Developing Methods of Repurposing Electronic Health Record Data for Identification of Older Adults at Risk of Unintentional Falls

by Adam Baus, PhD, MA, MPH; Keith Zullig, PhD, FASHA; Dustin Long, PhD; Charles Mullett, MD, PhD; Cecil Pollard, MA; Henry Taylor, MD, MPH; and Jeffrey Coben, MD

Abstract

Nationally, nearly 40 percent of community-dwelling adults age 65 and older fall at least once a year, making unintentional falls the leading cause of both fatal and nonfatal injuries among this age group. Addressing this public health problem in primary care offers promise. However, challenges in incorporating fall risk screening into primary care result in a problem of missed opportunities for screening, counseling, intervention, and ultimately prevention. Given these barriers, this study examines the potential for the innovative use of routinely collected electronic health record data to provide enhanced clinical decision support in busy, often resource-thin primary care environments. Using de-identified data from a sample of West Virginia primary care centers, we find that it is both feasible and worthwhile to repurpose routinely collected data for the purpose of identification of older adults at risk of falls. Searching of both free-text and semistructured data was particularly valuable.

Key words: electronic health records; unintentional falls; older adults; West Virginia

Introduction

Unintentional falls among older adults are a complex, formidable public health problem both nationally and in West Virginia. Falls often result in moderate to severe injuries such as head trauma and fractures while increasing the risk of early death.[1] Recent information from the US Preventive Services Task Force (USPSTF) highlights that nearly 40 percent of community-dwelling adults age 65 and older fall at least once a year, making unintentional falls the leading cause of both fatal and nonfatal injuries among this age group.[2,3] Unintentional falls accounted for more than 70 percent of emergency department visits among persons age 65 and older in 2010.[4] In 2012, there were 2.4 million nonfatal emergency department visits due to falls among older adults, with approximately 722,000 of those events resulting in hospitalization.[5] Further, recent research highlights an increased prevalence of falls among older adults.[6] This problem is especially relevant in West Virginia, in which the population is aging faster on average than the rest of the nation.[7,8] Further, poor health outcomes and complications following falls are exacerbated by various comorbidities prevalent among older adults.[9] Direct medical costs associated with these injuries were approximately $19.2 billion in 2000,[10] increased to approximately $30 billion in 2012,[11] and are projected to reach $43.8 billion by 2020.[12]

This nonexperimental retrospective study examines the utility of importing electronic health record (EHR) data into an external clinical information system to systematically identify older patients at risk of falls among select West Virginia primary care centers. Data are from an EHR that was certified by the Certification Commission for Health Information Technology (CCHIT). Previous research has identified common limitations of EHRs in the area of functionality necessary for analysis and research because they are instead designed primarily to support patient care.[13-17] Given this limitation, this research repurposes EHR data for fall risk identification, paying particular attention to the determination of the value added by data gathered from various areas of the medical record, including free-text notes. The outcome of interest is the development of methods to repurpose EHR data to identify this particular at-risk patient population. This expanded use of EHR data increases the opportunity to transform data collected at the time of patient care into knowledge that can be applied to better target services and intervention to patients in need, inform healthcare decisions, and bolster practice-based research.[18] Further, this approach offers the advantage of moving from an acute model of patient-by-patient screening to one of a planned, population-based model of data-driven clinical decision support for fall risk identification. This study was classified as non–human subjects

research by the West Virginia University Office of Research Integrity and Compliance (protocol number 1402217616) because it involves secondary data that do not include information protected under the Health Insurance Portability and Accountability Act (HIPAA).

Background

Detecting community-dwelling older adults at risk of falling poses a serious challenge. The timed Get-Up-and-Go test is the gold-standard assessment recommended by the USPSTF for determining fall risk.[19] However, this test is best considered within a larger battery of assessments to more definitively measure physical function[21] and depends on clinicians' use of standard procedures and equipment.[22] Although the test can be completed in less than a minute, this additional task can be challenging to incorporate into brief office visits given the complex health needs of older patients.[23] Nationally, screening for fall risk is completed only 30 to 37 percent of the time.[24]

Given the need for efficient, systematic primary care screening for fall risk, exploring the use of EHR data to identify patients at risk is warranted. EHRs have the potential to be valuable tools for health outcomes research in primary care[25-29] and a critical component in the reduction of preventable deaths through increased adherence to preventive services.[30] However, EHRs are primarily designed to support patient-level care and often lack population-level reporting and health analytics features essential to public health efforts.[31-35] Moving EHR data to an external system allows for more in-depth querying of the data, data transparency in that key data (i.e., patient diagnoses, demographics, vital signs, laboratory results, and services) can be queried for coding consistency and completeness and for analysis of free-text or narrative data. Analysis of free-text or narrative data is of particular interest because of the potential for essential information to be found in these locations and not in the coded areas of the EHR data.[36-41]

While repurposing EHR data for the identification of patients at risk of some chronic health conditions has been explored,[42-44] to date no known studies have examined the use of EHR data for identification of older adults at risk of falls. Given this gap in knowledge, this study examines the utility of importing EHR data into an external clinical information system to systematically identify older patients at risk of falls, incorporating methods for determining the accuracy and completeness of the data, or internal validity. Considering the tendency for important information to be entered into EHRs in free-text or narrative form as opposed to standardized data entry,[45-50] a secondary aim of this study is to use natural language processing methods to assess the potential for and value of finding information related to fall risk in free-text or narrative data in the EHR. Criteria used to identify fall risk reflect current fall prevention guidelines presented in a systematic review of current USPSTF guidelines and a meta-analysis of fall risk factors among community-dwelling older adults.[51,52]

Methods

This study is a nonexperimental retrospective analysis of de-identified EHR data from two primary care center organizations, representing nine physical locations, excluding school-based health centers and dental clinics, partnering with the West Virginia University Office of Health Services Research. Data were gathered using extract, transform, and load (ETL) methodology.[53] Appropriate data were selected and collected for analytical processing using SAP Business Objects.[54] This software is linked with the EHR and allows for querying and data export. Transformation of the data files was performed with a Microsoft Access–based clinical information system.[55] This tool is open-source, public domain software shown effective in previous research analyzing EHR data for diagnostic coding[56] and identifying patients at risk of diabetes.[57] Data were de-identified using the Safe Harbor method of data de-identification.[58] De-identified data were loaded from the Microsoft Access–based clinical information system into JMP Pro version 11.0, which served as the common data repository for analysis. The EHR data were examined for completeness and accuracy, which are measures of internal validity, through descriptive analyses in which JMP Pro was used to calculate percentages of missing, out-of-range, and questionable results for each data element.[59] Natural language processing techniques, based on manual evaluation, were used to examine the potential for obtaining value-added information from free-text or narrative data in the medical record. This was an iterative process in which a series of search terms were successively refined to improve their case-finding ability. With the use of the string handling functions in Microsoft Access Visual Basic for Applications (VBA), pertinent clinical narrative elements suggesting fall risk were identified, extracted, and coded into the same database format as the coded EHR data to retain continuity of the database structure to help ensure that the information could be presented in a way that would be suitable for use by clinicians and researchers.[60] Value added in locating data throughout various parts of the medical record (i.e., structured, semistructured, and

free text) was determined through descriptive analyses examining the percentage of cases missed when accounting for International Classification of Diseases, Ninth Revision (ICD-9) or Current Procedural Terminology (CPT) coding alone. Further, the chi-square test of independence was used to examine the relationship between variables.

Measures

Three categories of modifiable risk factors are associated with falls among older adults: biological, behavioral, and environmental.[61] The primary risk criteria for falls included in this study are biological and behavioral because these data elements are intrinsic to the patient and therefore more apt to be gleaned from EHR data. Criteria used to identify fall risk reflect current fall prevention guidelines presented in a systematic review of current USPSTF guidelines and a meta-analysis of fall risk factors among community-dwelling older adults.[62,63] Key variables of interest were as follows: age greater than or equal to 65 years; female gender; gait or balance impairment; history of falls; fear of falling; vision impairment; hearing impairment; diagnosis of Parkinson's disease; dizziness/vertigo; cognitive impairment; use of a walking aid or device; current prescription for a sedative medication; current prescription for an antiepileptic medication; current prescription for an antihypertensive medication; and polypharmacy (currently taking four or more medications). Appendix A lists the priority factors, the locations in which the data were found, and the coding used to locate the data.

This core set of variables was expanded to include a set of secondary variables based on a literature review of potential fall risk factors. Expanded factors or variables of interest were as follows: race, ethnicity, insurance status, fall assessment, fall guidance, hypertension, hypotension, dementia, osteoporosis, muscle weakness, rheumatoid arthritis, type 1 diabetes, type 2 diabetes, diabetic retinopathy, diabetic neuropathy, epilepsy, height, weight, body mass index (BMI), systolic blood pressure, and diastolic blood pressure. Insurance status was included to account for potential differences among patient groups. Appendix B lists the expanded set of variables, the locations in which the data were found, and the coding used to locate the data.

Results

The data sets from the two primary care organizations included in this study comprised nine unique locations excluding school-based health centers and dental clinics. Among these nine sites, 50,433 unique patients were identified. Of these, 43,531 patients (86.3 percent) were determined to be active on the basis of having at least one documented office visit, service, or laboratory test within three years of the date of data extraction (March 31, 2014). Among the 43,531 active patients, 3,933 patients (9.03 percent) were age 65 and older (see Table 1). This finding is slightly lower than the Uniform Data System result for patients 65 and older for 2013, which is 12.8 percent, yet is comparable to national results, with 7.0 percent of the national patient population age 65 and older.[64]

Table 1: Target Patient Population (Patients Age 65 and Older)

Category	Number	Percentage
Total unduplicated patients	50,433	100
Active patients	43,531	86.3
Active patients age 65 and older	3,933	9.03

Table 2 provides demographic data for the 3,933 patients age 65 and older. While statewide data for patients were sought for comparability, only gender statistics were available for the patient population age 65 years and older (87.9 percent female; 12.1 percent male).[65] Table 2 details patient demographics by age categories, gender, race, ethnicity, and health insurance information. Patients tended to be age 65 to 74 years (62.1 percent) with a mean age of 73.5 years; female (61.3 percent); white (95.7 percent); not Hispanic/Latino (99.1 percent); and insured under Medicare (63.1 percent). Data completeness and quality were strong in that all demographic data were coded consistently, which is likely attributable to standardization in the EHR data selections upon data entry; that is, there were no missing data (i.e., empty cells) across these metrics, only 0.1 percent of patients refused to report race or had race marked as unreported, and only 0.2 percent of patients refused to report ethnicity or had ethnicity marked as unreported.

Table 2: Demographic Data for Patients Age 65 and Older

Category	Number	Percentage
All active patients age 65 and older	3,933	100
Age		
65–74 years	2,443	62.1
75–84 years	1,069	27.2
85 years and older	421	10.7
Gender		
Female	2,411	61.3
Male	1,522	38.7
Race		
American Indian or Alaska Native	1	0.0
Asian	7	0.2
Black or African American	148	3.8
Multiple races	7	0.2
Other Pacific Islander	1	0.0
Unreported/refused to report	4	0.1
White	3,765	95.7
Ethnicity		
Hispanic/Latino	27	0.7
Not Hispanic/Latino	3,899	99.1
Unreported/refused to report	7	0.2
Insurance source		
Medicaid	268	6.8
Medicare	2,482	63.1
Private	1,178	30.0
Public	5	0.1

Note: Only 0.1 percent refused to report race or had race marked as unreported, and only 0.2 percent refused to report ethnicity or had ethnicity marked as unreported.

Table 3 provides data on physical characteristics and vital signs of the 3,933 patients age 65 and older. These data include patient height, weight, BMI, and systolic and diastolic blood pressures. In general, patients tended to be overweight with relatively controlled blood pressure. However, a chi-square test of independence was performed to further examine the relation between age and BMI. The relation between these variables was significant, $\chi^2(1, N = 3{,}607) = 127.3, p < .0001$. Patients age 65 to 84 years were more likely to be overweight or obese than patients 85 years and older. A check on data completeness and quality revealed some issues, with 8.0 percent of patients 65 and older having no documented height in their medical records, 2.9 percent having no documented weight, and 1.3 percent having no documented systolic or diastolic blood pressure readings. The majority of patients with these data missing were in the 65- to 84-year age range (90.1 percent height, 91.1 percent weight, 91.1 percent BMI, 89.3 percent systolic, 89.8 percent diastolic).

Table 3: Data on Physical Characteristics and Vital Signs of Patients Age 65 and Older

Factor	Number of Patients	Percentage of Patients with Missing Data	Mean	Minimum	Maximum	SD
Height (in.)	3,620	8.0	65.4	50	79	3.9

Weight (lb.)	3,818	2.9	178.64	64.6	417.0	42.9
Body mass index	3,607	8.3	29.3	13.8	60.4	6.4
Systolic blood pressure (mm Hg)	3,883	1.3	130.2	72	394	17.9
Diastolic blood pressure (mm Hg)	3,883	1.3	73.9	28	238	10.6

Priority health conditions relating to unintentional falls were identified in a stepwise process using data from multiple areas of the EHR in order to build a data set as complete as possible. These areas are (1) ICD-9 coding; (2) Medcin findings, which are semistructured data; (3) free-text notes; and (4) vital signs related to both high and low blood pressure diagnoses. Table 4 provides data on the value added by searching multiple areas of the medical record data. ICD-9 coding alone missed a minimum of 1.2 percent of cases (diabetes type 2) to a maximum of 98.1 percent of cases (vision impairment), with a median of 39.8 percent of cases missed across all conditions. Looking to multiple areas of the EHR data to identify patients with priority health conditions offers a clear advantage in case finding. Noteworthy, fear of falling, which is one of the priority fall risk metrics, was identified in only 1 patient record (0.02 percent) across all search methods. Likewise, use of a walking aid was identified in only 6 patient records (0.1 percent). Those instances were identified using free-text notes as opposed to coded information. Appendix A provides information on the specific text string used to search for this key word.

Table 4: Counts of Patients by Diagnoses According to Search Criteria

	ICD-9 Coding	Medcin Finding		Notes		Vitals		Unduplicated Count	Percent Missed with ICD-9 Coding Alone	Percent 65+
Condition	Total	Total	Added	Total	Added	Total	Added			
Arthritis	84	99	23	0	0	-	-	107	21.5	2.7
Cognitive impairment	63	65	44	3	3	-	-	110	42.7	2.8
Dementia	142	162	28	5	0	-	-	170	16.5	4.3
Diabetes type 1	106	110	21	0	0	-	-	127	16.5	3.2
Diabetes type 2	1,178	533	12	11	2	-	-	1,192	1.2	30.3
Diabetic neuropathy	41	97	64	2	1	-	-	106	61.3	2.7
Diabetic retinopathy	43	61	22	2	2	-	-	67	35.8	1.7
Dizziness/vertigo	575	0	0	67	39	-	-	614	6.4	15.6
Epilepsy	48	71	41	0	0	-	-	89	46.1	2.3
Essential hypertension	2,400	2,574	340	38	6	224	27	2,773	12.2	70.5
Fear of falling	0	0	0	1	1	-	-	1	--	0.02
Gait/balance impairment	106	149	94	7	4	-	-	204	48.0	5.2
Hearing impairment	214	457	296	9	4	-	-	514	58.4	13.1
History of falls	51	72	37	47	45	-	-	133	61.7	3.4
Hypotension	117	102	2	4	0	74	66	185	36.8	4.7
Muscle weakness	90	261	135	2	2	-	-	227	60.4	5.8
Osteoporosis	466	465	259	27	9	-	-	734	36.5	18.7

Parkinson's disease	23	54	31	1	0	-	-	54	57.4	1.4
Vision impairment	9	460	455	10	6	-	-	470	98.1	12.0

In sum, 238 instances of falls were documented among patients age 65 and older. These falls were documented across 133 unique patients. Falls range from a minimum of one documented fall among 80 patients (60.1 percent) to a maximum of 16 documented falls in one patient (0.7 percent), with a median of one documented fall. Free-text information was especially important in the identification of patients with a history of falls, with 33.8 percent of all cases added through free-text notes. Even with this expanded search method, however, only 133 patients (3.4 percent) had an indication in their medical records of having had an unintentional fall at some point in the past. This is likely a low estimate because one of three adults aged 65 and older nationwide experiences a fall each year, yet less than half of these individuals talk with their healthcare providers about falling.[66] Free-text searches were also developed to identify falls using the derivations "slip," "trip," and "stumble." Only 1 patient record (0.02 percent) had an indication of having stumbled. This notation, however, included no mention of a fall and therefore added no value to the case-finding process. No patient records were identified through searches on the words "slip" or "trip." Appendix B provides information on the specific text strings used to search for these key words.

A recent systematic review of current USPSTF guidelines and a meta-analysis of fall risk factors among community-dwelling older adults[67,68] highlight sedatives, antiepileptic medications, and antihypertensive medications as associated with increased risk of unintentional falls. Further, polypharmacy, defined as currently taking four or more medications,[69,70] is also highlighted as associated with increased risk of unintentional falls. Table 5 provides counts and percentages of active patients age 65 and older that were identified as having current prescriptions for these priority medications or polypharmacy. Data on medications were found in the medications portion of the EHR data only. Polypharmacy was identified in 85 percent of patients 65 and older.

Table 5: Counts of Patients with Select Medications and Polypharmacy

Medication category	Count	Percentage of Patients 65+
Antiepileptic	597	15.2
Antihypertensive	1,750	44.5
Sedative	294	7.5
Polypharmacy	3,343	85.0

Documented fall risk assessments were identified using data from multiple areas of the EHR. These areas are (1) CPT coding, (2) Medcin findings, and (3) free-text notes. Table 6 provides information on the counts of patients with documented fall risk assessments according to each search method, the numbers of patients added in each consecutive data step, the total unduplicated counts, and the prevalence among patients 65 and older. Noteworthy, only 23 patients (0.6 percent) have documentation in their medical records of a fall risk assessment at some point in the past. CPT coding alone missed 26.1 percent of all fall risk assessments. The value added by free-text notes alone is 13.0 percent of all assessments. Further, only two patient records (0.05 percent) indicated that the patient received anticipatory fall guidance at any time. Both of those instances were located in semistructured Medcin findings. Neither of these patients had documentation of a fall. Appendix B provides information on the specific text strings used to search for these metrics.

Measure	CPT Coding	Medcin Finding		Notes		Unduplicated Count	Percent Missed with CPT Coding Alone	Percent of Patients 65+
	Total	Total	Added	Total	Added			
Falls risk assessment	17	20	3	10	3	23	26.1	0.6

Discussion

This study supports the development of a novel methodology for repurposing EHR data to identify older patients at risk of falls for the purpose of early identification of risk and efforts toward prevention. Further, findings from this study draw attention to the need for increased emphasis on fall prevention during routine office visits. Among the 3,933 patients age 65 and older, only 133 patients (3.4 percent) had indication in their medical records of having had an unintentional fall at some point in the past. Searching the free-text data was vital to finding even this low number of patients because 33.8 percent of them were identified using free-text searches. Given the national statistic that falls occur among approximately 40 percent of adults 65 and older,[71] we can be confident that falls are underreported and/or underdocumented in this sample. Likewise, fall risk assessments were sparse, with only 23 patients (0.6 percent) having documentation in their medical records of a fall risk assessment at some point in the past. As with falls, fall risk assessments in the EHR data were largely found in semistructured and free-text data. Searching the CPT coding alone missed 26.1 percent of all fall risk assessments. While this study is based on one EHR system only, the results suggest that thorough accounting for multiple data types when searching for clinical information is important to ensure quality data for population health management, quality of care improvement, and practice-based research. Further, this study points to the need for EHRs to be developed in such a way that a comprehensive set of fall risk metrics can be consistently tracked and reported. A planned approach to systems development would support efforts in quality of care improvement and practice-based research.

This study draws attention to a multifaceted problem with the identification of falls in this sample of outpatient clinics. While low documentation of falls is an issue, this problem is combined with documentation practices that make it difficult to retrieve data that have been recorded. This research highlights a complex problem deserving of targeted quality improvement efforts and practice-based research. Although the Physician Quality Reporting System and the National Quality Forum have focused some attention on reporting of data and benchmarking regarding unintentional falls, the more commonly measured health conditions and metrics, such as diabetes, hypertension, vital signs, and patient demographics, were by far more commonly documented among this sample of clinics. While duration of EHR use may be a factor, all clinics in this study have used EHRs for at least six years.

One primary limitation of this study is that purposive sampling was used to identify primary care organizations for inclusion, thereby decreasing the generalizability of the findings. Second, this study focuses on intrinsic (biologic or behavioral) fall risk factors and not extrinsic, environmental risk factors because of the type of data available through the EHR. Combining data made available from EHRs with data sources offering extrinsic information would be beneficial. Third, this study is subject to limitations in the documentation of EHR data such as miscoding, missing data on falls, and gaps in data due to limited sharing of information from hospitals, physical rehabilitation centers, and other care locations where information on falls may have been recorded.

Conclusion

This expanded use of EHR data demonstrates an opportunity to transform data collected at the time of patient care into knowledge that can be applied to better target services and interventions to patients in need, inform healthcare decisions, and bolster practice-based research.[72] Further, this approach offers the advantage of moving from an acute model of patient-by-patient screening to one of a planned, population-based model of data-driven clinical decision support for the identification of fall risk. The strength of this study is its practical importance to public health: it facilitates the identification of a sector of the patient population at increased risk for falls in a way that is efficient and data-driven, taking into account the healthcare demands of primary care. For EHR data to be most useful not only for identification of the risk of falls but for identification of any health condition or injury, issues of data quality, format, and accessibility need to be addressed.[73] Recognizing the limits of EHR data and developing steps or interventions to improve those data are paramount, not only for health informatics purposes, but for the improvement of patient care and outcomes.

Two additional research efforts are underway in the use of EHR data for fall risk identification. First, research is being completed in the development of a validated EHR data-driven model for identifying older adults at risk of falls. This research builds on that presented in this article, aiming for application of methods to repurpose EHR data for fall risk identification and intervention in the clinical setting. Second, qualitative research into the context of fall risk screening practices in West Virginia primary care centers is underway to better understand facilitators and barriers to screening, EHR documentation practices, and the potential for EHRs to be used as clinical decision support for fall risk identification and ultimately prevention of falls.

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Conflict of Interest

The authors declare no competing financial interests.

Adam Baus, PhD, MA, MPH, is the assistant director of the Office of Health Services Research at West Virginia University School of Public Health in Morgantown, WV.

Keith Zullig, PhD, FASHA, is the chair of the Department of Social and Behavioral Health Sciences at West Virginia University School of Public Health in Morgantown, WV.

Dustin Long, PhD, is an assistant professor in the Department of Biostatistics at West Virginia University School of Public Health in Morgantown, WV.

Charles Mullett, MD, PhD, is an associate professor and section chief of Pediatric Critical Care in the Department of Pediatrics at West Virginia University School of Medicine in Morgantown, WV.

Cecil Pollard, MA, is the director of the Office of Health Services Research at West Virginia University School of Public Health in Morgantown, WV.

Henry Taylor, MD, MPH, is a senior associate in health policy and management at Johns Hopkins Bloomberg School of Public Health in Baltimore, MD.

Jeffrey Coben, MD, is the associate vice president for clinical innovations at West Virginia University School of Public Health in Morgantown, WV.

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Appendix A

Priority Fall Risk Factors, Locations of Data Extraction, and Coding

Factor	Location	Coding
Age ≥65	Demographics	Age categories calculated from date of birth
Cognitive impairment	ICD-9 codes	Cognitive disorder 294.1 - 294.9; Senile dementia 290.0 - 290.3; Vascular dementia 290.4; Dementia with Parkinson's disease 331.82; Mild cognitive impairment 331.83
	Medcin	AGE-RELATED COGNITIVE DECLINE 312268.00; COGNITIVE DISORDER 312247.00; Cognitive Functions Current Level Impaired 203821.00; Cognitive Functions Current Level Impaired Mild 297368.00; Cognitive Functions Current Level Superior 203819.00; Cognitive Functions Current Level Totally Dependent 242551.00; Cognitive Functions Decreased 203809.00; Cognitive Functions Decreased From Premorbid Estimate 203810.00; Cognitive Mini-Mental Status Exam Abnormal 296520.00; LATE CVD EFFECTS - COGNITIVE DEFICITS 98682.00; MILD COGNITIVE IMPAIRMENT 335113.00; No Cognitive Function 8369.00; URINARY INCONTINENCE DUE TO COGNITIVE IMPAIRMENT 313474.00; DEMENTIA 272570.00; DEMENTIA KNOWN (AXIS III) ETIOLOGY WITH BEHAVIOR DISTURBANCE 214080.00; DEMENTIA OF ALZHEIMER'S TYPE 278232.00; DEMENTIA OF ALZHEIMER'S TYPE WITH BEHAVIOR DISTURBANCE 278234.00; DEMENTIA OF ALZHEIMER'S TYPE WITH EARLY ONSET 312241.00; DEMENTIA OF ALZHEIMER'S TYPE WITH LATE ONSET 312242.00; DEMENTIA OF KNOWN (AXIS III) ETIOLOGY 35732.00; DEMENTIA OF UNKNOWN (AXIS III) ETIOLOGY 35733.00; DEMENTIA OF UNKNOWN (AXIS III) ETIOLOGY WITHOUT BEHAVIORAL DISTURBANCE 314928.00; DEMENTIA WITH BEHAVIORAL DISTURBANCE 318503.00; DEMENTIA WITH LEWY BODIES 272878.00; DEMENTIA, PATCHY 350856.00; FRONTOTEMPORAL DEMENTIA 272877.00; HEAD INJURY WITH DEMENTIA WITHOUT BEHAVIORAL DISTURBANCE 312231.00; PARKINSON DISEASE W/ DEMENTIA W/O BEHAVIORAL DISTURBANCE 312237.00; PARKINSON DISEASE WITH DEMENTIA 38397.00; PRESENILE DEMENTIA 312345.00; PRESENILE DEMENTIA UNCOMPLICATED 312420.00; PRESENILE DEMENTIA WITH DELIRIUM 312421.00; PRESENILE DEMENTIA WITH DEPRESSED MOOD 312423.00; SENILE DEMENTIA 312559.00; SENILE DEMENTIA WITH DELUSIONAL FEATURES 312561.00; VASCULAR DEMENTIA 32694.00; VASCULAR DEMENTIA UNCOMPLICATED 38381.00;

		VASCULAR DEMENTIA WITH DELUSIONS 38383.00; VASCULAR DEMENTIA WITH DEPRESSED MOOD 38384.00
	General notes	Like "*Cognitive*" Or Like “*Dementia*” And Not Like "*flexibility*" And Not Like "*anxiety management*" And Not Like "*therapy*" And Not Like "*education*" And Not Like "*average*" And Not Like "*guided practice*" And Not Like "*normal*"
Dizziness-vertigo	ICD-9 codes	Dizziness and giddiness, Light-headedness, Vertigo NOS 780.4; Vertigo 438.85
	Medcin findins	anxiety with dizziness or unsteady feelings 1179.00; BENIGN PAROXYSMAL POSITIONAL VERTIGO 32046.00; BENIGN PAROXYSMAL POSITIONAL VERTIGO BOTH EARS 312213.00; BENIGN PAROXYSMAL POSITIONAL VERTIGO LEFT EAR 312212.00; BENIGN PAROXYSMAL POSITIONAL VERTIGO RIGHT EAR 312211.00; BENIGN PAROXYSMAL VERTIGO OF CHILDHOOD 95303.00; CHLAMYDIAL INFECTIONS EPIDEMIC VERTIGO 97497.00; dizziness 650.00; dizziness episodes are recurrent 654.00; dizziness preceded 281450.00; dizziness preceded by chest pain 281455.00; dizziness preceded by flushing 281460.00; dizziness preceded by nausea 281461.00; dizziness preceded by sudden or severe headache 281451.00; dizziness preceded by sweating 281459.00; dizziness upon bending over 652.00; dizziness upon rolling over 2099.00; dizziness upon standing up 653.00; dizziness upon turning the head 116398.00; dizziness when walking up stairs 2100.00; dizziness while using hands or arms 651.00; headache preceded by everything spinning around (vertigo) 74.00; LATE CVD EFFECTS – VERTIGO 272323.00; PERIPHERAL VERTIGO 98368.00; spinning dizziness (vertigo) 655.00; spinning dizziness after rolling over 282960.00; spinning dizziness after turning the head 282961.00; spinning dizziness caused by noise 2009.00; spinning dizziness upon lying down 656.00; spinning dizziness with sudden changes in position 657.00; VERTIGO 275474.00; VERTIGO AURAL 275475.00; VERTIGO OF CENTRAL ORIGIN 96984.00; VERTIGO OF CENTRAL ORIGIN WITH MALIGNANT POSITIONAL VERTIGO 275478.00; VERTIGO OF CENTRAL ORIGIN WITH POSITIONAL NYSTAGMUS 275477.00; VERTIGO OTOGENIC 275476.00
	General notes	Like "*Dizzi*" Or Like "*Dizzy*" Or Like "*Vertigo*"
Fear of falling	General notes	Like “fall” And Like "*fear*" Or Like "*afraid*" Or Like "*worr*" Or Like "*scare*" Or Like "*fright*" Or Like "*concern*"
Gait/balance impairment	ICD-9 codes	Abnormality of gait 781.2; Difficulty in walking 719.7; Lack of coordination 781.3; Other musculoskeletal symptoms referable to limbs 729.89
	Medcin findings	ATAXIC GAIT 278528.00; Ataxic Gait - Staggering Or Falling To The Right 9038.00; Balance Limited While Shifting Weight 208797.00; difficulty with balance 743.00; DISTURBANCE OF Developing Methods of Repurposing Electronic Health Record Data for Identification of Older Adults at Risk of Unintentional Fall GAIT 278527.00; Gait – Antalgic 66733.00; Gait – Ataxic 9037.00; Gait - Ataxic, Wide-Based 9040.00; Gait – Hemiparetic 11143.00; Gait - Hemiparetic, Left Side 11145.00; Gait - Hemiparetic, Right Side 11144.00; Gait - Insufficient For Exercise Testing 155110.00; Gait – Limping 9036.00; Gait – Scissoring 262002.00; Gait – Shuffling 9800.00; Gait – Spastic 9043.00; Gait - Spastic, Right-Sided 9044.00; Gait – Stooped 240147.00; Gait - Swing Phase Foot Drop Left 8095.00; Gait - Swing Phase Foot Drop Right 8094.00; Gait - Toe Walk 11875.00; Gait - Waddling (Trendelenburg) 9048.00; Limited Balance 132533.00; PARALYTIC GAIT 278529.00; Sensation Romberg's Sign (balance lost without visual clues) 8909.00; SPASTIC GAIT 278530.00; STAGGERING GAIT 278531.00; Tandem Gait Test Off-Balance To Left 261242.00; waddling gait 736.00
	General notes	Like "*Balance*" Or Like "Gait*" And Not Like "*Electrolyte*" And Not Like "*Denies*" And Not Like "*Meal*" And Not Like "*Outstanding*" And Not Like "*previous*" And Not Like "*revious*" And Not Like "*Food*" And Not Like "*Chemical*"

Gender	Demographics	Patient gender: F Female; M Male
Hearing impairment	ICD-9 codes	Hearing loss 389.0 - 389.9
	Medcin findings	CENTRAL HEARING LOSS 37605.00; CONDUCTIVE HEARING LOSS 34074.00; CONDUCTIVE HEARING LOSS BOTH EARS 312207.00; CONDUCTIVE HEARING LOSS LEFT EAR 312206.00; CONDUCTIVE HEARING LOSS RIGHT EAR 312205.00; CONDUCTIVE HEARING LOSS, TYMPANIC MEMBRANE 37599.00; CONGENITAL EAR DEFORMITY CAUSING IMPAIRMENT OF HEARING 211210.00; difficulty hearing over background noise 282644.00; Hearing Difficulties 1002433.00; HEARING LOSS 34076.00; Hearing Loss 6676.00; Hearing Loss Bilaterally 6677.00; Hearing Loss Bilaterally Total 9445.00; Hearing Loss Left Only 6679.00; hearing loss left side only 145.00; Hearing Loss Right Only 6678.00; hearing loss right side only 144.00; Hearing Reception Threshold Whispered Voice Not Heard 155103.00; Hearing Services Hearing Aid Currently Being Worn 4055.00; loss of hearing 141.00; loss of hearing fluctuates 111726.00; loss of hearing for a month or more 1620.00; loss of hearing getting progressively worse 142.00; loss of hearing on both sides 1614.00; loss of hearing on one side only 143.00; loss of hearing which was sudden 111986.00; loss of hearing which was temporary 1619.00; MIXED CONDUCTIVE AND SENSORINEURAL HEARING LOSS 34077.00; NEURAL HEARING LOSS 37604.00; NOISE INDUCED HEARING LOSS 30788.00; Problems With Hearing 1003645.00; Problems With Hearing (on neurological exam) 11760.00; reported hearing problems using hearing aid both ears 127789.00; reported hearing problems using hearing aid right ear 127787.00; SENSORINEURAL HEARING LOSS 34075.00; SENSORINEURAL HEARING LOSS ASYMMETRICAL 311919.00; SENSORINEURAL HEARING LOSS BILATERAL 311925.00; SENSORINEURAL HEARING LOSS LEFT EAR 311924.00; SENSORINEURAL HEARING LOSS OF COMBINED TYPES 37606.00; SENSORINEURAL HEARING LOSS OF COMBINED TYPES BILATERAL 311922.00; SENSORINEURAL HEARING LOSS RIGHT EAR 311923.00; SENSORY HEARING LOSS 37603.00; SENSORY HEARING LOSS BILATERAL 311912.00; SENSORY HEARING LOSS UNILATERAL 312658.00; SPEECH AND LANGUAGE DEVELOPMENTAL DELAY DUE TO HEARING LOSS 312640.00; SUDDEN HEARING LOSS OF UNKNOWN ETIOLOGY 37597.00; total loss of hearing on both sides 1678.00
	General notes	Like "*Hearing*" Or Like "*Hear*" And Not Like "*voices*" And Not Like "*test*" And Not Like "*exam*" And Not Like "*check*" And Not Like "*screen*" And Not Like "*inquiry*" And Not Like “*evaluation*” And Not Like “*black lung*”
History of falls	ICD-9 codes	Accidental fall E880.0 - E888.9; Late effects of accidental fall E929.3; History of fall or at-risk for falling V15.88
	Medcin findings	a fall 4363.00; a fall due to slipping, tripping, or stumbling 124608.00; a fall from a bed 4955.00; a fall from a structure 124407.00; a fall from furniture 120562.00; a fall from stairs 4657.00; a fall into a hole 120194.00; a fall, striking an object 122430.00; Assess/Interv Future Risk Document 2+ Falls In Past Year 303647.00; Ataxic Gait - Staggering Or Falling To The Right 9038.00; fall due to ice and snow 128644.00; fall in shower or empty bathtub 128697.00; fall on same level from slipping, tripping and stumbling 128645.00; INJURY DUE TO UNDETERMINED INTENT FALL 95832.00; INJURY DUE TO UNDETERMINED INTENT FALL HOUSE 212627.00; LATE EFFECTS OF ACCIDENTAL FALL 38136.00
	General notes	Like "*fall*" And Not Like "*asleep*" And Not Like "*this fall at*" And Not Like "*fallen asleep*" And Not Like "*earlier this fall*" And Not Like "*last fall*" And Not Like "*date falls*" And Not Like "*falls on Sun*" And Not Like "*of last fall*" And Not Like "*filling fall*" And Not Like "*in fall*" And Not Like "*hair fall*" And Not Like "*tooth to fall*" And Not Like "*tonsils*" And Not Like "*going to fall*" And Not Like "*cap fall*" And Not Like

		"*fall 20*" And Not Like "*did not fall*" And Not Like "*preschool for fall*" And Not Like "*this falls on*" And Not Like "*fallopian*" And Not Like "*in the fall*" And Not Like "*falls on a weekend*" And Not Like "*falling asleep*" And Not Like "*fall off on the*" And Not Like "*cancer last fall*" And Not Like "*tsh is falling*" And Not Like "*f/p on mobility*" And Not Like "*falling on a week*" And Not Like "*fall season*" And Not Like "*falling apart*" And Not Like "*falls in this dosage*" And Not Like "*falls rsik low*" Or Like "*fell*"
Parkinson's disease	ICD-9 codes	Parkinson's disease 332.0
	Medcin findings	PARKINSON DISEASE 32004.00; PARKINSON DISEASE W/ DEMENTIA W/O BEHAVIORAL DISTURBANCE 312237.00; PARKINSON DISEASE WITH DEMENTIA 38397.00
	General notes	Like "*Parkinson*" And Not Like "*Parkinsonism*" And Not Like "*Parkinsonian*" And Not Like "*Wolff*" And Not Like "*Not Positive*"
Polypharmacy	Medications	Calculated based on current prescriptions for four or more medications
Prescription for antihypertensive	Medications	Accuretic; Aldactazide; Aldoclor; Aldoclor-150; Aldoclor-250; Aldoril 15; Aldoril 25; Aldoril D30; Aldoril D50; Aldoril; Aliskiren; Amiloride; Amlobenz; amlodipine; Amturnide; Apresazide; Atacand HCT; atenolol; atorvastatin; Avalide; azilsartan medoxomil; Azor; benazepril; bendroflumethiazide; Benicar HCT; BiDil; Bisoprolol; Caduet; candesartan; Capozide 25/15; Capozide 25/25; Capozide 50/15; Capozide 50/25; Capozide; captopril; chlorothiazide; Chlorthalidone ; Clorpres; Corzide 40/5; Corzide 80/5; Corzide; Demi-Regroton; deserpidine; Diltiazem; Diovan HCT; Diupres; Diupres-250; Diupres-500; Diuretic Ap-Es; Dutoprol; Dyazide; Edarbyclor; Enalapril; Enduronyl; eprosartan; Esimil; Exforge HCT; Exforge; Felodipine; Fosinopril; guanethidine; hydralazine; Hydrap-ES; Hydra-Zide; hydrochlorothiazide; Hydropres; Hydropres-25; Hydropres-50; Hydroserpine; Hyzaar; Inderide; Irbesartan; Lexxel; Lisinopril; Lopressor HCT; losartan; Lotensin HCT; Lotrel; Maxzide; Maxzide-25; methyldopa; Metoprolol; Micardis HCT; Minizide; Moduretic 5-50; Moduretic; moexipril; Monopril HCT; Nadolol; Olmesartan; polythiazide; Prazosin; Prinzide; propranolol; quinapril; Quinaretic; Regroton; Renese-R; reserpine; Ser-Ap-Es; Serpazide; spironolactone; Tarka; Teczem; Tekamlo; Tekturna HCT; telmisartan; Tenoretic 100; Tenoretic 50; Tenoretic; Teveten HCT; Timolide 10-25; Timolide; Timolol; trandolapril; triamterene; Tribenzor; Tri-Hydroserpine; Twynsta; Uni Serp; Uniretic; valsartan; Valturna; Vaseretic; Vaseretic 10- 25; Vaseretic 5-12.5; Vaseretic; verapamil; Zestoretic; Ziac
Prescription for antiepileptic	Medications	Acetazolamide; Carbamazepine; Carbogen modified release; Clobazam; Clonazepam; Convulex; Desitrend; Diacomit; Diamox SR; Emeside; Epanutin; Epilim; Epilim Chrono; Epilim Chronosphere; Episenta prolonged release; Epival; Eslicarbazepine acetate; Ethosuximide; Frisium; Fycompa; Gabapentin; Gabitril; Inovelon; Keppra; Lacosamide; Lamictal; Lamotrigine; Levetiracetam; Lyrica; Neurontin; Nitrazepam; Nootropil; Oxcarbazepine; Perampanel; Phenobarbital; Phenytoin; Phenytoin Sodium Flynn; Piracetam; Pregabalin; Primidone; Retigabine; Rivotril; Rufinamide; Sabril; Sodium valproate; Stiripentol; Tapclob; Tegretol; Tegretol Prolonged Release; Tiagabine; Topamax; Topiramate;Trileptal; Trobalt; Vigabatrin; Vimpat; Zarontin; Zebinix; Zonegran; Zonisamide
Prescription for sedative	Medications	Adgan; Anergan 50; Antinaus 50; Aquachloral Supprettes; Atarax; Ativan; butabarbital; Butisol Sodium; chloral hydrate; Desyrel Dividose; Desyrel; dexmedetomidine; fentanyl; fospropofol; hydroxyzine; Hyzine; lorazepam; Lorazepam Intensol; Luminal; Lusedra; Mebaral; mephobarbital; Nembutal Sodium Nembutal; pentazocine; pentobarbital; Phenadoz; Phenergan; phenobarbital; Precedex; promethazine; Promethegan; secobarbital; Seconal Sodium; Seconal; Solfoton; Somnote; Sublimaze; Talwin; trazodone; Vistaril
Use of walking aid/device	General notes	Like "*wheeled walker*" Or Like "*wheel walker*" Or Like "*a walker*" Or Like "*using walker*" Or Like "*has walker*" Or Like "*new walker*" Or Like "*requested walker*" Or Like "*of walker*" Or Like "*about walker*" Or Like "*use walker*" Or Like "*uses walker*" Or Like "*give walker*" Or Like "*uses cane*" Or Like "*a cane*" Or Like

		"*has cane*" Or Like "*new cane*" Or Like "*used cane*" Or Like "*for cane*" Or Like "*of cane*" Or Like "*using cane*" Or Like "*requested cane*" Or Like "*give cane*" Or Like "*walking aid*" Or Like "*walking device*"
Vision impairment	ICD-9 codes	Blindness and low vision 369.0 - 369.9
	Medcin findings	BINOCULAR VISION DISORDER 36625.00; blind spot (scotoma) 105.00; blurry vision 113.00; blurry vision as if looking through a glass of water 2016.00; blurry vision binocular 110203.00; blurry vision left 110202.00; blurry vision right 110201.00; COLOR BLINDNESS 30415.00; DAY BLINDNESS 318157.00; foggy vision 111364.00; foggy vision binocular 111367.00; foggy vision right 111365.00; headache preceded by double vision 68.00; headache preceded by loss of all vision in both eyes 66.00; headache preceded by loss of all vision in one eye (anopsia) 65.00; LATE CVD EFFECTS - VISION DISTURBANCES 272320.00; LEGALLY BLIND (USA DEFINITION) 36662.00; LEGALLY BLIND (USA DEFINITION) BOTH EYES 311746.00; LEGALLY BLIND (USA DEFINITION) RIGHT EYE 311744.00; loss of part of field of vision 104.00; ONE EYE: PROFOUND IMPAIRMENT; OTHER EYE: NEAR-NORMAL VISION 92938.00; ONE EYE: TOTAL IMPAIRMENT; OTHER EYE: NORMAL VISION 92933.00; Problems With Sight (on neurological exam) 11759.00; seeing insects at the edge of one's vision 1240.00; total loss of vision 1603.00; total vision loss left 2546.00; total vision loss unilaterally 1604.00; TRAUMATIC BLINDNESS - LEFT EYE 39760.00; Vision Assessment 6577.00; vision distortion 128.00; vision problems 111363.00; VISION SENSITIVITY DEFICIENCY 335352.00; vision worsens during the day 281502.00; Visual Acuity - Cortical Blindness 6592.00; white / light spots in field of vision 111376.00; worsening distance and near vision 111313.00; worsening distance and near vision right 111847.00; worsening distance vision 2904.00; worsening distance vision left 111842.00; worsening distance vision right 111841.00; worsening near vision 2905.00; worsening peripheral vision right 94.00; worsening vision 91.00; worsening vision occurring briefly (for a few minutes) 97.00; worsening vision progressing slowly 98.00; worsening vision right 102.00; worsening vision started suddenly 100.00; worsening vision sustained 111322.00; worsening vision worse in the morning 112172.00
	General notes	Like “*Blind*” Or Like "*Vision Imp*" Or Like "*Impaired Vision*" Or Like "*low vis*" Or Like "*vision*" Or Like "*sight*" And Not Like "*exam*" And Not Like "*milestone*" And Not Like "*guidance*" And Not Like "*supervision*" And Not Like "*oversight*" And Not Like "*religious*" And Not Like "*test*" And Not Like "*provision*" And Not Like "*television*" And Not Like "*insight*" And Not Like *”Revision*” And Not Like "*20/_*" And Not Like "*plus_*" And Not Like "*not obscuring*" And Not Like "*confrontation*"

Appendix B

Expanded Fall Risk Factors, Locations of Data Extraction, and Coding

Factor	Location	Coding
Blood pressure systolic	Vitals	Systolic blood pressure value (mmHG)
Blood pressure diastolic	Vitals	Diastolic blood pressure value (mmHG)
Body mass index	Vitals	Calculated body mass index

Diabetes type 1	ICD-9 codes	Diabetes mellitus type I 250.01; 250.03; 250.11; 250.13; 250.21; 250.23; 250.31; 250.33; 250.41; 250.43
	Medcin findings	DIAB W/ OPHTH MANIFESTATIONS TYPE 1 UNCONTROLLED RIGHT EYE 277991.00; DIABET HYPERGLYC HYPEROSMOLAR NONKETOTIC STATE COMA (TYPE I) 92762.00; DIABETES MELLITUS DIABETIC AUTONOMIC NEUROPATHY TYPE 1 212787.00; DIABETES MELLITUS DIABETIC PERIPHERAL NEUROPATHY TYPE 1 99839.00; DIABETES MELLITUS TYPE 1 30481.00; DIABETES MELLITUS TYPE 1 - UNCONTROLLED 92759.00; DIABETES MELLITUS TYPE 1 WITH COMPLICATION 99851.00; DIABETES MELLITUS TYPE 1 WITH COMPLICATION UNCONTROLLED 99853.00; DIABETES MELLITUS TYPE 1 WITH HYPERGLYCEMIA 315246.00; DIABETES MELLITUS TYPE 1 WITH MANIFESTATIONS 99847.00; DIABETES MELLITUS TYPE 1 WITH MANIFESTATIONS UNCONTROLLED 99848.00; DIABETES MELLITUS TYPE 1 WITH MULTIPLE COMPLICATIONS 351497.00; DIABETES MELLITUS TYPE 1 WITHOUT COMPLICATION 315582.00; DIABETES MELLITUS WITH FOOT ULCER TYPE 1 276336.00; DIABETES MELLITUS WITH FOOT ULCER TYPE 1 UNCONTROLLED 276337.00; DIABETES W/ PERIPH CIRCULATORY DISORDER TYPE 1 UNCONTROLLED 99846.00; DIABETES WITH KETOACIDOSIS TYPE 1 99829.00; DIABETES WITH KETOACIDOSIS TYPE 1 UNCONTROLLED 99830.00; DIABETES WITH NEUROLOGICAL COMPLICATIONS TYPE 1 276312.00; DIABETES WITH OPHTHALMIC MANIFESTATIONS TYPE 1 UNCONTROLLED 276308.00
	General notes	Like "*Diabetes type 1*" Or Like "*DM type 1*" Or Like "*DM type I*" Or Like "*Diabetes type I* *DM-1*" Or Like "*DM1*" Or Like "*Type 1*" Or Like "*Type-1*" Or Like "*DMI*" Or Like "*DM-I*" Or Like "*Type-I*" Or Like "*Type I*" And Not Like “*Blood*” And Not Like “*Herpes*” And Not Like “*Imperfecta*” And Not Like “*Crystal*” And Not Like “*HSV*” And Not Like “*Genitals*” And Not “*type of Medica*” And Not Like “*typed*”
Diabetes type 2	ICD-9 codes	Diabetes mellitus type II 250.00; 250.02; 250.10; 250.12; 250.20; 250.22; 250.30; 250.32; 250.40; 250.42
	Medcin findings	DIAB W/ OPHTH MANIFESTATIONS TYPE 2 UNCONTROLLED BOTH EYES 277987.00; DIAB W/ OPHTH MANIFESTATIONS TYPE 2 UNCONTROLLED LEFT EYE 277986.00; DIAB W/ OPHTH MANIFESTATIONS TYPE 2 UNCONTROLLED RIGHT EYE 277985.00; DIABETES HYPERGLYCEMIC HYPEROSMOLAR NONKETOTIC STATE TYPE 2 99831.00; DIABETES MELLITUS DIABETIC AUTONOMIC NEUROPATHY TYPE 2 212789.00; DIABETES MELLITUS DIABETIC PERIPHERAL NEUROPATHY TYPE 2 99838.00; DIABETES MELLITUS TYPE 2 30480.00; DIABETES MELLITUS TYPE 2 - INSULIN-TREATED, NON-INSULIN DEPENDENT 350143.00; DIABETES MELLITUS TYPE 2 - UNCOMPLICATED, CONTROLLED 273144.00; DIABETES MELLITUS TYPE 2 - UNCOMPLICATED, UNCONTROLLED 92758.00; DIABETES MELLITUS TYPE 2 IN OBESE 350042.00; DIABETES MELLITUS TYPE 2 WITH COMPLICATION 99850.00; DIABETES MELLITUS TYPE 2 WITH COMPLICATION UNCONTROLLED 99852.00; DIABETES MELLITUS TYPE 2 WITH DIABETIC NEUROPATHIC ARTHROPATHY 315290.00; DIABETES MELLITUS TYPE 2 WITH GANGRENE 350059.00; DIABETES MELLITUS TYPE 2 WITH HYPERGLYCEMIA 315291.00; DIABETES MELLITUS TYPE 2 WITH HYPOGLYCEMIA 315292.00; DIABETES MELLITUS TYPE 2 WITH HYPOGLYCEMIA WITH COMA 315293.00; DIABETES MELLITUS TYPE 2 WITH MANIFESTATIONS 276315.00; DIABETES MELLITUS TYPE 2 WITH MANIFESTATIONS UNCONTROLLED 276316.00; DIABETES MELLITUS WITH FOOT ULCER TYPE 2 276338.00; DIABETES MELLITUS WITH FOOT ULCER TYPE 2 UNCONTROLLED 276339.00; DIABETES W/ NEUROLOGICAL COMPLICATIONS TYPE 2 UNCONTROLLED 276311.00;

	General notes	Like "*Diabetes type 2*" Or Like "*DM type 2*" Or Like "*DM type II*" Or Like "*Diabetes type II* *DM-2*" Or Like "*DM2*" Or Like "*Type 2*" Or Like "*Type-2*" Or Like "*DMII*" Or Like "*DM-II*" Or Like "*Type-2*" Or Like "*Type II*" And Not Like "*Blood*" And Not Like "*Herpes*" And Not Like "*Imperfecta*" And Not Like "*Crystal*" And Not Like "*HSV*" And Not Like "*Genitals*" And Not "*type of Medica*" And Not Like "*typed*
Diabetic neuropathy	ICD-9 codes	Diabetic neuropathy 357.2
	Medcin findings	CHRONIC PAINFUL DIABETIC NEUROPATHY 350370.00; DIABETES MELLITUS DIABETIC AUTONOMIC NEUROPATHY 30488.00; DIABETES MELLITUS DIABETIC AUTONOMIC NEUROPATHY TYPE 1 212787.00; DIABETES MELLITUS DIABETIC AUTONOMIC NEUROPATHY TYPE 2 212789.00; DIABETES MELLITUS DIABETIC AUTONOMIC NEUROPATHY UNCONTROLLED 92763.00; DIABETES MELLITUS DIABETIC MONONEUROPATHY SIMPLEX 350044.00; DIABETES MELLITUS DIABETIC PERIPHERAL NEUROPATHY 30487.00; DIABETES MELLITUS DIABETIC PERIPHERAL NEUROPATHY TYPE 1 99839.00; DIABETES MELLITUS DIABETIC PERIPHERAL NEUROPATHY TYPE 2 99838.00; DIABETES MELLITUS SECONDARY WITH DIABETIC NEUROPATHY 315150.00; DIABETES MELLITUS SECONDARY WITH PERIPHERAL NEUROPATHY 313960.00; DIABETES WITH DIABETIC NEUROPATHY 315314.00; DIABETES WITH DIABETIC POLYNEUROPATHY 315316.00; DIABETIC AUTONOMIC NEUROPATHY TYPE 1 UNCONTROLLED 212788.00; DIABETIC AUTONOMIC NEUROPATHY TYPE 2 UNCONTROLLED 212790.00
	General notes	Like "*Neuropathy*" And Like "*Diab*"
Diabetic retinopathy	ICD-9 codes	Diabetic retinopathy 362.01 – 362.07
	Medcin findings	DIABETES MELLITUS SECONDARY WITH DIABETIC RETINOPATHY 315139.00; DIABETES WITH DIABETIC RETINOPATHY 315298.00; DIABETES WITH DIABETIC RETINOPATHY PROLIFERATIVE 315310.00; DIABETIC RETINOPATHY 98355.00; DIABETIC RETINOPATHY NONPROLIFERATIVE 30485.00; DIABETIC RETINOPATHY PREPROLIFERATIVE 277921.00; DIABETIC RETINOPATHY PRE-PROLIFERATIVE BOTH EYES 277924.00; DIABETIC RETINOPATHY PROLIFERATIVE 30486.00; DIABETIC RETINOPATHY RETINAL MICROANEURYSMS BOTH EYES 277966.00; DIABETIC RETINOPATHY TYPE 2 315211.00; RETINOPATHY 212800.00; RETINOPATHY NONPROLIFERATIVE 210147.00; RETINOPATHY NONPROLIFERATIVE BOTH EYES 277903.00; RETINOPATHY NONPROLIFERATIVE LEFT EYE 277902.00; TYPE 2 DIABETES WITH DIABETIC RETINOPATHY 315265.00
	General notes	Like "*Retinopathy*" And Like "*Diab*"
Epilepsy	ICD-9 codes	Epilepsy 345.0 – 345.91; V17.2 other neurological diseases
	Medcin findings	EPILEPSY 313582.00; EPILEPSY AND RECURRENT SEIZURES 31974.00; EPILEPSY GENERALIZED 335635.00; PYKNO-EPILEPSY WITH INTRACTABLE SEIZURE 275268.00; SEIZURE DISORDER GENERALIZED NONCONVULSIVE PYKNO-EPILEPSY 275267.00
	General notes	Like "*epilepsy*"
Essential hypertension	ICD-9 codes	Essential hypertension 401.0 – 401.9
	Medcin findings	ACP Staging Stage 1 Hypertension: 140-159 / 90-99 294917.00; ACP Staging Stage 2 Hypertension: Greater Than Or = 160/100 294918.00; ARTERIOLAR NEPHRITIS WITH HYPERTENSION 275572.00; BENIGN HYPERTENSION 350325.00; ESSENTIAL HYPERTENSION 33291.00; ESSENTIAL HYPERTENSION ACCELERATED 33289.00; ESSENTIAL HYPERTENSION BENIGN 34080.00; ESSENTIAL HYPERTENSION MALIGNANT 33292.00; HYPERTENSION (SYSTEMIC) 33288.00; HYPERTENSION

		(SYSTEMIC) MALIGNANT 350241.00; HYPERTENSION DIASTOLIC ESSENTIAL 33290.00; HYPERTENSION SYSTOLIC 339874.00; HYPERTENSION SYSTOLIC ESSENTIAL 33293.00; SECONDARY HYPERTENSION 39910.00; SECONDARY HYPERTENSION BENIGN 39911.00; SECONDARY HYPERTENSION MALIGNANT 39912.00
	General notes	Like "*HTN*" Or Like "*Hyperten*" Or Like "*High Blood Pressure*" Or Like "*High BP*" Or Like "*Elevated BP*" Or Like "*Elevated Blood Pressure*" And Not Like "*Hypertens heart*" And Not Like "*prehyperten*" And Not Like "*hypertensive heart*" And Not Like "*pregnancy*" And Not Like "*heavy pressure*" And Not Like "*antihypertensive*" And Not Like "*ocular*" And Not Like "*venous*" And Not Like "*eclampsic*" And Not Like "*kidney*" And Not Like "*portal*" And Not Like "*episode*" And Not Like "*intracerbral*" And Not Like "*iatrogenic*" And Not Like "*renal*" And Not Like "*renovascular*" And Not Like "*screening*" And Not Like "*nephrosclerosis*" And Not Like "*pulmonary*" And Not Like "*maternal*" And Not Like "*vascular*"
	Vitals	Patients with last three blood pressure readings consistently greater than or equal to 140/90 mm Hg
Ethnicity	Demographics	Patient ethnicity: Hispanic/Latino; Not Hispanic/Latino
Falls assessment	Medcin findings	PT FALLS ASSESS-DOCD LE1/YR 1101F; PTFALLS ASSESS-DOCD GE2>/YR 1100F
	General notes	Like "*fall*" And Like "*assess*"
Falls guidance	Medcin findings	Anticipatory Guidance: Preventing Falls 71090.00; RN Care: Monitoring Patient on Fall Precautions 76326.00
Height	Vitals	Height (inches)
Hypotension	ICD-9 codes	Hypotension 458
	Medcin findings	CHRONIC HYPOTENSION 38310.00; HYPOTENSION 38480.00; Hypotension 6058.00; HYPOTENSION ORTHOSTATIC 'DELAYED' 213414.00; IATROGENIC HYPOTENSION 38481.00; IATROGENIC HYPOTENSION DRUG-INDUCED 95863.00; ORTHOSTATIC HYPOTENSION 38311.00; Orthostatic Hypotension 6059.00; ORTHOSTATIC HYPOTENSION IDIOPATHIC 30476.00
	General notes	Like "*hypotension*”
	Vitals	Patients with last three blood pressure readings consistently less than or equal to 90/60 mmHG
Insurance status	Demographics	Insurance source: MEDICAID; MEDICARE; PRIVATE INSURANCE; PUBLIC
Muscle weakness	ICD-9 codes	Muscle weakness (generalized) 728.87
	Medcin findings	muscle weakness 281082.00; muscle weakness generalized 282527.00
	General notes	Like “*Muscle*” and Like “*Weakness*” and Not Like “*if muscle*”
Osteoporosis	ICD-9 codes	Osteoporosis 733.0 – 733.09
	Medcin findings	OSTEOPOROSIS 30472.00; OSTEOPOROSIS DISUSE 30474.00; OSTEOPOROSIS DRUG-INDUCED 30475.00; OSTEOPOROSIS IDIOPATHIC 34477.00; OSTEOPOROSIS POSTMENOPAUSAL 30473.00; OSTEOPOROSIS SENILE 37653.00; OSTEOPOROSIS TRANSIENT, HIP 230088.00
	General notes	Like “*Osteoporosis*” and Not Like “*Dexascan normal*” and Not Like “*No osteoporosis*” and Not Like “*prevention of osteoporosis*”
Race	Demographics	AMERICAN INDIAN OR ALASKA NATIVE; ASIAN; BLACK OR AFRICAN AMERICAN; MULTIPLE RACES; NATIVE HAWAIIAN; NATIVE HAWAIIAN OR

		OTHER PACIFIC ISLANDER; OTHER PACIFIC ISLANDER; UNREPORTED/REFUSED TO REPORT; WHITE
Rheumatoid arthritis	ICD-9 codes	Rheumatoid arthritis 714.0
	Medcin findings	INFLAMMATORY MYOPATHY SECONDARY TO RHEUMATOID ARTHRITIS 95358.00; POLYMYOSITIS IN RHEUMATOID ARTHRITIS 91066.00; POLYNEUROPATHY SECONDARY TO RHEUMATOID ARTHRITIS 95335.00; RHEUMATOID ARTHRITIS 31844.00; RHEUMATOID ARTHRITIS ANKLE 230186.00; RHEUMATOID ARTHRITIS ANKLE LEFT 230189.00; RHEUMATOID ARTHRITIS ANKLE LEFT TALONAVICULAR 230190.00; RHEUMATOID ARTHRITIS ANKLE RIGHT 230187.00; RHEUMATOID ARTHRITIS ANKLE RIGHT TALONAVICULAR 230188.00; RHEUMATOID ARTHRITIS FELTY'S SYNDROME 31845.00; RHEUMATOID ARTHRITIS KNEE LEFT 230996.00; RHEUMATOID ARTHRITIS NODULE NECROBIOTIC 33833.00; RHEUMATOID ARTHRITIS RF POSITIVE 279141.00; RHEUMATOID ARTHRITIS WRIST BILATERAL 230993.00
	General notes	Like "*rheumatoid arthritis*" And Not Like "*juvenile*" And Not Like "*screen*" And Not Like "*exam*"
Stumble	General notes	Like "*stumble*”
Slip	General notes	Like "*slip*" and Not Like “*order slip*” and Not Like “*slipped disc*” and Not Like “*slip faxed*” and Not Like “*work slip*” and Not Like “*slippage*” and not like “*needs slip*” and Not Like “*slip given*” and Not Like “*dyslipidemia*” and Not Like “*school slip*” and Not Like “*slip for*” and Not Like “*lab slip*” and Not Like “*packing slip*” and Not Like “*given slip*” and Not Like “*referral slip*” and Not Like “*permission slip*”
Trip	General notes	Like "*trip*" Or Like "*tripped*" And Not Like "*strip*" And Not Like "*amitriptyline*" And Not Like "*triple*" And Not Like "*tripple*" And Not Like "*school trip*" And Not Like "*airplane trip*" And Not Like "*car trip*" And Not Like "*Tripack*" And Not Like "*lipatripsey*" And Not Like "*trip to*" And Not Like "*amitriptylline*" And Not Like "*anitriptyline*" And Not Like "*trips*" And Not Like "*going on a trip*" And Not Like "*planning on a trip*" And Not Like "*amitriptalyine*" And Not Like "*Triplix*" And Not Like "* trip back to*" And Not Like "*Tripak*" And Not Like "*make a trip*" And Not Like "*made a trip*" And Not Like "*making a trip*" And Not Like "*amitriptylline*" And Not Like "*amytriptoline*" And Not Like "*Amytriptyline*" And Not Like "*triptan*" And Not Like "*Amitripytlkine*" And Not Like "*field trip*" And Not Like "*amitriptylene*" And Not Like "*lithotripsy*" And Not Like "*making another*" And Not Like "*make another*" And Not Like "*take a trip*"

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