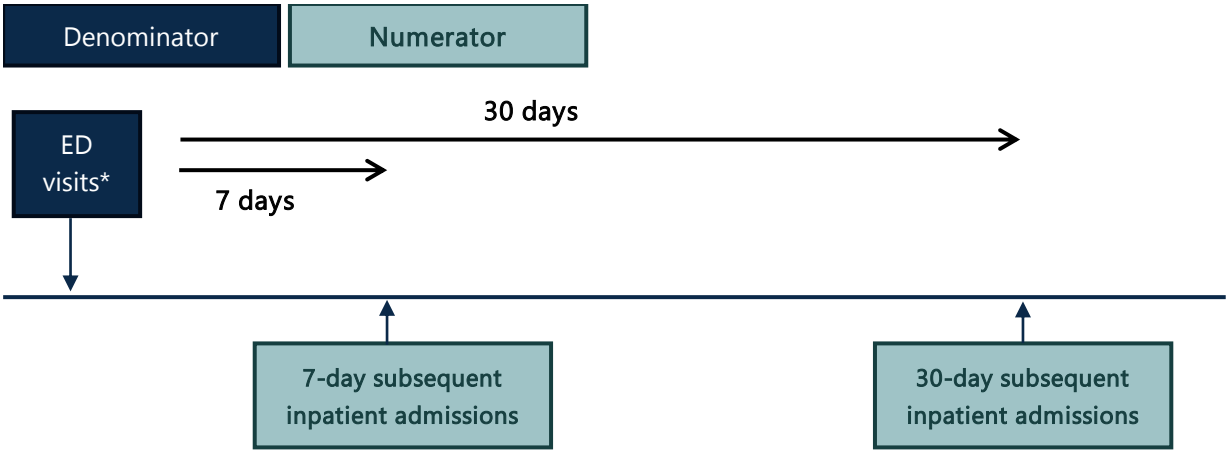
Customization

The SPADE Research Tool has the flexibility to accommodate users' measurement objectives. The tool includes predefined ICD-10-CM code sets for symptom-disease pairings for AMI and stroke. Users are encouraged to use these predefined ICD-10-CM code sets, but users can tailor these lists to fit their measurement goals. For example, users may directly edit SPADE_DISEASE_SYMPTOM_CODES.xlsx to add ICD-10-CM codes capturing a broader range of symptoms or remove codes not relevant in their setting. Users may also add new tabs to the Excel workbook (formatted the same as the existing tabs) to apply code lists for their own symptom-disease pairings.

Denominator and Numerator

Figure 2 illustrates how the SPADE Research Tool's look-forward approach defines the denominator and numerator for the look-forward approach. It starts with ED visits with potentially related symptoms and follows them to determine whether they result in subsequent inpatient admissions with a principal diagnosis of AMI or stroke within 7 days or 30 days.

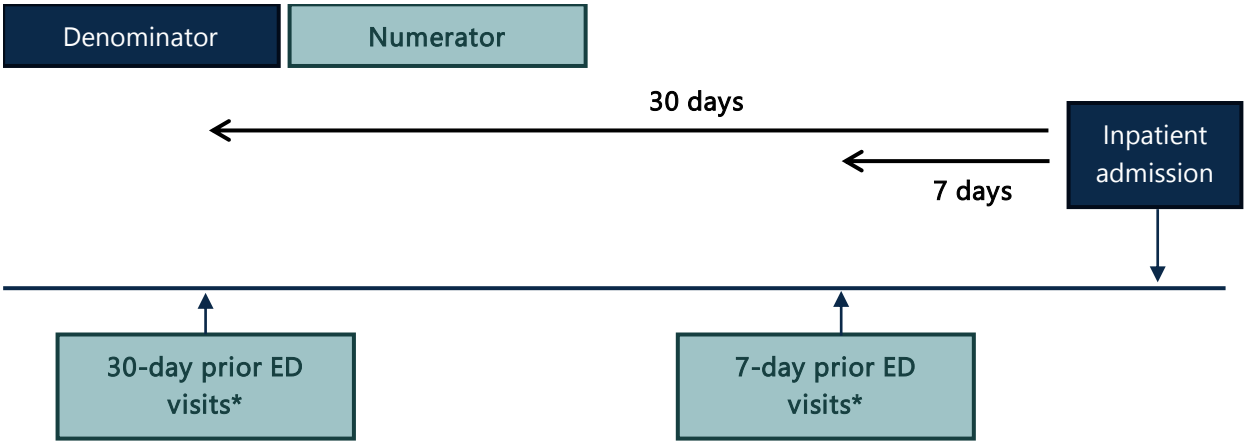
Figure 2. Denominator and Numerator for Look-Forward Approach



Note: For the look-forward approach, ED visits* are included if they are the first ED visit with potentially-related symptoms in the measurement period and subsequent ED visits occurring at least 360 days after the previous one. For more information, see the technical specifications available in the Appendix of the Scientific Rationale Document.

Figure 3 illustrates how the SPADE Research Tool defines the denominator and numerator for the look-back approach. It starts with inpatient admissions with a principal diagnosis of AMI or stroke and looks back to identify 7-day or 30-day prior ED visits with potentially related symptoms.

Figure 3. Denominator and Numerator for Look-Back Approach



Note: For the look-back approach, if multiple ED visits for potentially related symptoms are identified, only the ED visit closest to each inpatient admission date is included in the analysis. For more information, see the technical specifications available in the Appendix of the Scientific Rationale Document.

Hypothetical Examples

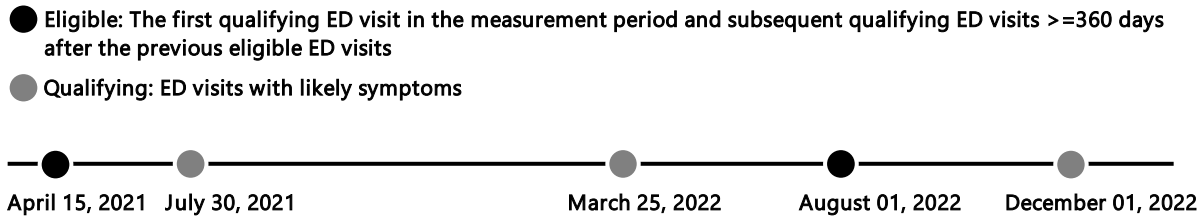
This section presents hypothetical examples of how the SPADE Research Tool can be used to measure the relationship between ED visits with benign dizziness and subsequent inpatient admission for stroke within 30 days using both look-forward and look-back approaches between January 2021 and January 2023.

Look-Forward Analysis

The user aims to estimate how frequently patients presenting to the ED with symptoms of benign dizziness are subsequently hospitalized for stroke within 30 days. To conduct the look-forward analysis, the SPADE Research Tool first identifies all treat-and-release ED visits for benign dizziness between January 2021 and December 2022. Then, it applies the eligibility criteria (e.g., retaining only the first qualifying ED visit per patient and subsequent ED visits occurring >= 360 days after the previous eligible ED visits), and it retains 50,000 eligible ED visits (Figure 3). These ED visits are linked to inpatient data based on the linkage variable (PATIENTID) between February 2021 through January 2023 to capture any stroke admissions occurring within 30 days of the eligible ED visits. Among these 50,000 ED visits, 100 patients were admitted for stroke within 30 days, resulting in a stroke rate of 20 admissions per 10,000 ED visits for benign dizziness (0.2%). This look-forward analysis shows that among patients discharged from the ED after presenting with stroke-like symptoms, 0.2% returned to the hospital with a stroke diagnosis, suggesting potential missed strokes in the ED setting (Table 2).

For look-forward measures, the tool also supports the calculation of risk-differenced rates. Following the example above, among 50,000 eligible ED visits for dizziness, 100 resulted in stroke admissions within 30 days (observed rate = 20 per 10,000). In the 91–360 day window, 900 stroke admissions occurred, equivalent to 100 per 30-day period after scaling (baseline rate = 18 per 10,000). The risk-differenced rate is 20 – 18 = 2 per 10,000 ED visits, suggesting that about 2 missed strokes per 10,000 visits may be due to potential diagnostic error.[4]

Figure 4 Qualifying and Eligible ED visits per Patient Example for the Look-Forward approach



Look-Back Analysis

The user aims to estimate the proportion of stroke admissions preceded by an ED visit where stroke symptoms were present but not diagnosed- a potential missed opportunity. To conduct the look-back analysis, the SPADE Research tool first identifies inpatient admissions for stroke that occurred between February 2021 and January 2023, resulting in 1,000 stroke hospitalizations. These inpatient admissions are linked to ED data between January 2021 and January 2023 based on the linkage variable (PATIENTID) to look back 30 days prior to each stroke admission to determine if there was a treat-and-release ED visit with symptoms potentially suggestive of stroke. Among 1,000 stroke hospitalizations, 100 were preceded by an ED visit for such symptoms within the prior 30 days. Represented as a rate per 10,000, this means the ED visits occurred at a rate of 1000 ED visits per 10,000 inpatient admissions (Table 2).

[4] Note: Consistent with the Johns Hopkins team's CBE endorsement specifications, we applied small adjustments to both the observed and baseline rates to avoid issues with zero values.

Table 2. Hypothetical Examples of Stroke (SPADE 03 and SPADE 04)

SPADE Approach	Denominator	Numerator	Result	Interpretation
Look-Forward (SPADE 03)	50,000 eligible ED visits with dizziness	100 followed by stroke admission within 30 days	Inpatient admission rate among ED visits with dizziness per 10,000 ED visits: 20 Risk-differenced rate per 10,000 ED visits: 2	Among ED visits for dizziness, 0.2% (20 per 10,000 ED visits) result in stroke hospitalization within 30 days After accounting for baseline stroke risk, about 2 missed stroke hospitalizations per 10,000 ED visits may be due to potential diagnostic error.
Look-Back (SPADE 04)	1,000 stroke admissions	100 had prior ED visits for dizziness within 30 days	Rate of patients who previously had an ED visit for dizziness, among patients later hospitalized for stroke: 1000 ED visits per 10,000 subsequent inpatient admissions for stroke	Among 1,000 stroke admissions, 100 had an ED visit for dizziness within 30 days prior to hospitalization, which means they occurred at a rate of 1,000 ED visits per 10,000 admissions.

References

Liberman AL, Newman-Toker DE. Symptom-Disease Pair Analysis of Diagnostic Error (SPADE): a conceptual framework and methodological approach for unearthing misdiagnosis-related harms using big data *BMJ Quality & Safety* 2018;27:557-566.

Appendix

Table A1 Data Dictionary for SPADE_ANALYTIC_FILE_LF

VARIABLE	DESCRIPTION	VARIABLE TYPE and VALUE DESCRIPTION
DaysToEvent_ED	Days from "start date" to ED admission	Numeric Null Conditions: no DaysToEvent variable is available
LOS_ED	ED length of stay	Numeric Null Conditions: no LOS variable is available in the user's data
ADMDT_IP	Date of inpatient admission	Date (YYYY/MM/DD) Null Conditions: DaysToEvent and LOS are available in the user's data.
DISCDT_ED	Date of inpatient discharge	Date (YYYY/MM/DD) Null Conditions: DaysToEvent and LOS are available in the user's data
DX1_ED	First-listed diagnosis code of potentially related symptoms from ED visit	Character
PATIENT_ID	Unique patient identifier (Linkage variable)	Character
AGE_ED	Age at the time of ED admission	Numeric
FLAG_SYMP_AMI	Indicator for ED visit with symptoms potentially related to coronary artery disease	0: No symptoms identified 1: Symptom identified Null Conditions: not relevant for given disease
FLAG_SYMP_STROKE	Indicator for ED visit with symptoms of benign dizziness	0: No symptoms identified 1: Symptoms identified Null Conditions: not relevant for given disease
ED_ELIG_AMI	Indicator for eligible ED visits with symptoms potentially related to coronary artery disease	0: Not Eligible ED visit 1: Eligible ED visit Null Conditions: not relevant for given disease
ED_ELIG_STROKE	Indicator for eligible ED visits with symptoms of benign dizziness	0: Not Eligible ED visit 1: Eligible ED visit Null Conditions: not relevant for given disease

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VARIABLE	DESCRIPTION	VARIABLE TYPE and VALUE DESCRIPTION
FLAG_AMI	Indicator for inpatient admission with AMI diagnosis	0: No AMI admission 1: AMI admission Null Conditions: not relevant for given disease
DAYS_DIFF_AMI	Days between ED discharge with symptoms potentially related to coronary artery disease and AMI admission date	Numeric Null Conditions: not relevant for given disease
AMI_LF_7d	Indicator for AMI admission within 7 days of ED visit for symptoms potentially related to coronary artery disease	0: No 1: Yes Null Conditions: not relevant for given disease
AMI_LF_30d	Indicator for AMI admission within 30 days of ED visit for symptoms potentially related to coronary artery disease	0: No 1: Yes Null Conditions: not relevant for given disease
FLAG_STROKE	Indicator for inpatient admission with stroke diagnosis	0: No stroke admission 1: Stroke admission Null Conditions: not relevant for given disease
DAYS_DIFF_STROKE	Days between ED discharge with symptoms for benign dizziness and stroke admission date	Numeric Null Conditions: not relevant for given disease
STROKE_LF_7d	Indicator for stroke admission within 7 days of ED visit	0: No 1: Yes Null Conditions: not relevant for given disease
STROKE_LF_30d	Indicator for stroke admission within 30 days of ED visit	0: No 1: Yes Null Conditions: not relevant for given disease

Table A2 Data Dictionary for SPADE_ANALYTIC_FILE_LB

DATA ELEMENT	DESCRIPTION	VARIABLE TYPE and VALUE DESCRIPTION
DaysToEvent_IP	Days from "start date" to inpatient admission	Numeric Null Conditions: no DaysToEvent variable is available
LOS_IP	Inpatient length of stay	Numeric Null Conditions: no LOS variable is available in the user's data
ADMDT_IP	Date of inpatient admission	Date (YYYY/MM/DD) Null Conditions: DaysToEvent and LOS are available in the user's data.
DISCDT_ED	Date of ED discharge	Date (YYYY/MM/DD) Null Conditions: DaysToEvent and LOS are available in the user's data
DX1_IP	Principal diagnosis code for inpatient admission	Character
PATIENT_ID	Unique patient identifier (Linkage variable)	Character
AGE_IP	Age at the time of inpatient admission	Numeric
FLAG_AMI	Indicator for inpatient admission with AMI diagnosis	0: No AMI admission 1: AMI admission Null Conditions: not relevant for given disease
FLAG_STROKE	Indicator for inpatient admission with stroke diagnosis	0: No stroke admission 1: Stroke admission Null Conditions: not relevant for given disease
FLAG_SYMP_AMI	Indicator for ED visit with symptoms possibly related to coronary artery disease	0: No possibly related symptom identified 1: Possibly related symptom identified Null Conditions: not relevant for given disease
DAYS_DIFF_AMI	Days between ED discharge with symptoms possibly related to coronary artery disease and AMI admission date	Numeric Null Conditions: not relevant for given disease
AMI_LB_7d	Indicator for AMI admission with a prior ED visit for	0: No 1: Yes

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DATA ELEMENT	DESCRIPTION	VARIABLE TYPE and VALUE DESCRIPTION
	potentially related symptoms within 7 days	Null Conditions: not relevant for given disease
AMI_LB_30d	Indicator for AMI admission with a prior ED visit for potentially related symptoms within 30 days	0: No 1: Yes Null Conditions: not relevant for given disease
FLAG_SYMP_STROKE	Indicator for ED visit with benign dizziness	0: No symptom identified 1: Symptom identified Null Conditions: not relevant for given disease
DAYS_DIFF_STROKE	Days between ED discharge with benign dizziness and stroke admission date	Numeric Null Conditions: not relevant for given disease
STROKE_LB_7d	Indicator for stroke admission with a prior ED visit within 7 days	0: No 1: Yes Null Conditions: not relevant for given disease
STROKE_LB_30d	Indicator for stroke admission with a prior ED visit within 30 days	0: No 1: Yes Null Conditions: not relevant for given disease