Claims and Registry Data Analysis Plan

Vision & Eye Health Surveillance System

LAST UPDATED:
MAY 7, 2018

PRESENTED TO:
Jinan Saaddine,
Division of Diabetes Translation,
Centers for Disease Control and Prevention

PRESENTED BY:
John Wittenborn,
David Rein,
Michelle Dougherty,
Emily Phillips
NORC at the University of Chicago

NORC at the UNIVERSITY of CHICAGO

VISION & EYE HEALTH SURVEILLANCE SYSTEM

Table of Contents

List of Tables

Introduction

The Vision and Eye Health Surveillance System (VEHSS)

The Centers for Disease Control and Prevention (CDC) issued a cooperative agreement with NORC at the University of Chicago (NORC) to establish a national Vision and Eye Health Surveillance System (VEHSS). The VEHSS initiative aims to combine and analyze multiple existing data sources to address knowledge gaps in vision and eye health surveillance. To achieve this, the project team must identify and prioritize available sources of secondary information, define common outcome indicators, analyze and report outcomes from individual data sources, and resolve methods to harmonize or integrate multiple data sources to produce integrated national and state prevalence and service utilization estimates.

Through partnerships with leading organizations in vision and eye health, NORC and CDC conducted the following major steps to integrate administrative claims databases and electronic health record (EHR) registries for the VEHSS:

- Step 1. Identify vision and eye health related data in administrative databases and EHR-based registries.
- Step 2. Summarize characteristics of claims databases and EHR-based registries.
- Step 3. Identify and define data indicators by developing diagnosis and exam code categories.
- Step 4. Analyze each claims and registry data source to estimate prevalence rates for data indicators (single-source estimates).
- Step 5. Identify select sources to include in statistical models which will be used to generate the comprehensive national estimates.

Document Purpose

This document serves as a data analysis guide for claims and registry data used by VEHSS analysts and data providers and may be updated throughout the course of the project. It further details our approach to Steps 1-4. This approach is used for administrative claims databases and the American Academy of Ophthalmology Intelligent Research In Sight (IRIS)® Registry. The objective of this plan is to determine annual treated prevalence rates, defined as the proportion of individuals within the populations represented by each data source who have been treated for or recently diagnosed with vision or eye health disorders. Because this analysis relies on administrative records, it is not representative of individuals who have not been diagnosed or treated (i.e. those who are underserved or uninsured).

Claims and Registry Data Sources

Administrative Claims Data

Administrative claims databases include insurance claims and payment information and usually contain codes for patient diagnoses and billed procedures. In the VEHSS, claims data are used to estimate diagnosed prevalence rates of disease, and service utilization rates. Claims data have very large sample sizes and wide geographic coverage. Combined, these advantages allow claims data estimates to be aggregated for states, counties, and postal zip codes. When billed using visual health diagnosis or procedure codes, claims data systems also capture eye care services provided outside of ophthalmology and optometry practices. Visual health services may at times be provided by general practitioners, pediatricians, other specialists, and in emergency department or inpatients settings.

To assure coverage of different parts of the U.S. population, VEHSS includes five different sources of medical claims information. Multiple sources are needed because to reimburse for health care services, the U.S. healthcare system relies on a diverse set of public and private payer organizations. Capturing all administrative payment claims is beyond the scope and capacity of VEHSS at this time. However, we attempted to include claims data sources that are representative or inclusive of all payer types, and were feasible to include. The administrative claims sources selected for initial inclusion in VEHSS are described below:

- **Medicare claims**; inclusive of all Medicare fee-for-service (FFS) beneficiaries, including those who are dually eligible for Medicaid. We analyzed 100% Research Identifiable Files (RIFs) obtained from the Centers for Medicare and Medicaid Services (CMS). The VEHSS team analyzed visual health information contained in the following files:
  - Inpatient
  - Outpatient
  - Skilled Nursing Facility
  - Hospice
  - Home Health
  - Carrier
  - DME
  - MBSF Base Beneficiary Summary File
  - MBSF Chronic Conditions segment file
  - Part D Event data
  - Part D Characteristics, including Drug, Pharmacy, Prescriber, and Plan characteristics
- **Medicaid claims**; inclusive of all Medicaid FFS and Children's Health Insurance Program (CHIP) beneficiaries in reporting states, managed care encounter and premium payments. We analyzed 100% Medicaid Analytic eXtract (MAX) data from CMS. The VEHSS team analyzed visual health information contained in the following files:

  - Personal Summary
  - Inpatient
  - RX Drug
  - Other Therapy
  - Long Term Care
  - Medicaid Enrollee Supplemental File – Chronic Conditions segment

- **VSP Inc**.; inclusive of patients with supplemental vision insurance through VSP, which is the largest vision insurance provider in the U.S. Vision insurance claims provide information on services not routinely captured in other claims systems, including most routine optometry care and vision correction.

  VSP also maintains a fleet of four mobile eye examination clinics that provide free optometric exams and services for approximately 10,000 underserved, non-insured persons per year, or in response to disaster relief. These mobile exams maintain the same level of claims detail, plus additional race/ethnicity data, making it a potential source of data for the uninsured and underserved. VSP data is not nationally representative, but VSP has developed capability to control for market participation/penetration rates when calculating outcome prevalence rates.

- **MarketScan**; includes beneficiaries of several commercial plans, beneficiaries with some Medicare managed care plans, beneficiaries with some supplemental insurance plans, and Medicaid managed care beneficiaries from several states. MarketScan is the largest source of private insurance claims, with over 55 million beneficiaries included, but nonetheless MarketScan data is not nationally representative.
- **Military Health System**; includes data analyzed from the Military Health System Data Repository, which includes claim records from the military health system and Tricare civilian network. This encompasses over 9 million beneficiaries including active duty military members, active reservists, family members, and retirees. It is a joint system providing care to the Army, Navy, Air Force, Marines, Public Health Service, and Coast Guard from the battlefield to rehabilitative care.

Registry Data Developed from Electronic Health Records

EHR registries contain information on the physician diagnosis given during an encounter (as opposed to diagnoses that were billed for) and may also contain important laboratory and observation test results that are unavailable in claims data. For the VEHSS, the most important of these results are patient-level measures of visual acuity. EHR and registry data also have the advantage of capturing service utilization for all patients seen in the practice, regardless of their insurance status. This allows for service utilization to be broken down by insurer; an important control for integrating claims data. In addition, registry data captures care for patients for whom no claims are generated, e.g., uninsured patients, or patients who pay out-of-pocket. The first EHR-based registry source to be included in the VEHSS system is the IRIS Registry, detailed below:

- **IRIS Registry:** the nation's first comprehensive eye disease clinical database. The IRIS Registry enables ophthalmologists to use clinical data to improve care delivery and patient outcomes, and help practices meet requirements of the federal Physician Quality Reporting System (PQRS). The system tracks diagnosed disorders based on International Classification of Diseases (ICD) -9 and -10 codes, and also includes visual acuity measures. It is the only dataset that may include procedures and care for uninsured patients. The IRIS Registry also has race/ethnicity coverage based on EMR records.

Data Indicator Overview

The VEHSS tracks three separate topic areas:

- Medical diagnoses
- Service utilization
- Visual function

Diagnosis categories

Diagnosis codes are used to identify vision and eye disorders in all administrative claims data and the IRIS Registry. Diagnosis codes are categorized based on the ICD system. We reviewed ICD-9 and ICD-10 codes to identify all codes that are related to vision, the eye, and ocular adnexa. This included codes for eye-related systems such as the orbit and the lacrimal system, including conjunctivitis. We found 1,017 ICD-9 codes and 2,738 ICD-10 codes meeting these criteria.

We organized the individual diagnosis codes into a 2-level categorization schema consisting of categories and subgroups. These categories aggregated clinically similar codes. This reduced the number of indicator outcomes, and also increased the outcome sample sizes. Grouping conditions reduced the level of detail but provided more estimates for closely related outcomes where none would otherwise be available if individual codes were considered. All vision, eye, and ocular adnexa related diagnosis codes were assigned to mutually exclusive categories and subgroups. Every code is in one subgroup, and a category may contain multiple subgroups. The Diagnosis Code data indicators are listed in **Table 1**.

Table 1. Diagnosis Categories

Category	Description
Cat_1	**Retinal Detachment and Defects**
Sub_1.1	Retinal Detachment
Cat_2	**Diabetic Eye Diseases**
Sub_2.1	Early/Mild Diabetic Retinopathy
Sub_2.2	Moderate /Severe Non-proliferative Diabetic Retinopathy
Sub_2.3	Proliferative Diabetic Retinopathy
Sub_2.4	Diabetic Macular Edema (DME, CSDME)
Sub_2.5	Other/unspecified diabetes related eye conditions
Cat_3	**Age related macular degeneration**
Sub_3.1	AMD, unspecified
Sub_3.2	Early AMD
Sub_3.3	Dry-form AMD
***Sub_3.3x_GA**	GA, modifier for 3.3
Sub_3.4	Wet-form AMD
***Sub_3.4x_CNV**	CNV, modifier for 3.4

Category	Description
Cat_4	**Other Retinal Disorders**
Sub_4.1	Retina vascular disease, Occlusive (arterial, venous)
Sub_4.2	Central retinal vein occlusion
Sub_4.3	Branch retinal vein occlusion
Sub_4.4	Central retinal arterial occlusion
Sub_4.5	Branch retinal artery occlusion
Sub_4.6	Retina vascular disease, Non-Occlusive
Sub_4.7	Macular edema (if not diabetic)
Sub_4.8	Hereditary chorioretinal dystrophy
Sub_4.9	Myopic degeneration
Sub_4.10	Other/unspecified retinal disorders
Cat_5	**Glaucoma**
Sub_5.1	Open-angle glaucoma
Sub_5.2	Primary open-angle glaucoma
Sub_5.3	Low-tension glaucoma
Sub_5.4	Glaucoma suspect
Sub_5.5	Primary angle-closure glaucoma
Sub_5.6	Narrow-angle glaucoma
Sub_5.7	Congenital glaucoma
Sub_5.8	Neovascular glaucoma
Sub_5.9	Other/unspecified glaucoma
Cat_6	**Cataracts**
Sub_6.1	Senile cataract
Sub_6.2	Non-congenital cataract
Sub_6.3	Congenital Cataract
Sub_6.4	Posterior capsular opacity
Sub_6.5	Pseudophakia
Sub_6.6	Aphakia and other disorders of lens
Cat_7	**Disorders of Refraction and accommodation**
Sub_7.1	Myopia
Sub_7.2	Hypermetropia
Sub_7.3	Astigmatism
Sub_7.4	Presbyopia
Sub_7.5	Other disorder of refraction and accommodation
Cat_8	**Blindness and low vision**
Sub_8.1	Unqualified visual loss, both eyes
Sub_8.2	Unqualified vision loss in one eye, or unspecified visual loss
Sub_8.3	Vision impairment one eye
Sub_8.4	Moderate or severe vision impairment better eye; profound vision impairment of lesser eye
Sub_8.5	Moderate or severe vision impairment both eyes
Sub_8.6	Profound vision impairment, bilateral, or legal blindness
Cat_9	**Strabismus and amblyopia**
Sub_9.1	Strabismus
Sub_9.2	Amblyopia

Category	Description
Cat_10	**Injury, burns and surgical complications of the eye**
Sub_10.1	Injury
Sub_10.2	Burn
Sub_10.3	Surgical complication
Cat_11	**Disorders of optic nerve and visual pathways**
Sub_11.1	Optic nerve disorders
Sub_11.2	Visual pathway disorders
Cat_12	**Other visual disturbances**
Sub_12.1	Visual field defect
Sub_12.2	Color blindness
Sub_12.3	Night blindness
Sub_12.4	Other/unspecified visual disturbances
Cat_13	**Infectious and Inflammatory diseases**
Sub_13.1	Infectious diseases
Sub_13.2	Keratitis
Sub_13.3	Conjunctivitis
Sub_13.4	Eyelid disorders
Sub_13.5	Other inflammatory conditions
Sub_13.6	Lacrimal system and orbit inflammation
Sub_13.7	Endophthalmitis
Cat_14	**Orbital and external disease**
Sub_14.1	Congenital anomalies
Sub_14.2	Other/unspecified orbital or external disease
Sub_14.3	Lacrimal diseases
Sub_14.4	Eyelid disorders
Sub_14.5	Dry eye syndrome
Sub_14.6	Disorders of the globe
Cat_15	**Cancer and neoplasms of the eye**
Sub_15.1	Malignant neoplasm of the eye
Sub_15.2	Benign neoplasm of the eye
Cat_16	**Cornea disorders**
Sub_16.1	Keratoconus
Sub_16.2	Endothelial dystrophy (including Fuchs)
Sub_16.3	Other Corneal disorders
Cat_17	**Other eye disorders**
Sub_17.1	Other eye disorders

Service Utilization

A primary goal of VEHSS is to identify service utilization and access to care trends and disparities. The initial service utilization measure included in VEHSS is the rate of patients receiving eye exams.

Eye exams are identified in claims and registry data based on the presence of procedure codes, including Current Procedural Terminology (CPT) Codes or Healthcare Common Procedure Coding System

(HCPCPS) Codes (**Table 2)**. Four procedure codes denote an eye exam (92002, 92004, 92012, 92014). All instances of these procedures are counted as an eye exam.

Other Evaluation & Management (E & M) codes (99***) are not specific to eye exams, but nonetheless are frequently billed for eye exams. In this case, we include E & M codes if they are coded by an eye care provider. In vision-specific data, this may plausibly include all providers captured in the dataset. However, in general claims data, the exam will be included if the provider type taxonomy indicates an ophthalmologist, optometrist or optician, or a general physician (**Table 3)**.

Table 2. Procedure Codes Included in Exams

CPT/HCPCS Code	Code Description
Eye Exam Codes, Always Included	
92002	Eye exam new patient
92004	Eye exam new patient
92012	Eye exam established patient
92014	Eye exam established patient
General Exam Codes, Require Specified Provider Specialty Code	
99201	Office/outpatient visit new
99202	Office/outpatient visit new
99203	Office/outpatient visit new
99204	Office/outpatient visit new
99205	Office/outpatient visit new
99212	Office/outpatient visit established patient
99213	Office/outpatient visit established patient
99214	Office/outpatient visit established patient
99215	Office/outpatient visit established patient
99241	Office consultation
99242	Office consultation
99243	Office consultation
99244	Office consultation
99245	Office consultation
99341	Home visit new patient
99342	Home visit new patient
99343	Home visit new patient
99344	Home visit new patient
99345	Home visit new patient
99347	Home visit established patient
99348	Home visit established patient
99349	Home visit established patient
99350	Home visit established patient

Table 3. 2013 CMS Eye Care Provider Taxonomy Codes

Medicare Specialty Code	Medicare Provider/Supplier Type Description	Provider Taxonomy Code	Provider Taxonomy Description: Type, Classification, Specialization
2	Physician/General Surgery	207WX0200X	Allopathic & Osteopathic Physicians/Ophthalmic Plastic and Reconstructive Surgery
18	Physician/Ophthalmology	207W00000X	Allopathic & Osteopathic Physicians/Ophthalmology
41	Optometry	152W00000X	Eye and Vision Service Providers/Optometrist
		152WC0802X	Eye and Vision Service Providers/Optometrist, Corneal and Contact Management
		152WL0500X	Eye and Vision Service Providers/Optometrist, Low Vision Rehabilitation
		152WX0102X	Eye and Vision Service Providers/Optometrist, Occupational Vision
		152WP0200X	Eye and Vision Service Providers/Optometrist, Pediatrics
		152WS0006X	Eye and Vision Service Providers/Optometrist, Sports Vision
		152WV0400X	Eye and Vision Service Providers/Optometrist, Vision Therapy
96[5]	Optician	156FX1800X	Eye & Vision Service Providers/Technician/Technologist, Optician

Visual Function

Visual function is measured based on best-corrected visual acuity in the better-seeing eye. The VEHSS system also tracks monocular impairment based on the best-corrected acuity in the worse-seeing eye. Uncorrected refractive error (URE) is not currently defined due to limitations in claims and registry data.

Visual acuity categories are listed in **Table 4**.

Table 4. Visual Acuity Categories

Description	Definition
Normal Vision	20/12.5 - 20/25 (better eye)
Any Vision Loss	≤20/32 in better-seeing eye
Mild Visual Impairment	20/32 - 20/63 (better eye)
Moderate Visual Impairment	20/70 - 20/160 (better eye)
US Blind	≤20/200 in better-seeing eye
WHO Blind	≤20/400 in better-seeing eye
Monocular impairment	≤20/70 in either eye
Missing Acuity	No acuity measure classified above

Analysis Approach

Below we summarize the analysis approach for each outcome measure.

Treated Prevalence of Diagnosed Disorder Groups

Patient counts:

We assess the annual prevalence of categorized diagnosis codes within each dataset. Patients must be enrolled in the program during the year of observation. The definition of enrollment is defined in the data summary report for each data set, which are located on the VEHSS website. Individual patients are assigned to diagnosis categories and subgroups based on the presence of an included ICD9 or ICD10 code on any patient claim, diagnosis, or procedure during the year of observation. Diagnosis codes may be primary or secondary codes. Only one instance of a code is required to assign the patient to a diagnosis category and subgroup.

In summary, we use the following algorithm to assign diagnosis category and subgroup:

1. Any observation of an indicated diagnosis code in any claim by a patient.
2. The diagnosis code can be primary or secondary.
3. Only one instance of the diagnosis code is necessary to trigger a diagnosis.
4. Patients may be assigned to multiple categories and subgroups.
5. Data is analyzed on an annual basis.

The VEHSS team anticipates revisions to the analytic approach and diagnosis categorization based on analysis, review, and comments. The development of this algorithm was based on the practices of the CMS Chronic Conditions Warehouse reporting system, feedback from project partners, the expert panel, and the results of a literature review intended to identify normal and best practices for prevalence reporting from administrative data sources. This literature review is described in **Appendix A**.

Diagnosis categories and subgroups are defined in the "VEHSS Medical Diagnosis Categorization" spreadsheet. All eye and vision related ICD9 and ICD10 codes are mapped to a single subgroup. Categories can contain multiple subgroups. Patients with diagnoses that meet the criteria for multiple subgroups within a category are only assigned to that category once. Thus, the sum of patients across all subgroups can total more than the sum of patients in their associated categories.

For example, assume a patient has three eye and vision related ICD9 codes in the year of observation:

- 362.3 Retinal vascular occlusion, unspecified
- 362.9 Retinal nerve fiber bundle defects
- 362.11 Hypertensive retinopathy

362.3 and 362.9 are both assigned to subgroup '4.1 Retina vascular disease, Occlusive (arterial, venous)'. The patient is assigned to subgroup 4.1.

362.11 is assigned to subgroup '4.6 Retina vascular disease, Non-Occlusive'

The patient is counted as one prevalent case for subgroup 4.1, one case for subgroup 4.6, and one case for 'Category 4 Other Retinal Disorders'. Thus, individual patients can appear in multiple subgroups and categories, but cannot be double counted within a specific category or subgroup.

Patient denominator

The patient denominator consists of the total number of patients or beneficiaries enrolled in the payer or provider systems during the year of observation. The definition of "enrolled" patients is not uniform across data systems and is defined in the data summary report for each data set. For example, Medicare patients are considered enrolled if they are enrolled for all 12 months of the calendar year. However, other claims systems do not have monthly enrollment data. For example, VSP enrollment is based on employer-reported member counts which may be submitted annually. Likewise, Medicaid has complex enrollment criteria that differs by state. Further details are included in the respective data set summary reports.

Eye Examination Rates

Patient counts:

The VEHSS investigates the eye examination rate among claims system beneficiaries and Registry patients by age group, state, race, and gender. The rate of exams is defined as the proportion of patients who have at least one eye exam during the year of observation.

Examination rates are reported by provider type, including "Any Provider Type", "Optometry and Optician", and "Ophthalmology & Physicians". Providers are defined based on the provider codes included in each dataset. For example, **Table 3** "Eye-provider Taxonomy Codes" lists the provider codes from 2013 Medicare claims. In this example, provider type 41 and 96[5] would be included in "Optometry and Optician," provider types 2 and 18 would be included in "Ophthalmology & Physicians," and all types would be included in "Any Provider Type."

Patients are defined as those who are enrolled in the payer program or represented in the EHR registry during the year of observation.

Exams are defined by the included list of CPT codes in **Table 2** "Exam CPT/HCPCS Codes," All procedures with an eye exam code (92002, 92004, 92012, and 92014) are counted. Other E/M codes are only counted if they are provided by an eye care provider based on the provider taxonomy codes contained in **Table 3**, "Eye-provider Taxonomy Codes."

Visual Acuity

Patient counts:

Patients are assigned to visual function categories based on their best-corrected visual acuity in the better-seeing eye. Patients with multiple measures are assigned to a category based on their last recorded acuity during the period of observation. Scored acuity values take precedence over any measures that are unknown, incomplete, or indeterminate acuity. Patients who cannot be assigned to a visual acuity category are reported as Missing acuity.

Patients are assigned to one or more of the visual acuity categories listed in **Table 4**. Normal vision, Any Vision Loss, and Missing Acuity are mutually exclusive, and incorporate all patients. Normal, Mild impairment, Moderate impairment, US blind, and Missing Acuity are also mutually exclusive and contain all patients. WHO Blind and Monocular Impairment are not mutually exclusive with any other visual acuity category. The definition of uncorrected refractive error (URE) is to be determined.

Patient denominator

Patient counts:

The patient denominator is the total count of patients enrolled in the payer system or EHR registry during the year of observation. The definition of "enrolled" patients is not uniform across data systems and is defined in the data summary report for each data set. For example, Medicare patients are considered enrolled if they are enrolled for all 12 months of the calendar year. However, other claims systems (i.e. VSP) do not have monthly enrollment data: Most employers provide enrollee data annually. Likewise, Medicaid has complex enrollment criteria that differs by state. Further details are included in the respective data set summary reports.

High Level Validation

To ensure scientific accuracy and integrity, we conduct internal and external validation of the outcomes of this analysis.

Internal Validation

Upon completion or delivery of each dataset, we conduct initial quality testing and internal validation steps to mitigate the chance of errors. We assess file structure, and extent and patterns of missing data. We use the following checklist on all data sources:

- All of the tables/outputs are complete
- Measures and variables are not missing
- Correct identifiers are used
- Stratification by identifiers reconcile with "All" identifiers
- Denominators and total sample size are the same across different tables from the same source
- Variable values are within a plausible range
- Conditions: Sub-categories should sum to be greater than their constituent category since subcategories are not mutually exclusive
- Exams: Exams by type reconcile with total exams
- Vision: Normal, vision loss and missing reconcile with denominator

External Validation

To externally validate the data we receive, we compare estimates across different years and different data sources, particularly those developed using common data, measures, or methods. We do not expect results to align across datasets. Differences in estimates are analyzed, summarized, and documented. The differences between datasets are evaluated based on what is considered reasonable and how these differences meet the expectations of the project team and the expert panel.

Primary measures from each dataset are compared to others. For example, we compared the national level treated prevalence of each category and subgroup of diagnosed disorders from each claims system and IRIS Registry.

We also compare estimates to those in the published literature. We conducted a review of the published literature to identify existing measures of prevalence of vision loss for major eye disorders. We included studies that reported prevalence estimates based on primary data and identified 78 articles from 1991 to 2016 using combinations the search term, 'prevalence,' with specific eye and vision condition terms, including:

- "age-related macular degeneration", "age-related maculopathy", "macular degeneration", "AMD"

- “diabetic retinopathy”
- “glaucoma”
- “cataract"
- “vision impairment”, “visual impairment”, “acuity”
- “blindness”
- “uncorrected refractive error”

The VEHSS team compares estimates from the VEHSS system to the age, race, and sex-specific prevalence estimates identified in this literature review. We consider the differences in case definitions, data, and methodology when making these comparisons; differences across these factors are likely to lead to different results. This external validation step allows the VEHSS team to assess the general comparability of VEHSS prevalence results to existing published estimates.

Dataset Preparation

Summary Table Public Use Files (PUF) and Research De-identified Files (RDF)

The VEHSS system prepares and releases summary table public use files (PUFs) on the VEHSS system website and through the CDC Open Data platform. PUFs are state and national de-identified summary tables aggregated by demographic characteristics. PUFs do not contain person-level records. To ensure compliance with the Health Insurance Portability and Accountability Act (HIPAA), it is necessary to suppress some PUF results to mitigate the potential of patient re-identification, which could pose a risk to the privacy of individual patients. We assessed various options for data suppression. While protecting patient privacy is of paramount importance, it is also important to ensure that data is not unnecessarily suppressed to retain research utility.

In addition to the PUF, VEHSS prepares research de-identified files (RDF) for use in the data integration model (Step 5). These are also fully de-identified data files but do not undergo the stringent suppression of the PUFs, and include more detailed age groups as noted in **Appendix C Tables A6** and **A7**.

Calculating Rates and Confidence Intervals

Rates are calculated as crude prevalence rates per 100 persons. The denominator is defined for each dataset based on its unique characteristics. All rates are expressed as annual rates.

Unless otherwise noted on the VEHSS, confidence intervals are calculated using the Clopper-Pearson (Exact) method based on a binomial distribution, which is the standard approach for calculating uncertainty in small proportion estimates by the National Center for Health Statistics. [1]

Data Suppression

CMS VRDC DUA Suppression requirement

In order to analyze and report data from the CMS Virtual Research Data Center (VRDC), including Medicare 100% claims and Medicaid MAX data, the VRDC requires suppression of denominators less than 11. As specified in our Data Use Agreement:

> "…no cell (e.g. admittances, discharges, patients, services) 10 or less may be displayed. Also, no use of percentages or other mathematical formulas may be used if they result in the display of a cell 10 or less."

This suppression rule is used for RDFs.

[1] Parker JD, Talih M, Malec DJ, et al. National Center for Health Statistics Data Presentation Standards for Proportions. National Center for Health Statistics. Vital Health Stat 2(175). 2017

Additional Suppression for PUFs

To ensure patient privacy and protections, the VEHSS project adopted additional data suppression on PUFs. NORC worked with its internal data governance board, external experts, and data providers to design a suppression algorithm to balance high level patient protection while maintaining the research utility of PUF data. Currently, VEHSS employs the following data suppression algorithm:

1. Suppress rates and denominator when denominator < 11
2. Suppress rate if numerator <3 and denominator <30
3. Rounding the denominator to the nearest 100, for example
    a. 27 rounded to <100
    b. 79 rounded to 100
    c. 249,501 rounded to 249,500
4. Report rates to 4 digits, formatting as percentage and two decimal points. For example,
    a. 0.001223 reported as 0.12%,
    b. 0.0724896 reported as 7.25%,
    c. 0.500000 reported as 50.00%

Indicating Suppression in PUFs

PUF files indicate suppressed results by reporting a blank value in the suppressed 'Data_Value' field, and then indicating the suppression in the 'Data_Value_Footnote_Symbol' field and reason for suppression in the 'Data_Value_Footnote' field, as noted in **Appendix B**.

Stratification Combinations

The CDC data visualization application displays a line from the PUF file based on queries matching the demographic and risk factor stratification variables selected by users. The application does not perform any calculations. Therefore, every single combination of factors that are intended to be shown are presented as a row in the PUF file. Up to 15 stratification combinations are possible:

One –way

1. Age group
2. Race
3. Gender
4. RiskFactor

2-way

5. Age group*Race
6. Age group*Gender
7. Age group*RiskFactor
8. Race*Gender
9. Race*RiskFactor
10. Gender*RiskFactor

3-way

11. Age group*Race*Gender
12. Age group*Race*RiskFactor
13. Age group*Gender*RiskFactor
14. Race*Gender*RiskFactor

4-way

15. Age group*Race*Gender*RiskFactor

Single-source Data Briefs

Preliminary results and statistics from each RDF dataset are compiled into a data brief report, with tables, figures, and maps depicting high-level outcomes. Briefs are provided to CDC, project partners, the expert panel, and are released on the project website.

Results, tabulated by strata, are presented for each outcome measure:

Outcome measures:

- Diagnosis category and subgroup counts, denominator, rate
- Exam count, denominator, rate
- Visual function count, denominator, rate
- Missing cells count (RDF only)
- Suppressed cells count (PUF only)

Outcome measures will be stratified by:

- Age group
- Race
- Gender
- Race x gender
- State*
- Insurance*

*when available

Data Dissemination

The VEHSS data visualization application allows analysis and visualization of each dataset. The visualization pages have the following features:

- Users may select one source of data.
- Users may select one topic, such as medical diagnoses, service utilization, or visual function.
- Users may select a condition category, which will populate the subgroup options. Users may then select one subgroup. Users may select age group, race, and sex. In the first year of development, only one year of claims data may be displayed at a time.
- Users may display results in different graph or map formats. When map formats are selected, users may select individual states.
- Users may save figures and export summary tables.
- Suppressed data does not appear as an option among the stratification categories in queries. For example, if data is suppressed for a particular state, that state will appear as gray in the resulting map, and blank in tables and figures.

Through the CDC Open Data platform the public can also directly access VEHSS summary table PUFs for all data. The IRIS Registry data are, however, not available.

Appendix A. Summary of data inclusion literature review

A number of different approaches have been used for translating administrative claims data into treated prevalence estimates. NORC conducted a scan of published articles in PubMed to identify different approaches for case identification and assessed whether a particular approach is most commonly used in eye and vision research.

The review focused on published articles identified by using the following search terms:

- "Claims"
- "Eye"
- "Vision"
- "Diagnosis"
- "ICD-9"
- "ICD-10"

NORC reviewed 17 papers focusing on the analysis of administrative data for vision and eye disorders and categorized each according to whether they used ≥1 instances of a diagnosis code to identify a particular eye condition or ≥2 instances of a code (Table A1). Several papers did not specify how many instances of each code were used to identify an eye condition; in these instances, the NORC team assumed that these papers used ≥1 instances of a code.

Table A1. Literature Scan Results: Studies Utilizing Claims Data for Identifying Vision Loss and Eye Conditions

Study Citation	Data	Years of Data	Instances of Each Code Required
Lee PP, Levin LA, Walt JG, et al. The impact of glaucoma coding in a large claims database. Am J Ophthalmol. 2007;143:867–70. [PubMed]	PharMetrics claims database	1998-2003	≥2
Healthcare charges in patients who transition from ocular hypertension to primary open-angle glaucoma based on ophthalmic coding data. Pasquale LR, Walt JG, Stern LS, Wiederkehr D, Malangone E, Dolgitser M. Adv Ther. 2009 Oct	PharMetrics claims d atabase	1998-2005	≥2: Ocular Hypertension ≥1: Primary Open Angle Glaucoma
Monitoring visual status: why patients do or do not comply with practice guidelines. Sloan FA, Brown DS, Carlisle ES, Picone GA, Lee PP. Health Serv Res. 2004 Oct;39(5):1429-48.	Medicare claims: carrier (physician supplier/Part B), outpatient, inpatient, skilled nursing, home health agency, and hospice.	1984-1999	≥1

Study Citation	Data	Years of Data	Instances of Each Code Required
Longitudinal rates of annual eye examinations of persons with diabetes and chronic eye diseases. Lee PP, Feldman ZW, Ostermann J, Brown DS, Sloan FA. Ophthalmology. 2003 Oct;110(10):1952-9.	Medicare Parts A (mainly institutional claims) and B (mainly physician claims)	1991-1999	≥1
Risk of Ocular Complications in Patients with Noninfectious Intermediate Uveitis, Posterior Uveitis, or Panuveitis. Dick AD, Tundia N, Sorg R, Zhao C, Chao J, Joshi A, Skup M. Ophthalmology. 2016 Mar;123(3):655-62. doi: 10.1016/j.ophtha.2015.10.028. Epub 2015 Dec 19.	OptumHealth (Eden Prairie, MN) Reporting and Insights database, which includes medical and drug claims for 16.4 million privately insured individuals in 69 self-insured companies.	1998-2012	≥2
Treatment Patterns for Myopic Choroidal Neovascularization in the United States: Analysis of the IRIS Registry. Willis J, Morse L, Vitale S, Parke DW 2nd, Rich WL, Lum F, Cantrell RA. Ophthalmology. 2017 Mar 31. pii: S0161-6420(16)32051-6. doi: 10.1016/j.ophtha.2017.02.018. [Epub ahead of print]	IRIS	2012-2014	≥1
Medicare costs for neovascular age-related macular degeneration, 1994-2007. Day S, Acquah K, Lee PP, Mruthyunjaya P, Sloan FA. Am J Ophthalmol. 2011 Dec;152(6):1014-20. doi: 10.1016/j.ajo.2011.05.008. Epub 2011 Aug 16.	Medicare 5% Part-B claims	1994, 2000, 2006	≥1
An updated estimate of costs of endophthalmitis following cataract surgery among Medicare patients: 2010-2014. Schmier JK, Hulme-Lowe CK, Covert DW, Lau EC. Clin Ophthalmol. 2016 Oct 26;10:2121-2127. eCollection 2016.	5% Medicare claims	2010-2014	≥1
Risk of musculoskeletal injuries, fractures, and falls in medicare beneficiaries with disorders of binocular **vision**. Pineles SL, Repka MX, Yu F, Lum F, Coleman AL. JAMA Ophthalmol. 2015 Jan;133(1):60-5. doi: 10.1001/jamaophthalmol.2014.3941.	Medicare Part B fee-for-service claims	2002-2011	≥1
Gaps in receipt of regular **eye** examinations among medicare beneficiaries diagnosed with diabetes or chronic **eye** diseases. Sloan FA, Yashkin AP, Chen Y. Ophthalmology. 2014 Dec;121(12):2452-60. doi: 10.1016/j.ophtha.2014.07.020. Epub 2014 Sep 7.	Medicare Part B claims	1993–7 for the 1998 baseline, from 1993–9 for the 2000, and from 1993–2001 for the 2002	≥1

Study Citation	Data	Years of Data	Instances of Each Code Required
Sight-Threatening Ocular Diseases Remain Underdiagnosed Among Children Of Less Affluent Families. Stein JD, Andrews C, Musch DC, Green C, Lee PP. Health Aff (Millwood). 2016 Aug 1;35(8):1359-66. doi: 10.1377/hlthaff.2015.1007.	Clinformatics Data Mart from Optum Insight	2001-2014	≥2
Assessing Geographic Variation in Strabismus Diagnosis among Children Enrolled in Medicaid. Ehrlich JR, Anthopolos R, Tootoo J, Andrews CA, Miranda ML, Lee PP, Musch DC, Stein JD. Ophthalmology. 2016 Sep;123(9):2013-22. doi: 10.1016/j.ophtha.2016.05.023. Epub 2016 Jun 24.	Medicaid Analytic Extract database	2009	≥1
Rates of Vitrectomy among Enrollees in a United States Managed Care Network, 2001-2012. Wubben TJ, Talwar N, Blachley TS, Gardner TW, Johnson MW, Lee PP, Stein JD. Ophthalmology. 2016 Mar;123(3):590-8. doi: 10.1016/j.ophtha.2015.11.001. Epub 2015 Dec 31.	Clinformatics DataMart database	2001-2012	≥1
Direct medical costs and resource use for treating central and branch retinal vein occlusion in commercially insured working-age and Medicare populations. Suñer IJ, Margolis J, Ruiz K, Tran I, Lee P. Retina. 2014 Nov;34(11):2250-8. doi: 10.1097/IAE.0000000000000217.	Administrative medical and pharmacy claims from the Truven Health Analytics MarketScan commercial database and Medicare supplemental database	2002-2008	≥1
Ten-year incidence of age-related macular degeneration according to diabetic retinopathy classification among medicare beneficiaries. Hahn P, Acquah K, Cousins SW, Lee PP, Sloan FA. Retina. 2013 May;33(5):911-9. doi: 10.1097/IAE.0b013e3182831248.	Medicare 5% inpatient, outpatient, and Part B claims files	1991-2005	≥1
Ocular complications after anti-vascular endothelial growth factor therapy in Medicare patients with age-related macular degeneration. Day S, Acquah K, Mruthyunjaya P, Grossman DS, Lee PP, Sloan FA. Am J Ophthalmol. 2011 Aug;152(2):266-72. doi: 10.1016/j.ajo.2011.01.053. Epub 2011 Jun 12.	Medicare 5% inpatient, outpatient, Part-B, and durable medical equipment claims files	2002-2008	≥2
Rates of glaucoma medication utilization among persons with primary open-angle glaucoma, 1992 to 2002. Stein JD, Ayyagari P, Sloan FA, Lee PP. Ophthalmology. 2008 Aug;115(8):1315-9, 1319.e1. doi: 10.1016/j.ophtha.2007.12.017. Epub 2008 Mar 5.	Medicare Current Beneficiary Survey merged with Medicare claims data	1992-2002	≥1

Of the 17 papers reviewed, 13 appeared to use ≥1 instances of selected diagnosis codes and 5 used ≥2. Based on this review, the NORC team concluded that no standard practice exists specifying how many instances of diagnosis codes should be used to identify a condition. In addition, we noted that all studies identified used multiple years of data. The papers that required multiple instances of a diagnosis had 4, 5,

6, 7, and 13 years of data. Also, of these five studies, four followed patients for progression of adverse outcomes (where correct case identification is vital, but actual case counts are not used), and did not focus on population prevalence or treated prevalence estimates (where case counts is presumably at least as important as correct case identification).

Based on our review of the literature and because the initial VEHSS analyses have a different intent and are limited to only one year, the NORC team required only one instance of a particular diagnosis code to trigger classification to the relevant eye condition.

Appendix B. VEHSS Uniform Data Template, Version 3-3

Table B1. VEHSS Uniform Dataset Template, version 3.3

Source Column	Description	Data Type
YearStart	Starting Year for year range	number
YearEnd	Ending Year if data pooled over multiple years	number
LocationAbbr	State Abbreviation	plain text
LocationDesc	State Name	plain text
DataSource	Abbreviation of Data Source	plain text
Topic	Topic Description	plain text
Category	Category description	plain text
Question	Question Description (i.e., Percentage of adults with diabetic retinopathy)	plain text
Response	Optional column to hold the response value	plain text
Age	Stratification value for age group e.g. 18-39yrs	plain text
Gender	Stratification value for gender e.g. Male, Female	plain text
RaceEthnicity	Stratification value for race e.g. White, non-hispanic	plain text
RiskFactor	Stratification value for major risk factor e.g. diabetes	plain text
RiskFactorResponse	Optional column to hold response for the risk factor that was evaluated.	plain text
Data_Value_Unit	The unit, such as "%" for percentage	plain text
Data_Value_Type	The data value type, such as age-adjusted prevalence or crude prevalence	plain text
Data_Value	Data Value, such as 14.7 or no value if footnote symbol is present	number
Data_Value_Footnote_Symbol	Footnote symbol	plain text
Data_Value_Footnote	Footnote text	plain text
Low_Confidence_limit	95% confidence interval lower bound	number
High_Confidence_Limit	95% confidence interval higher bound	number
Sample_Size	Sample size used to calculate the data value	number
LocationID	Lookup identifier value for Location	plain text
GeoLocation	GeoLocation or Geocode in the format (latitude, longitude)	Location
TopicID	Lookup identifier value for Topic	plain text
CategoryID	Identifier for category	plain text
QuestionID	Lookup identifier value for Question	plain text
ResponseID	Response identifier for Question	Plain text
AgeID	Identifier for the stratification1 (Age)	plain text
GenderID	Identifier for the stratification2 (Sex)	plain text
RaceEthnicityID	Identifier for the stratification3 (Race/Ethnicity)	plain text
RiskFactorID	Identifier for the stratification4 (Major Risk Factor)	plain text
RiskFactorResponseID	Response identifier for Major Risk Factor Response	Plain text

Appendix C. VEHSS Uniform Data Dictionary, Version 3-3

Table C1. Topics

TopicID	Topic
tDx	Medical Diagnoses
tVis	Vision Exam Measures
tUtl	Service Utilization

Table C2. Categories

CategoryID	Category
Medical Diagnoses	
cDxC1	Retinal Detachment and Defects
cDxC2	Diabetic Eye Diseases
cDxC3	Age related macular degeneration
cDxC4	Other Retinal Disorders
cDxC5	Glaucoma
cDxC6	Cataracts
cDxC7	Disorders of Refraction and accommodation
cDxC8	Blindness and low vision
cDxC9	Strabismus and amblyopia
cDxC10	Injury, burns and surgical complications of the eye
cDxC11	Disorders of optic nerve and visual pathways
cDxC12	Other visual disturbances
cDxC13	Infectious and Inflammatory diseases
cDxC14	Orbital and external disease
cDxC15	Cancer and neoplasms of the eye
cDxC16	Cornea disorders
cDxC17	Other eye disorders
Visual Acuity Measures	
cVisAc	Visual Acuity
Service Utilization	
cUtlEx	Eye Exams

Table C3. Responses: Medical Diagnoses

Category	ResponseID	Response (Category & Subgroup description)
Cat_1	r1_All	All Retinal detachment and defects
Cat_2	r2_All	All Diabetic eye diseases
Sub_2.1	r2_1	Early/mild
Sub_2.2	r2_2	Moderate/Severe non-proliferative
Sub_2.3	r2_3	Proliferative
Sub_2.4	r2_4	Diabetic macular edema
Sub_2.5	r2_5	Other diabetes related
Cat_3	r3_All	All Age related macular degeneration
Sub_3.1	r3_1	Unspecified
Sub_3.2	r3_2	Early
Sub_3.3	r3_3	Dry-form
*Sub_3.3x_GA	r3_3GA	Geographic atrophy
Sub_3.4	r_3_4	Wet-form
*Sub_3.4x_CNV	r3_4CNV	Choroidal neovascularization
Cat_4	r4_All	All Other retinal disorders
Sub_4.1	r4_1	Retina vascular disease, Occlusive
Sub_4.2	r4_2	Central retinal vein occlusion
Sub_4.3	r4_3	Branch retinal vein occlusion
Sub_4.4	r4_4	Central retinal arterial occlusion
Sub_4.5	r4_5	Branch retinal artery occlusion
Sub_4.6	r4_6	Non-Occlusive
Sub_4.7	r4_7	Macular edema (not diabetic)
Sub_4.8	r4_8	Hereditary chorioretinal dystrophy
Sub_4.9	r4_9	Myopic degeneration
Sub_4.10	r4_10	Other/unspecified
Cat_5	r5_All	All Glaucoma
Sub_5.1	r5_1	Open-angle
Sub_5.2	r5_2	Primary open-angle
Sub_5.3	r5_3	Low-tension
Sub_5.4	r5_4	Glaucoma suspect
Sub_5.5	r5_5	Primary angle-closure
Sub_5.6	r5_6	Narrow-angle
Sub_5.7	r5_7	Congenital
Sub_5.8	r5_8	Neovascular
Sub_5.9	r5_9	Other/unspecified
Sub_5.x_Severe	r5_xS	Severe stage
Cat_6	r6_All	All Cataracts
Sub_6.1	r6_1	Senile cataract

Category	ResponseID	Response (Category & Subgroup description)
Sub_6.2	r6_2	Non-congenital cataract
Sub_6.3	r6_3	Congenital Cataract
Sub_6.4	r6_4	Posterior capsular opacity
Sub_6.5	r6_5	Pseudophakia
Sub_6.6	r6_6	Aphakia and disorders of lens
Cat_7	r7_All	All Refraction and accommodation
Sub_7.1	r7_1	Myopia
Sub_7.2	r7_2	Hypermetropia
Sub_7.3	r7_3	Astigmatism
Sub_7.4	r7_4	Presbyopia
Sub_7.5	r7_5	Other
Cat_8	r8_All	All Blindness and low vision
Sub_8.1	r8_1	Unqualified, both eyes
Sub_8.2	r8_2	Unqualified in one eye, or unspecified
Sub_8.3	r8_3	Vision impairment one eye
Sub_8.4	r8_4	Moderate imp. better eye, profound imp. lesser eye
Sub_8.5	r8_5	Moderate bilateral impairment
Sub_8.6	r8_6	Profound bilateral imp., legal blindness
Cat_9	r9_All	All Strabismus and amblyopia
Sub_9.1	r9_1	Strabismus
Sub_9.2	r9_2	Amblyopia
Cat_10	r10_All	All Injury, burns and surgical complications of the eye
Sub_10.1	r10_1	Injury
Sub_10.2	r10_2	Burn
Sub_10.3	r10_3	Surgical complication
Cat_11	r11_All	All Disorders of optic nerve and visual pathways
Sub_11.1	r11_1	Optic nerve disorders
Sub_11.2	r11_2	Visual pathway disorders
Cat_12	r12_All	All Other visual disturbances
Sub_12.1	r12_1	Visual field defect
Sub_12.2	r12_2	Color blindness
Sub_12.3	r12_3	Night blindness
Sub_12.4	r12_4	Other/unspecified
Cat_13	r13_All	All Infectious and inflammatory diseases
Sub_13.1	r13_1	Infectious diseases
Sub_13.2	r13_2	Keratitis
Sub_13.3	r13_3	Conjunctivitis
Sub_13.4	r13_4	Eyelid disorders
Sub_13.5	r13_5	Other/unspecified
Sub_13.6	r13_6	Lacrimal and orbit inflammation

Category	ResponseID	Response (Category & Subgroup description)
Sub_13.7	r13_7	Endophthalmitis
Cat_14	r14_All	All Orbital and external disease diseases
Sub_14.1	r14_1	Congenital anomalies
Sub_14.2	r14_2	Other/unspecified
Sub_14.3	r14_3	Lacrimal diseases
Sub_14.4	r14_4	Eyelid disorders
Sub_14.5	r14_5	Dry eye syndrome
Sub_14.6	r14_6	Disorders of the globe
Cat_15	r15_All	All Cancer and neoplasms of the eye diseases
Sub_15.1	r15_1	Malignant neoplasm
Sub_15.2	r15_2	Benign neoplasm
Cat_16	r16_All	All Cornea disorders
Sub_16.1	r16_1	Keratoconus
Sub_16.2	r16_2	Endothelial dystrophy (Fuchs)
Sub_16.3	r16_3	Other corneal disorders
Cat_17	r17_All	All Other eye disorders

Table C4. Responses: Visual Acuity

ResponseID	Response
rVNorm	Normal Vision
rVAny	Any Vision Loss (≤20/32 in better eye)
rVImp	Visual impairment (20/32 - 20/160 in better eye)
rVImild	Visual impairment (20/32 - 20/63 in better eye)
rVImod	Visual impairment (20/70 - 20/160 in better eye)
rVUSB	US Blind (≤20/200 in better eye)
rVWB	WHO Blind (≤20/400 in better eye)
rVMon	Monocular vision loss (≤20/70 in either eye)
rVURE	Uncorrected Refractive Error
rVmiss	Missing acuity

Table C5. Responses: Eye Exams

ResponseID	Response
rExAny	By any provider type
rExPhs	By an ophthalmologists or other physician
rExOpt	By an optometrist or optician

Table C6. PUF major age groups

AgeID	Text
AgeAll	All ages
Age017	0-17 years
Age1839	18-39 years
Age4064	40-64 years
Age6584	65-84 years
Age85Plus	85 years and older

Table C7. RDF Modified WHO Age Groups

AgeID	Text
AgeAll	All ages
Age01	Less than 1 year
Age14	1-4 years
Age59	5-9 years
Age1014	10-14 years
Age1519	15-19 years
Age2024	20-24 years
Age2529	25-29 years
Age3034	30-34 years
Age3539	35-39 years
Age4044	40-44 years
Age4549	45-49 years
Age5054	50-54 years
Age5559	55-59 years
Age6064	60-64 years
Age6569	65-69 years
Age7074	70-74 years
Age7579	75-79 years
Age8084	80-84 years
Age8589	85-89 years
Age9094	90-94 years
Age9599	95-99 years

Table C8. Gender

GenderID	Text
gAll	Total
gM	Male
gF	Female
gU	Unknown

Table C9. Race/Ethnicity

RaceEthnicityID	RaceEthnicity Text
ALLRACE	All races
ASN	Asian
BLK	Black, non-Hispanic
HISP	Hispanic, any race
NONE	None given or missing
AIAN	North American Native
OTH	Other
WHT	White, non-Hispanic

Table C10. Risk Factors

RiskFactorID	RiskFactor Text
RFALL	All patients
RFDM	Diabetes
RFHT	Hypertension
RFSM	Smoking
RFNR	No Risk Factors

Table C11. Insurance

InsuranceID	Insurance Text
Ins_D	Medicare+Medicaid Dual Eligible
Ins_E	Medicaid
Ins_S	Medicare Fee For Service
Ins_C	Medicare Managed
Ins_Y	Military
Ins_G	Other Government
Ins_P	Private
Ins_U	No Payment Listed
Ins_All	All payers

Table C12. Locations

LocationId	LocationAbbr	LocationDesc	GeoLocation
59	US	National (States and DC)	
01	AL	Alabama	(32.84057112200048, -86.63186076199969)
02	AK	Alaska	(64.84507995700051, -147.72205903599973)
04	AZ	Arizona	(34.865970280000454, -111.76381127699972)
05	AR	Arkansas	(34.74865012400045, -92.27449074299966)
06	CA	California	(37.63864012300047, -120.99999953799971)
08	CO	Colorado	(38.843840757000464, -106.13361092099967)
09	CT	Connecticut	(41.56266102000046, -72.64984095199964)
10	DE	Delaware	(39.008830667000495, -75.57774116799965)
12	FL	Florida	(28.932040377000476, -81.92896053899966)
13	GA	Georgia	(32.83968109300048, -83.62758034599966)
16	ID	Idaho	(43.682630005000476, -114.3637300419997)
17	IL	Illinois	(40.48501028300046, -88.99771017799969)
18	IN	Indiana	(39.766910452000445, -86.14996019399968)
19	IA	Iowa	(42.46940091300047, -93.81649055599968)
20	KS	Kansas	(38.34774030000045, -98.20078122699965)
31	NE	Nebraska	(41.6410409880005, -99.36572062299967)
40	OK	Oklahoma	(35.47203135600046, -97.52107021399968)
44	RI	Rhode Island	(41.70828019300046, -71.52247031399963)
47	TN	Tennessee	(35.68094058000048, -85.77449091399967)
15	HI	Hawaii	(21.304850435000446, -157.85774940299973)
22	LA	Louisiana	(31.31266064400046, -92.44568007099969)
23	ME	Maine	(45.254228894000505, -68.98503133599962)
24	MD	Maryland	(39.29058096400047, -76.60926011099963)
25	MA	Massachusetts	(42.27687047000046, -72.08269067499964)
26	MI	Michigan	(44.6613195430005, -84.71439026999968)
27	MN	Minnesota	(46.35564873600049, -94.79420050299967)
28	MS	Mississippi	(32.745510099000455, -89.53803082499968)
29	MO	Missouri	(38.635790776000476, -92.56630005299968)
30	MT	Montana	(47.06652897200047, -109.42442064499971)
32	NV	Nevada	(39.493240390000494, -117.07184056399967)
33	NH	New Hampshire	(43.65595011300047, -71.50036091999965)
34	NJ	New Jersey	(40.13057004800049, -74.27369128799967)
35	NM	New Mexico	(34.52088095200048, -106.24058098499967)
36	NY	New York	(42.82700103200045, -75.54397042699964)
37	NC	North Carolina	(35.466220975000454, -79.15925046299964)
38	ND	North Dakota	(47.47531977900047, -100.11842104899966)
39	OH	Ohio	(40.06021014100048, -82.40426005599966)
41	OR	Oregon	(44.56744942400047, -120.15503132599969)
42	PA	Pennsylvania	(40.79373015200048, -77.86070029399963)

LocationId	LocationAbbr	LocationDesc	GeoLocation
45	SC	South Carolina	(33.998821303000454, -81.04537120699968)
46	SD	South Dakota	(44.353130053000484, -100.3735306369997)
48	TX	Texas	(31.827240407000488, -99.42677020599967)
49	UT	Utah	(39.360700171000474, -111.58713063499971)
50	VT	Vermont	(43.62538123900049, -72.51764079099962)
51	VA	Virginia	(37.54268067400045, -78.45789046299967)
53	WA	Washington	(47.52227862900048, -120.47001078999972)
54	WV	West Virginia	(38.66551020200046, -80.71264013499967)
55	WI	Wisconsin	(44.39319117400049, -89.81637074199966)
56	WY	Wyoming	(43.23554134300048, -108.10983035299967)
11	DC	District of Columbia	(38.89037138500049, -77.03196112699965)
21	KY	Kentucky	(37.645970271000465, -84.77497104799966)
72	PR	Puerto Rico	(18.2208330,-66.5901490)
66	GU	Guam	(13.4443040,144.7937310)
78	VI	U.S. Virgin Islands	(18.3357650,-64.8963350)
69	MP	Northern Mariana Islands	(15.097900,145.673900)
68	MH	Marshall Islands	(11.3246908,166.84174239999993)
70	PW	Palau	(7.514979999999999,134.58251999999993)
60	AS	American Samoa	(-14.3016396,-170.69618149999997)