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Data obtained through Sentinel are intended to complement other types of evidence such as preclinical studies, clinical trials, postmarket studies, and adverse event reports, all of which are used by FDA to inform regulatory decisions regarding medical product safety. The information contained in this report is provided as part of FDA's commitment to place knowledge acquired from Sentinel in the public domain as soon as possible. Any public health actions taken by FDA regarding products involved in Sentinel queries will continue to be communicated through existing channels.

FDA wants to emphasize that the fact that FDA has initiated a query involving a medical product and is reporting findings related to that query does not mean that FDA is suggesting health care practitioners should change their prescribing practices for the medical product or that patients taking the medical product should stop using it. Patients who have questions about the use of an identified medical product should contact their health care practitioners.

The following report contains a description of the request, request specifications, and results from the modular program run(s).

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Overview

Date Run: December 29, 2016

Request Description: This purpose of this report was to compare the frequency of diagnoses for ischemic stroke using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) versus International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes. ICD-10-CM code definitions were determined by mapping from ICD-9-CM code definitions using the Centers for Medicare and Medicaid Services (CMS) General Equivalence Mappings (GEMs). Simple forward mapping (SFM) and forward-backward mapping (FBM) were used to map ICD-9-CM to ICD-10-CM codes.¹

Sentinel Modular Program Tool Used: Cohort Identification and Descriptive Analysis (CIDA) tool, version 3.3.2

Data Source: This request was run against data from 11 Data Partners contributing to the Sentinel Distributed Database (SDD). Data from October 1, 2010 to August 31, 2016 were included in this report. The report includes three separate time periods: 1) October 1, 2010 to August 31, 2016 2) January 1, 2015 to March 31, 2015 and 3) January 1, 2016 to March 31, 2016. See Appendix A for a list of the dates of available data for each Data Partner.

Study Design: We examined the incidence of ischemic stroke across the ICD-9-CM era (October 2010 - September 2015) and the ICD-10-CM era (October 2015 - September 2016) in the US. See Appendices B, C, and D for specific codes.

Cohort Eligibility Criteria: Members included in the cohort were required to be continuously enrolled in plans with medical coverage for at least 6 months (183 days) before their diagnosis date, during which gaps in coverage of up to 45 days were allowed. The following age groups were included in the cohort: 0-17, 18-49, 50-64, 65+ years.

Limitations: Algorithms used to define outcomes are imperfect; thus, it is possible that there may be misclassification. Therefore, data should be interpreted with this limitation in mind.

Please refer to Appendix E for detailed specifications of parameters used in the analyses for this request.

Notes: Please contact the Sentinel Operations Center Query Fulfillment Team (qf@sentinelssystem.org) for questions and to provide comments/suggestions for future enhancements to this document.

¹Fung, K. W., et al. (2016). "Preparing for the ICD-10-CM Transition: Automated Methods for Translating ICD Codes in Clinical Phenotype Definitions." EGEMS (Wash DC) 4(1): 1211.

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Glossary of Terms for Analyses Using Cohort Identification and Descriptive Analysis (CIDA) Tool*

Amount Supplied - number of units (pills, tablets, vials) dispensed. Net amount per NDC per dispensing. This is equivalent to the "RxAmt" value in the Sentinel Common Data Model.

Blackout Period - number of days at the beginning of a treatment episode that events are to be ignored. If an event occurs during the blackout period, the episode is excluded.

Care Setting - type of medical encounter or facility where the exposure, event, or condition code was recorded. Possible care settings include: Inpatient Hospital Stay (IP), Non-Acute Institutional Stay (IS), Emergency Department (ED), Ambulatory Visit (AV), and Other Ambulatory Visit (OA). For laboratory results, possible care settings include: Emergency department (E), Home (H), Inpatient (I), Outpatient (O), or Unknown or Missing (U). Along with the Principal Diagnosis Indicator, forms the Care Setting/PDX parameter.

Ambulatory Visit (AV) - includes visits at outpatient clinics, same-day surgeries, urgent care visits, and other same-day ambulatory hospital encounters, but excludes emergency department encounters.

Emergency Department (ED) - includes ED encounters that become inpatient stays (in which case inpatient stays would be a separate encounter). Excludes urgent care visits.

Inpatient Hospital Stay (IP) - includes all inpatient stays, same-day hospital discharges, hospital transfers, and acute hospital care where the discharge is after the admission date.

Non-Acute Institutional Stay (IS) - includes hospice, skilled nursing facility (SNF), rehab center, nursing home, residential, overnight non-hospital dialysis and other non-hospital stays.

Other Ambulatory Visit (OA) - includes other non overnight AV encounters such as hospice visits, home health visits, skilled nursing facility visits, other non-hospital visits, as well as telemedicine, telephone and email consultations.

Cohort Definition (drug/exposure) - indicates how the cohort will be defined: (1) 01: Cohort includes only the first valid treatment episode during the query period; (2) 02: Cohort includes all valid treatment episodes during the query period; (3) 03: Cohort includes all valid treatment episodes

Days Supplied - number of days supplied for all dispensings in qualifying treatment episodes.

Eligible Members - number of members eligible for an incident treatment episode (defined by the drug/exposure and event washout periods) with drug and medical coverage during the query period.

Episodes - treatment episodes; length of episode is determined by days supplied in one dispensing or consecutive dispensings bridged by the

Enrollment Gap - number of days allowed between two consecutive enrollment periods without breaking a "continuously enrolled" sequence.

Episode Gap - number of days allowed between two (or more) consecutive exposures (dispensings/procedures) to be considered the same

Event Deduplication - specifies how events are counted by the MP algorithm: (0) 0: Counts all occurrences of an HOI during an exposure episode; (1) 1: de-duplicates occurrences of the same HOI code and code type on the same day; (2) 2: de-duplicates occurrences of the same HOI group on the same day (e.g., de-duplicates at the group level).

Exposure Extension Period - number of days post treatment period in which the outcomes/events are counted for a treatment episode. Extensions days are added after any episode gaps have been bridged.

Exposure Episode Length - number of days after exposure initiation that is considered "exposed time."

Lookback Period (pre-existing condition) - number of days wherein a member is required to have evidence of pre-existing condition

Maximum Episode Duration - truncates exposure episodes after a requester-specified number of exposed days. Applied after any gaps are bridged

Member-Years - sum of all days of enrollment with medical and drug coverage** in the query period preceded by an exposure washout period all

Minimum Days Supplied - specifies a minimum number of days in length of the days supplied for the episode to be considered.

Minimum Episode Duration - specifies a minimum number of days in length of the episode for it to be considered. Applied after any gaps are bridged and extension days added to the length of the exposure episode.

Principal Diagnosis (PDX) - diagnosis or condition established to be chiefly responsible for admission of the patient to the hospital. 'P' = principal diagnosis, 'S' = secondary diagnosis, 'X' = unspecified diagnosis, '.' = blank. Along with the Care Setting values, forms the Caresetting/PDX

Query Period - period in which the modular program looks for exposures and outcomes of interest.

Treatment Episode Truncation Indicator - indicates whether observation of the incident query code during follow-up requires truncation of valid treatment episodes. A value of Y indicates that the treatment episodes should be truncated at the first occurrence of an incident query code. A value of N indicates that the treatment episodes should not be truncated at the occurrence of the incident query code.

Users - number of members with exposure during the query period. Member must have no evidence of exposure(s) of interest (defined by incidence criteria) in the prior washout period. A user may only be counted once in a query period.

Washout Period (drug/exposure)** - number of days a user is required to have no evidence of prior exposure (drug dispensing/procedure) and continuous drug and medical coverage prior to an incident treatment episode.

Washout Period (event/outcome)** - number of days a user is required to have no evidence of a prior event (procedure/diagnosis) and continuous drug and medical coverage prior to an incident treatment episode.

Years at Risk - number of days supplied plus any episode gaps and exposure extension periods all divided by 365.25.

*all terms may not be used in this report

**incident treatment episodes must be incident to both the exposure and the event

Table 1. Comparison of Incident Ischemic Stroke Diagnoses* in the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) Eras (January 1, 2015 - March 31, 2015 and January 1, 2016 - March 31, 2016)

	Number of Incident Diagnoses		Eligible Members	Member-Years	Number of Incident Diagnoses per 1,000 Eligible Members
Ischemic Stroke					
ICD-9-CM: January 1, 2015 - March 31, 2015	11,011	11,011	57,634,007	13,535,439.4	0.19
ICD-10-CM Simple Forward Mapping: January 1, 2016 - March 31, 2016	791	791	57,447,546	13,777,259.3	0.01
ICD-10-CM Forward-Backward Mapping: January 1, 2016 - March 31, 2016	10,898	10,898	57,421,718	13,758,294.2	0.19

*Incidence defined by 90 day washout

Figure 1. Incidence of Ischemic Stroke Diagnoses per 1,000 Members from October 2010 - August 2016 by Code Type, 183-Day Washout

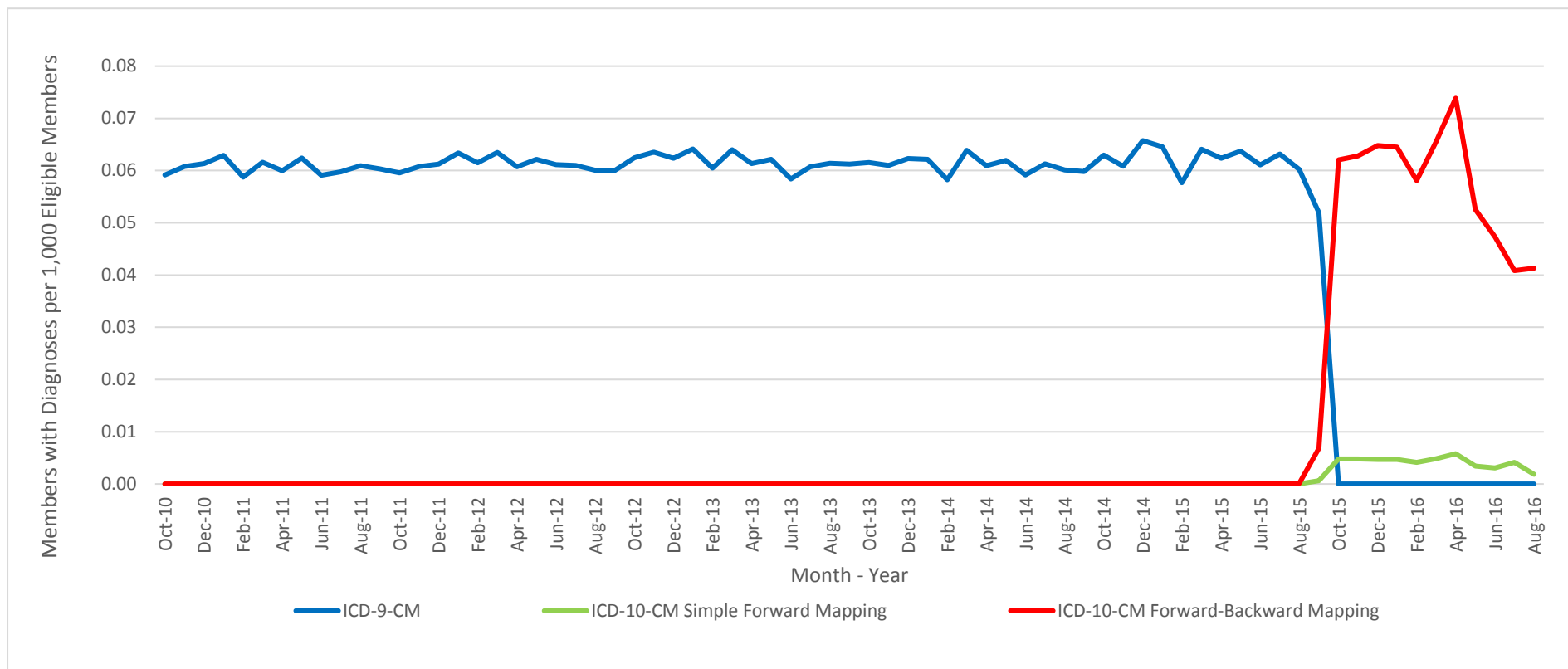
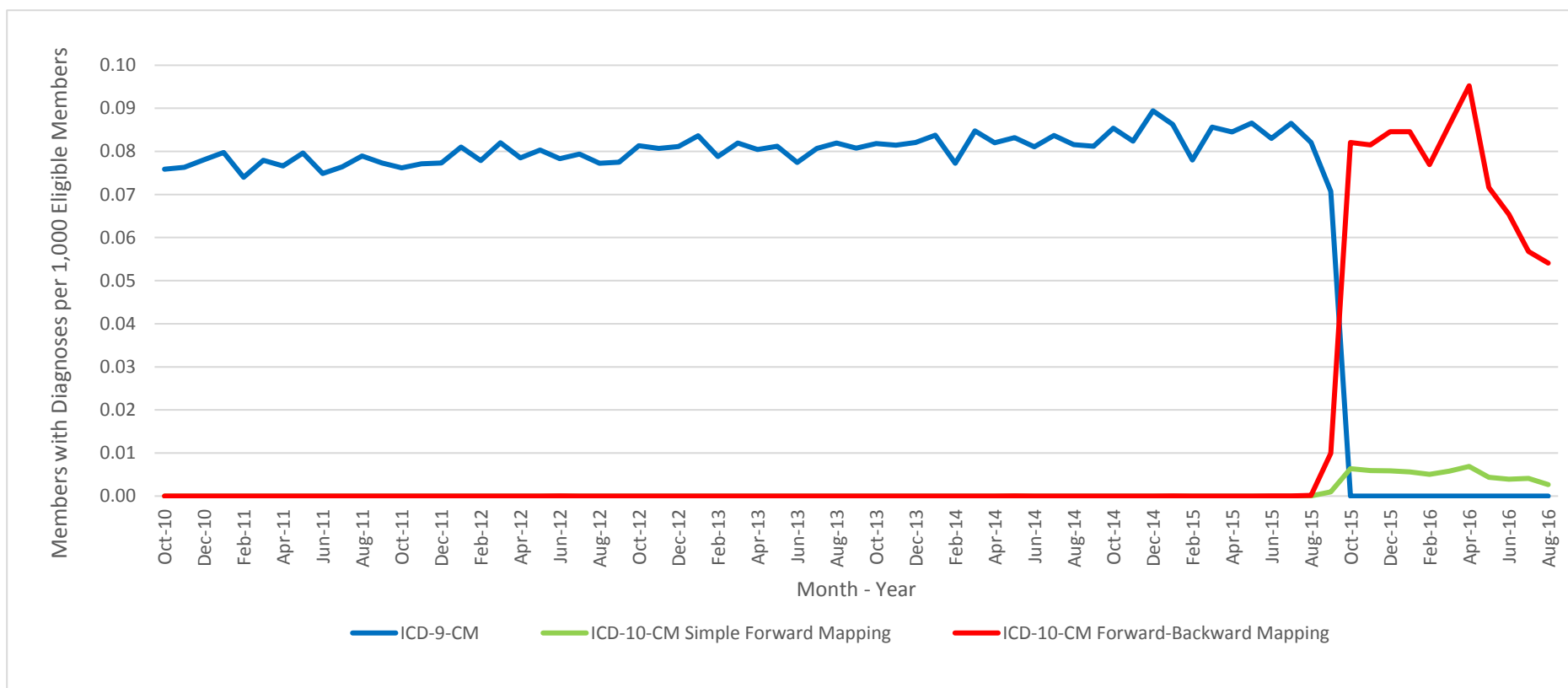


Figure 2. Prevalence of Ischemic Stroke Diagnoses per 1,000 Eligible Members from October 2010 - August 2016 by Code Type, 0-Day Washout



Appendix A. Date of Available Data for Each Data Partner in the Sentinel Distributed Database (SDD) as of Request End Date (August 31, 2016)

DP ID	Start Date	End Date
DP0001	10/1/2010	6/30/2016
DP0002	10/1/2010	4/30/2016
DP0003	10/1/2010	6/30/2016
DP0004	10/1/2010	7/31/2016
DP0005	10/1/2010	7/31/2016
DP0006	10/1/2010	6/30/2016
DP0007	10/1/2010	5/31/2016
DP0008	10/1/2010	7/31/2016
DP0009	10/1/2010	8/31/2016
DP0010	10/1/2010	3/31/2016
DP0011	10/1/2010	4/30/2016

Appendix B. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Algorithm¹

Code	Description	Code Type
433.01	Occlusion and stenosis of basilar artery with cerebral infarction	ICD-9-CM
433.11	Occlusion and stenosis of carotid artery with cerebral infarction	ICD-9-CM
433.21	Occlusion and stenosis of vertebral artery with cerebral infarction	ICD-9-CM
433.31	Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction	ICD-9-CM
433.81	Occlusion and stenosis of other specified precerebral artery with cerebral infarction	ICD-9-CM
433.91	Occlusion and stenosis of unspecified precerebral artery with cerebral infarction	ICD-9-CM
434.01	Cerebral thrombosis with cerebral infarction	ICD-9-CM
434.11	Cerebral embolism with cerebral infarction	ICD-9-CM
434.91	Unspecified cerebral artery occlusion with cerebral infarction	ICD-9-CM
436	Acute, but ill-defined, cerebrovascular disease	ICD-9-CM
H34.1	Central retinal artery occlusion	ICD-10-CM
H34.13	Central retinal artery occlusion, bilateral	ICD-10-CM
H34.12	Central retinal artery occlusion, left eye	ICD-10-CM
H34.11	Central retinal artery occlusion, right eye	ICD-10-CM
H34.10	Central retinal artery occlusion, unspecified eye	ICD-10-CM
I63.41	Cerebral infarction due to embolism of middle cerebral artery	ICD-10-CM
I63.422	Cerebral infarction due to embolism of left anterior cerebral artery	ICD-10-CM
I63.52	Cerebral infarction due to unspecified occlusion or stenosis of anterior cerebral artery	ICD-10-CM
I63.139	Cerebral infarction due to embolism of unspecified carotid artery	ICD-10-CM
I63.212	Cerebral infarction due to unspecified occlusion or stenosis of left vertebral arteries	ICD-10-CM
I63.541	Cerebral infarction due to unspecified occlusion or stenosis of right cerebellar artery	ICD-10-CM
I63.339	Cerebral infarction due to thrombosis of unspecified posterior cerebral artery	ICD-10-CM
I63.1	Cerebral infarction due to embolism of precerebral arteries	ICD-10-CM
I63.5	Cerebral infarction due to unspecified occlusion or stenosis of cerebral arteries	ICD-10-CM
I63.119	Cerebral infarction due to embolism of unspecified vertebral artery	ICD-10-CM
I63.2	Cerebral infarction due to unspecified occlusion or stenosis of precerebral arteries	ICD-10-CM
I63.039	Cerebral infarction due to thrombosis of unspecified carotid artery	ICD-10-CM
I63.33	Cerebral infarction due to thrombosis of posterior cerebral artery	ICD-10-CM
I63.42	Cerebral infarction due to embolism of anterior cerebral artery	ICD-10-CM
I63.032	Cerebral infarction due to thrombosis of left carotid artery	ICD-10-CM
I63.419	Cerebral infarction due to embolism of unspecified middle cerebral artery	ICD-10-CM
I63.513	Cerebral infarction due to unspecified occlusion or stenosis of bilateral middle arteries	ICD-10-CM
I63.532	Cerebral infarction due to unspecified occlusion or stenosis of left posterior cerebral artery	ICD-10-CM
I63.01	Cerebral infarction due to thrombosis of vertebral artery	ICD-10-CM
I63.10	Cerebral infarction due to embolism of unspecified precerebral artery	ICD-10-CM
I63.21	Cerebral infarction due to unspecified occlusion or stenosis of vertebral arteries	ICD-10-CM
I63.133	Cerebral infarction due to embolism of bilateral carotid arteries	ICD-10-CM
I63.32	Cerebral infarction due to thrombosis of anterior cerebral artery	ICD-10-CM
I63.239	Cerebral infarction due to unspecified occlusion or stenosis of unspecified carotid arteries	ICD-10-CM
I63.411	Cerebral infarction due to embolism of right middle cerebral artery	ICD-10-CM
I63.132	Cerebral infarction due to embolism of left carotid artery	ICD-10-CM
I63.34	Cerebral infarction due to thrombosis of cerebellar artery	ICD-10-CM
I63.313	Cerebral infarction due to thrombosis of bilateral middle cerebral arteries	ICD-10-CM
I63.6	Cerebral infarction due to cerebral venous thrombosis, nonpyogenic	ICD-10-CM

Appendix B. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Algorithm¹

Code	Description	Code Type
I63.49	Cerebral infarction due to embolism of other cerebral artery	ICD-10-CM
I63.03	Cerebral infarction due to thrombosis of carotid artery	ICD-10-CM
I63.341	Cerebral infarction due to thrombosis of right cerebellar artery	ICD-10-CM
I63.412	Cerebral infarction due to embolism of left middle cerebral artery	ICD-10-CM
I63.323	Cerebral infarction due to thrombosis of bilateral anterior arteries	ICD-10-CM
I63.211	Cerebral infarction due to unspecified occlusion or stenosis of right vertebral arteries	ICD-10-CM
I63.529	Cerebral infarction due to unspecified occlusion or stenosis of unspecified anterior cerebral artery	ICD-10-CM
I63.31	Cerebral infarction due to thrombosis of middle cerebral artery	ICD-10-CM
I63.331	Cerebral infarction due to thrombosis of right posterior cerebral artery	ICD-10-CM
I63.51	Cerebral infarction due to unspecified occlusion or stenosis of middle cerebral artery	ICD-10-CM
I63.231	Cerebral infarction due to unspecified occlusion or stenosis of right carotid arteries	ICD-10-CM
I63.421	Cerebral infarction due to embolism of right anterior cerebral artery	ICD-10-CM
I63.50	Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebral artery	ICD-10-CM
I63.232	Cerebral infarction due to unspecified occlusion or stenosis of left carotid arteries	ICD-10-CM
I63.332	Cerebral infarction due to thrombosis of left posterior cerebral artery	ICD-10-CM
I63.443	Cerebral infarction due to embolism of bilateral cerebellar arteries	ICD-10-CM
I63.521	Cerebral infarction due to unspecified occlusion or stenosis of right anterior cerebral artery	ICD-10-CM
I63.00	Cerebral infarction due to thrombosis of unspecified precerebral artery	ICD-10-CM
I63.29	Cerebral infarction due to unspecified occlusion or stenosis of other precerebral arteries	ICD-10-CM
I63.349	Cerebral infarction due to thrombosis of unspecified cerebellar artery	ICD-10-CM
I63.033	Cerebral infarction due to thrombosis of bilateral carotid arteries	ICD-10-CM
I63.8	Other cerebral infarction	ICD-10-CM
I63.19	Cerebral infarction due to embolism of other precerebral artery	ICD-10-CM
I63.449	Cerebral infarction due to embolism of unspecified cerebellar artery	ICD-10-CM
I63.11	Cerebral infarction due to embolism of vertebral artery	ICD-10-CM
I63.113	Cerebral infarction due to embolism of bilateral vertebral arteries	ICD-10-CM
I63.43	Cerebral infarction due to embolism of posterior cerebral artery	ICD-10-CM
I63.523	Cerebral infarction due to unspecified occlusion or stenosis of bilateral anterior arteries	ICD-10-CM
I63.539	Cerebral infarction due to unspecified occlusion or stenosis of unspecified posterior cerebral artery	ICD-10-CM
I63.549	Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebellar artery	ICD-10-CM
I63.423	Cerebral infarction due to embolism of bilateral anterior cerebral arteries	ICD-10-CM
I63.44	Cerebral infarction due to embolism of cerebellar artery	ICD-10-CM
I63.321	Cerebral infarction due to thrombosis of right anterior cerebral artery	ICD-10-CM
I63.40	Cerebral infarction due to embolism of unspecified cerebral artery	ICD-10-CM
I63.20	Cerebral infarction due to unspecified occlusion or stenosis of unspecified precerebral arteries	ICD-10-CM
I63.54	Cerebral infarction due to unspecified occlusion or stenosis of cerebellar artery	ICD-10-CM
I63.013	Cerebral infarction due to thrombosis of bilateral vertebral arteries	ICD-10-CM
I63.342	Cerebral infarction due to thrombosis of left cerebellar artery	ICD-10-CM
I63.02	Cerebral infarction due to thrombosis of basilar artery	ICD-10-CM
I63.311	Cerebral infarction due to thrombosis of right middle cerebral artery	ICD-10-CM
I63.9	Cerebral infarction, unspecified	ICD-10-CM
I63.329	Cerebral infarction due to thrombosis of unspecified anterior cerebral artery	ICD-10-CM
I63.519	Cerebral infarction due to unspecified occlusion or stenosis of unspecified middle cerebral artery	ICD-10-CM
I63.111	Cerebral infarction due to embolism of right vertebral artery	ICD-10-CM

Appendix B. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Algorithm¹

Code	Description	Code Type
I63.112	Cerebral infarction due to embolism of left vertebral artery	ICD-10-CM
I63.39	Cerebral infarction due to thrombosis of other cerebral artery	ICD-10-CM
I63.413	Cerebral infarction due to embolism of bilateral middle cerebral arteries	ICD-10-CM
I63.441	Cerebral infarction due to embolism of right cerebellar artery	ICD-10-CM
I63.322	Cerebral infarction due to thrombosis of left anterior cerebral artery	ICD-10-CM
I63.543	Cerebral infarction due to unspecified occlusion or stenosis of bilateral cerebellar arteries	ICD-10-CM
I63.511	Cerebral infarction due to unspecified occlusion or stenosis of right middle cerebral artery	ICD-10-CM
I63.13	Cerebral infarction due to embolism of carotid artery	ICD-10-CM
I63.442	Cerebral infarction due to embolism of left cerebellar artery	ICD-10-CM
I63.011	Cerebral infarction due to thrombosis of right vertebral artery	ICD-10-CM
I63.343	Cerebral infarction to thrombosis of bilateral cerebellar arteries	ICD-10-CM
I63.30	Cerebral infarction due to thrombosis of unspecified cerebral artery	ICD-10-CM
I63.432	Cerebral infarction due to embolism of left posterior cerebral artery	ICD-10-CM
I63.219	Cerebral infarction due to unspecified occlusion or stenosis of unspecified vertebral arteries	ICD-10-CM
I63.439	Cerebral infarction due to embolism of unspecified posterior cerebral artery	ICD-10-CM
I63.53	Cerebral infarction due to unspecified occlusion or stenosis of posterior cerebral artery	ICD-10-CM
I63.012	Cerebral infarction due to thrombosis of left vertebral artery	ICD-10-CM
I63.213	Cerebral infarction due to unspecified occlusion or stenosis of bilateral vertebral arteries	ICD-10-CM
I63.431	Cerebral infarction due to embolism of right posterior cerebral artery	ICD-10-CM
I63.312	Cerebral infarction due to thrombosis of left middle cerebral artery	ICD-10-CM
I63.22	Cerebral infarction due to unspecified occlusion or stenosis of basilar arteries	ICD-10-CM
I63.0	Cerebral infarction due to thrombosis of precerebral arteries	ICD-10-CM
I63.12	Cerebral infarction due to embolism of basilar artery	ICD-10-CM
I63.533	Cerebral infarction due to unspecified occlusion or stenosis of bilateral posterior arteries	ICD-10-CM
I63.019	Cerebral infarction due to thrombosis of unspecified vertebral artery	ICD-10-CM
I63.131	Cerebral infarction due to embolism of right carotid artery	ICD-10-CM
I63.333	Cerebral infarction to thrombosis of bilateral posterior arteries	ICD-10-CM
I63.031	Cerebral infarction due to thrombosis of right carotid artery	ICD-10-CM
I63.512	Cerebral infarction due to unspecified occlusion or stenosis of left middle cerebral artery	ICD-10-CM
I63.23	Cerebral infarction due to unspecified occlusion or stenosis of carotid arteries	ICD-10-CM
I63.522	Cerebral infarction due to unspecified occlusion or stenosis of left anterior cerebral artery	ICD-10-CM
I63.433	Cerebral infarction due to embolism of bilateral posterior cerebral arteries	ICD-10-CM
I63.59	Cerebral infarction due to unspecified occlusion or stenosis of other cerebral artery	ICD-10-CM
I63.319	Cerebral infarction due to thrombosis of unspecified middle cerebral artery	ICD-10-CM
I63.531	Cerebral infarction due to unspecified occlusion or stenosis of right posterior cerebral artery	ICD-10-CM
I63.3	Cerebral infarction due to thrombosis of cerebral arteries	ICD-10-CM
I63.4	Cerebral infarction due to embolism of cerebral arteries	ICD-10-CM
I63.429	Cerebral infarction due to embolism of unspecified anterior cerebral artery	ICD-10-CM
I63.09	Cerebral infarction due to thrombosis of other precerebral artery	ICD-10-CM
I63.233	Cerebral infarction due to unspecified occlusion or stenosis of bilateral carotid arteries	ICD-10-CM
I63.542	Cerebral infarction due to unspecified occlusion or stenosis of left cerebellar artery	ICD-10-CM

¹ICD-10-CM codes from Algorithm include codes used in countries outside of the US, as they started using ICD-10-CM codes prior to their use in the US.

Appendix C. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Simple Forward Mapping (SFM)

Code	Description	Code Type
433.01	Occlusion and stenosis of basilar artery with cerebral infarction	ICD-9-CM
433.11	Occlusion and stenosis of carotid artery with cerebral infarction	ICD-9-CM
433.21	Occlusion and stenosis of vertebral artery with cerebral infarction	ICD-9-CM
433.31	Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction	ICD-9-CM
433.81	Occlusion and stenosis of other specified precerebral artery with cerebral infarction	ICD-9-CM
433.91	Occlusion and stenosis of unspecified precerebral artery with cerebral infarction	ICD-9-CM
434.01	Cerebral thrombosis with cerebral infarction	ICD-9-CM
434.11	Cerebral embolism with cerebral infarction	ICD-9-CM
434.91	Unspecified cerebral artery occlusion with cerebral infarction	ICD-9-CM
436	Acute, but ill-defined, cerebrovascular disease	ICD-9-CM
I63.22	Cerebral infarction due to unspecified occlusion or stenosis of basilar arteries	ICD-10-CM
I63.139	Cerebral infarction due to embolism of unspecified carotid artery	ICD-10-CM
I63.239	Cerebral infarction due to unspecified occlusion or stenosis of unspecified carotid arteries	ICD-10-CM
I63.019	Cerebral infarction due to thrombosis of unspecified vertebral artery	ICD-10-CM
I63.119	Cerebral infarction due to embolism of unspecified vertebral artery	ICD-10-CM
I63.219	Cerebral infarction due to unspecified occlusion or stenosis of unspecified vertebral arteries	ICD-10-CM
I63.59	Cerebral infarction due to unspecified occlusion or stenosis of other cerebral artery	ICD-10-CM
I63.20	Cerebral infarction due to unspecified occlusion or stenosis of unspecified precerebral arteries	ICD-10-CM
I63.30	Cerebral infarction due to thrombosis of unspecified cerebral artery	ICD-10-CM
I63.40	Cerebral infarction due to embolism of unspecified cerebral artery	ICD-10-CM
I63.50	Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebral artery	ICD-10-CM
I67.89	Other cerebrovascular disease	ICD-10-CM

Appendix D. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Forward Backward Mapping (FBM)

Code	Description	Code Type
433.01	Occlusion and stenosis of basilar artery with cerebral infarction	ICD-9-CM
433.11	Occlusion and stenosis of carotid artery with cerebral infarction	ICD-9-CM
433.21	Occlusion and stenosis of vertebral artery with cerebral infarction	ICD-9-CM
433.31	Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction	ICD-9-CM
433.81	Occlusion and stenosis of other specified precerebral artery with cerebral infarction	ICD-9-CM
433.91	Occlusion and stenosis of unspecified precerebral artery with cerebral infarction	ICD-9-CM
434.01	Cerebral thrombosis with cerebral infarction	ICD-9-CM
434.11	Cerebral embolism with cerebral infarction	ICD-9-CM
434.91	Unspecified cerebral artery occlusion with cerebral infarction	ICD-9-CM
436	Acute, but ill-defined, cerebrovascular disease	ICD-9-CM
I63.22	Cerebral infarction due to unspecified occlusion or stenosis of basilar arteries	ICD-10-CM
I63.139	Cerebral infarction due to embolism of unspecified carotid artery	ICD-10-CM
I63.239	Cerebral infarction due to unspecified occlusion or stenosis of unspecified carotid arteries	ICD-10-CM
I63.019	Cerebral infarction due to thrombosis of unspecified vertebral artery	ICD-10-CM
I63.119	Cerebral infarction due to embolism of unspecified vertebral artery	ICD-10-CM
I63.219	Cerebral infarction due to unspecified occlusion or stenosis of unspecified vertebral arteries	ICD-10-CM
I63.59	Cerebral infarction due to unspecified occlusion or stenosis of other cerebral artery	ICD-10-CM
I63.20	Cerebral infarction due to unspecified occlusion or stenosis of unspecified precerebral arteries	ICD-10-CM
I63.30	Cerebral infarction due to thrombosis of unspecified cerebral artery	ICD-10-CM
I63.40	Cerebral infarction due to embolism of unspecified cerebral artery	ICD-10-CM
I63.50	Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebral artery	ICD-10-CM
I67.89	Other cerebrovascular disease	ICD-10-CM
I63.00	Cerebral infarction due to thrombosis of unspecified precerebral artery	ICD-10-CM
I63.011	Cerebral infarction due to thrombosis of right vertebral artery	ICD-10-CM
I63.012	Cerebral infarction due to thrombosis of left vertebral artery	ICD-10-CM
I63.013	Cerebral infarction due to thrombosis of bilateral vertebral arteries	ICD-10-CM
I63.02	Cerebral infarction due to thrombosis of basilar artery	ICD-10-CM
I63.031	Cerebral infarction due to thrombosis of right carotid artery	ICD-10-CM
I63.032	Cerebral infarction due to thrombosis of left carotid artery	ICD-10-CM
I63.033	Cerebral infarction due to thrombosis of bilateral carotid arteries	ICD-10-CM
I63.039	Cerebral infarction due to thrombosis of unspecified carotid artery	ICD-10-CM
I63.09	Cerebral infarction due to thrombosis of other precerebral artery	ICD-10-CM
I63.10	Cerebral infarction due to embolism of unspecified precerebral artery	ICD-10-CM
I63.111	Cerebral infarction due to embolism of right vertebral artery	ICD-10-CM
I63.112	Cerebral infarction due to embolism of left vertebral artery	ICD-10-CM
I63.113	Cerebral infarction due to embolism of bilateral vertebral arteries	ICD-10-CM
I63.12	Cerebral infarction due to embolism of basilar artery	ICD-10-CM
I63.131	Cerebral infarction due to embolism of right carotid artery	ICD-10-CM
I63.132	Cerebral infarction due to embolism of left carotid artery	ICD-10-CM
I63.133	Cerebral infarction due to embolism of bilateral carotid arteries	ICD-10-CM
I63.19	Cerebral infarction due to embolism of other precerebral artery	ICD-10-CM
I63.211	Cerebral infarction due to unspecified occlusion or stenosis of right vertebral arteries	ICD-10-CM
I63.212	Cerebral infarction due to unspecified occlusion or stenosis of left vertebral arteries	ICD-10-CM
I63.213	Cerebral infarction due to unspecified occlusion or stenosis of bilateral vertebral arteries	ICD-10-CM

Appendix D. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Forward Backward Mapping (FBM)

Code	Description	Code Type
I63.231	Cerebral infarction due to unspecified occlusion or stenosis of right carotid arteries	ICD-10-CM
I63.232	Cerebral infarction due to unspecified occlusion or stenosis of left carotid arteries	ICD-10-CM
I63.233	Cerebral infarction due to unspecified occlusion or stenosis of bilateral carotid arteries	ICD-10-CM
I63.29	Cerebral infarction due to unspecified occlusion or stenosis of other precerebral arteries	ICD-10-CM
I63.311	Cerebral infarction due to thrombosis of right middle cerebral artery	ICD-10-CM
I63.312	Cerebral infarction due to thrombosis of left middle cerebral artery	ICD-10-CM
I63.313	Cerebral infarction due to thrombosis of bilateral middle cerebral arteries	ICD-10-CM
I63.319	Cerebral infarction due to thrombosis of unspecified middle cerebral artery	ICD-10-CM
I63.321	Cerebral infarction due to thrombosis of right anterior cerebral artery	ICD-10-CM
I63.322	Cerebral infarction due to thrombosis of left anterior cerebral artery	ICD-10-CM
I63.323	Cerebral infarction due to thrombosis of bilateral anterior arteries	ICD-10-CM
I63.329	Cerebral infarction due to thrombosis of unspecified anterior cerebral artery	ICD-10-CM
I63.331	Cerebral infarction due to thrombosis of right posterior cerebral artery	ICD-10-CM
I63.332	Cerebral infarction due to thrombosis of left posterior cerebral artery	ICD-10-CM
I63.333	Cerebral infarction to thrombosis of bilateral posterior arteries	ICD-10-CM
I63.339	Cerebral infarction due to thrombosis of unspecified posterior cerebral artery	ICD-10-CM
I63.341	Cerebral infarction due to thrombosis of right cerebellar artery	ICD-10-CM
I63.342	Cerebral infarction due to thrombosis of left cerebellar artery	ICD-10-CM
I63.343	Cerebral infarction to thrombosis of bilateral cerebellar arteries	ICD-10-CM
I63.349	Cerebral infarction due to thrombosis of unspecified cerebellar artery	ICD-10-CM
I63.39	Cerebral infarction due to thrombosis of other cerebral artery	ICD-10-CM
I63.411	Cerebral infarction due to embolism of right middle cerebral artery	ICD-10-CM
I63.412	Cerebral infarction due to embolism of left middle cerebral artery	ICD-10-CM
I63.413	Cerebral infarction due to embolism of bilateral middle cerebral arteries	ICD-10-CM
I63.419	Cerebral infarction due to embolism of unspecified middle cerebral artery	ICD-10-CM
I63.421	Cerebral infarction due to embolism of right anterior cerebral artery	ICD-10-CM
I63.422	Cerebral infarction due to embolism of left anterior cerebral artery	ICD-10-CM
I63.423	Cerebral infarction due to embolism of bilateral anterior cerebral arteries	ICD-10-CM
I63.429	Cerebral infarction due to embolism of unspecified anterior cerebral artery	ICD-10-CM
I63.431	Cerebral infarction due to embolism of right posterior cerebral artery	ICD-10-CM
I63.432	Cerebral infarction due to embolism of left posterior cerebral artery	ICD-10-CM
I63.433	Cerebral infarction due to embolism of bilateral posterior cerebral arteries	ICD-10-CM
I63.439	Cerebral infarction due to embolism of unspecified posterior cerebral artery	ICD-10-CM
I63.441	Cerebral infarction due to embolism of right cerebellar artery	ICD-10-CM
I63.442	Cerebral infarction due to embolism of left cerebellar artery	ICD-10-CM
I63.443	Cerebral infarction due to embolism of bilateral cerebellar arteries	ICD-10-CM
I63.449	Cerebral infarction due to embolism of unspecified cerebellar artery	ICD-10-CM
I63.49	Cerebral infarction due to embolism of other cerebral artery	ICD-10-CM
I63.511	Cerebral infarction due to unspecified occlusion or stenosis of right middle cerebral artery	ICD-10-CM
I63.512	Cerebral infarction due to unspecified occlusion or stenosis of left middle cerebral artery	ICD-10-CM
I63.513	Cerebral infarction due to unspecified occlusion or stenosis of bilateral middle arteries	ICD-10-CM
I63.519	Cerebral infarction due to unspecified occlusion or stenosis of unspecified middle cerebral artery	ICD-10-CM
I63.521	Cerebral infarction due to unspecified occlusion or stenosis of right anterior cerebral artery	ICD-10-CM
I63.522	Cerebral infarction due to unspecified occlusion or stenosis of left anterior cerebral artery	ICD-10-CM
I63.523	Cerebral infarction due to unspecified occlusion or stenosis of bilateral anterior arteries	ICD-10-CM

Appendix D. List of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM Codes used to Define Ischemic Stroke, Forward Backward Mapping (FBM)

Code	Description	Code Type
I63.529	Cerebral infarction due to unspecified occlusion or stenosis of unspecified anterior cerebral artery	ICD-10-CM
I63.531	Cerebral infarction due to unspecified occlusion or stenosis of right posterior cerebral artery	ICD-10-CM
I63.532	Cerebral infarction due to unspecified occlusion or stenosis of left posterior cerebral artery	ICD-10-CM
I63.533	Cerebral infarction due to unspecified occlusion or stenosis of bilateral posterior arteries	ICD-10-CM
I63.539	Cerebral infarction due to unspecified occlusion or stenosis of unspecified posterior cerebral artery	ICD-10-CM
I63.541	Cerebral infarction due to unspecified occlusion or stenosis of right cerebellar artery	ICD-10-CM
I63.542	Cerebral infarction due to unspecified occlusion or stenosis of left cerebellar artery	ICD-10-CM
I63.543	Cerebral infarction due to unspecified occlusion or stenosis of bilateral cerebellar arteries	ICD-10-CM
I63.549	Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebellar artery	ICD-10-CM
I63.6	Cerebral infarction due to cerebral venous thrombosis, nonpyogenic	ICD-10-CM
I63.8	Other cerebral infarction	ICD-10-CM
I63.9	Cerebral infarction, unspecified	ICD-10-CM

Appendix E. Specifications for Parameters for this Request

Sentinel's Cohort Identification and Descriptive Analysis (CIDA) tool, version 3.3.2, was used to compare the frequency of diagnoses for a selection of health outcomes using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) versus ICD-10-CM codes.

Enrollment Gap: 45 Days

Age Groups: 0-17, 18-49, 50-64, 65+ years

Enrollment Requirement: 183 Days

Coverage Requirement: Medical Coverage

Scenario	Code Source	Query Start Date	Query End Date	Event	Care Setting	Event			
						Incident w/ respect to:	Washout (days)	Incident w/ respect to Care Setting	Cohort Definition
1	ICD-9-CM Code Search	1/1/2015	3/31/2015	Acute Ischemic Stroke diagnosis (only ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436)	Inpatient	Acute Ischemic Stroke diagnosis (only ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436)	90	Any	01
2	SFM	1/1/2016	3/31/2016	Acute Ischemic Stroke diagnosis (only ICD-10-CM: I63.019, I63.119, I63.139, I63.20, I63.219, I63.22, I63.239, I63.30, I63.40, I63.50, I63.59, I67.89)	Inpatient	Acute Ischemic Stroke diagnosis (only ICD-10-CM: I63.019, I63.119, I63.139, I63.20, I63.219, I63.22, I63.239, I63.30, I63.40, I63.50, I63.59, I67.89)	90	Any	01
3	FBM	1/1/2016	3/31/2016	Acute Ischemic Stroke diagnosis (only ICD-10-CM: see Appendix D for 91 codes)	Inpatient	Acute Ischemic Stroke diagnosis (only ICD-10-CM: see Appendix D for 91 codes)	90	Any	01
4	ICD-9-CM Code Search	10/1/2010	Current	Acute Ischemic Stroke diagnosis (only ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436)	Inpatient	Acute Ischemic Stroke diagnosis (ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436 or ICD-10-CM ¹ : I63.* or H34.1*)	183	Any	01
5	SFM	10/1/2010	Current	Acute Ischemic Stroke diagnosis (only ICD-10-CM: I63.019, I63.119, I63.139, I63.20, I63.219, I63.22, I63.239, I63.30, I63.40, I63.50, I63.59, I67.89)	Inpatient	Acute Ischemic Stroke diagnosis (ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436; or ICD-10-CM: I63.019, I63.119, I63.139, I63.20, I63.219, I63.22, I63.239, I63.30, I63.40, I63.50, I63.59, I67.89)	183	Any	01
6	FBM	10/1/2010	Current	Acute Ischemic Stroke diagnosis (only ICD-10-CM: see Appendix D for 91 codes)	Inpatient	Acute Ischemic Stroke diagnosis (ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436; or ICD-10-CM: see Appendix D for 91 codes)	183	Any	01
7	ICD-9-CM Code Search	10/1/2010	Current	Acute Ischemic Stroke diagnosis (only ICD-9-CM: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436)	Inpatient	NA	0	Any	02
8	SFM	10/1/2010	Current	Acute Ischemic Stroke diagnosis (only ICD-10-CM: I63.019, I63.119, I63.139, I63.20, I63.219, I63.22, I63.239, I63.30, I63.40, I63.50, I63.59, I67.89)	Inpatient	NA	0	Any	02
9	FBM	10/1/2010	Current	Acute Ischemic Stroke diagnosis (only ICD-10-CM: see Appendix D for 91 codes)	Inpatient	NA	0	Any	02

ICD-9-CM and ICD-10-CM are provided by Optum360. ICD-10-CM codes were mapped from ICD-9-CM codes using the Centers for Medicare and Medicaid Services General Equivalence Mappings.

¹ICD-10-CM codes from Algorithm include codes used in countries outside of the US, as they started using ICD-10-CM codes prior to their use in the US.