Applying Comorbidity Measures Using VA and CMS (Medicare/Medicaid) Data

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We dedicate this lecture to the memory of our good friend and colleague, James F. Burgess, Jr., PhD, who died on June 26, 2017.

Jim was a senior investigator at HSR&D's Center for Healthcare Organization and Implementation Research (CHOIR) in Bedford and Boston, and a pillar of scholarship and mentorship in the VA. He made huge impacts at the Boston University School of Public Health and contributed to national and international communities of health services research scientists and educators.

To VIReC, Jim was a great friend—a long-time member of our Steering Committee, an advisor on many topics, and a regular presenter of this cyberseminar. He will truly be missed.
Database & Methods Cyberseminar Series

*Informational seminars to help VA researchers access and use VA databases.*

**Topics**

- Application of VA and non-VA data to research and quality improvement questions
- Limitations of secondary data use
- Resources to support VA data use
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<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>10/3/16</td>
<td>Overview of VA Data &amp; Research Uses</td>
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<tr>
<td>11/7/2016</td>
<td>Requesting Access to VA Data</td>
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<td>12/5/2016</td>
<td>VA Healthcare Utilization</td>
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<td>1/9/2017*</td>
<td>VA Medicare Data (VA/CMS)</td>
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<td>2/6/2017</td>
<td>Measuring &amp; Assessing Outpatient Care</td>
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<td>Pharmacy Data</td>
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<td>7/10/2017</td>
<td>Chart Review Using National EHR Tools</td>
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<td>8/7/2017</td>
<td>Applying Comorbidity Measures Using VA and CMS (Medicare/Medicaid) Data</td>
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<td>9/11/2017</td>
<td>Using CDW Microbiology and Pharmacy Data in Outcomes Research</td>
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FY ‘17 Database & Methods Schedule
First Monday of the month*  | 1:00pm-2:00pm ET

Visit our Education page for more information & registration links.
www.virec.research.va.gov
Database & Methods Cyberseminar Series

Applying Comorbidity Measures Using VA and CMS (Medicare/Medicaid) Data
Today’s objectives

At the end of this session, the participant will be able to:

• Name 4 sources of comorbidity information in VA and CMS data

• Identify 3 common data elements used in measuring comorbidities

• Recognize important measurement issues encountered when using administrative data to assess comorbidities

• Avoid common pitfalls in combining VA and CMS (Medicare/Medicaid) data to assess comorbidities
Agenda

• Background on comorbidity measurement

• Finding comorbidity information in VA and CMS Data

• Using administrative data to assess comorbidities: Important measurement considerations

• Case study: Example of VA Study that used VA and/or Medicare data to construct comorbidities

• Summary

• Additional Resources
Poll Question #1: *What is your role in the VA?*

- Research investigator/PI
- Data manager, analyst, or programmer
- Project coordinator
- Clinical or operations staff
- Other – please describe via the Q&A function
Agenda

• Background on comorbidity measurement

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• Case study: Example of VA Study that used VA and/or Medicare data to construct comorbidities

• Additional Resources
Definition: Comorbidity

- A concomitant but unrelated pathological or disease process\(^1\)
- Several variations on this concept have emerged\(^2\)
- Assuming focal condition, comorbidities are unrelated and specific, separate from health status

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\(^1\) American Heritage Medical Dictionary
Comorbidities

• Can be used to evaluate:
  • Clinical outcomes
  • Resource use (e.g., costs)
  • Quality of care

• “Risk adjustment” and “case mix” terms often used

• May be conceptualized/ operationalized as:
  • Predictor (of direct interest for impact)
  • Covariate/confounder (adjusting for factors not of focus)
  • Moderator (affects the impact of variables of focus)
  • Dependent variable (SOMETIMES is the focus)
For each research question requiring information on comorbidities – Which Role?

- Comparative effectiveness studies
  - Is chemotherapy more effective than radiotherapy in the treatment of endometrial cancer?
- Healthcare disparities
  - Do comorbidities explain race/ethnic disparities in kidney transplants?
- Healthcare quality
  - Are VA patients more likely than those in FFS Medicare to receive recommended screening tests?
- Healthcare costs / Provider productivity
  - Who provides more cost-effective care for diabetes – endocrinologists, nephrologists or general internists?
Sources of Comorbidity Information in Administrative Data

• Workload (VA) or claims (Medicare, Medicaid) data for diagnosis and procedure codes

• Pharmacy data for medications specific to a disease/condition

• Lab data for laboratory results indicating a condition

• Other, e.g., program enrollment records
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• Additional Resources
Administrative Data Sources for Comorbidity Information

- Diagnosis and Procedure Codes
  - VA workload data
    - Corporate Data Warehouse
    - Medical SAS Datasets
    - Non-VA Medical Care (formerly Fee Basis) Files
  - Medicare claims
    - Institutional Standard Analytic Files (SAFs)
    - Non-Institutional SAFs
    - Institutional Stay Level File (MedPAR)
  - Medicaid claims
    - Medicaid Analytic Extract (MAX) Files
Administrative Data Sources for Comorbidity Information (cont’d)

• Medications
  • Pharmacy data
    • e.g., oral hypoglycemics, insulin indicate diabetes
    • VA Pharmacy Benefit Management (PBM), Managerial Cost Accounting (MCA; formerly Decision Support System (DSS)), CDW Pharmacy BCMA and Outpatient data
  • Medicare Part D claims
  • Medicaid Prescription Drug claims
• Laboratory Results
  • MCA Laboratory Results National Data Extract (NDE)
  • CDW LabChem data
    • e.g., elevated glycohemoglobin indicates diabetes
    • Not available in Medicare data
• Other
  • e.g., condition-focused program enrollment
Types of Diagnosis Codes

• ICD-9-CM/ICD-10-CM Diagnosis Codes
  • International Classification of Diseases, Ninth Revision, Clinical Modification
  • Transition to ICD-10 in FY2015 VA data
  • Admitting code - patient’s initial diagnosis at the time of admission
  • Primary/principal codes - conditions chiefly responsible for the visit/admission
  • Secondary codes - conditions affecting services provided
  • Line item code - diagnosis supporting procedure/service on the non-institutional claim

¹ National Center for Health Statistics
Types of Procedure Codes

- ICD-9-CM/ICD-10-CM Procedure Codes
  - Used for inpatient services in VA, institutional inpatient Medicare claims, and inpatient and other services in Medicaid claims

  - Current Procedural Terminology
  - Used for outpatient services in VA
  - Used for inpatient and other services in Medicaid claims

¹AMA CPT Terminology
Types of Procedure Codes (cont’d)

HCPCS (Healthcare Common Procedure Coding System) Codes¹

- Used in Medicare/Medicaid billing
- Level 1: CPT® codes (services & procedures)
- Level 2: Used to identify products, supplies, and services not included in the CPT codes (e.g., ambulance service & durable medical equipment)

¹ Centers for Medicare & Medicaid Services- HCPCS Codes
# VA MedSAS Datasets: Diagnosis and Procedure Codes

<table>
<thead>
<tr>
<th></th>
<th>Principal Admitting Diagnosis Code</th>
<th>Primary Diagnosis Code</th>
<th>Secondary Diagnosis Codes</th>
<th>ICD-9/10 Procedure Codes</th>
<th>CPT Procedure Codes</th>
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Non-VA Medical Care Files: Diagnosis and Procedure Codes

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<th>Discharge Diagnosis Codes</th>
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<th>ICD-9/10 Procedure Codes</th>
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*Beginning FY2009
# Medicare Data: Diagnosis and Procedure Codes

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<th>Admitting Diagnosis Code</th>
<th>Primary Diagnosis Code</th>
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<th>ICD-9/10 Procedure Codes</th>
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<td>Carrier</td>
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<td>DME</td>
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## Medicaid Data: Diagnosis and Procedure Codes

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<th>Principal Diagnosis Code</th>
<th>Secondary Diagnosis Codes</th>
<th>ICD-9/10 Procedure Codes</th>
<th>CPT Procedure Codes</th>
<th>HCPCS Procedure Codes</th>
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<td>Long Term Care</td>
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<td>X</td>
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*Procedure coding system variable (ICD-9, CPT-4, or HCPCS) accompanies the procedure code variables*
Pharmacy Data

Potential value in using pharmacy-based measure versus ICD-based measures

• When diagnosis information is not available
• Stable chronic conditions not occasioning a provider visit (e.g., hypertension, epilepsy)
• Conditions for which the treatment regimen is set and time-limited (e.g., TB)
Agenda

• Background on comorbidity measurement

• Finding comorbidity information in VA and CMS Data

• Using administrative data to assess comorbidities: Important measurement considerations

• Case study: Example of VA Study that used VA and/or Medicare data to construct comorbidities

• Additional Resources
Comorbidities vs. comorbidity burden or summary risk measure

• Are specific conditions of interest?
• Summary measures
  • Provide one number—the score, simplifying the analysis
  • Allows for parsimony in statistical regression models
• Influences data that can be used and conditions to be identified
What conditions or condition groups to capture?

Depends on:

• Population

• Objective (e.g., case-mix adjustment)

• Outcome (e.g., mortality? post-stroke rehab? expenditures?)

• Data availability - inpatient, outpatient, or both
  • (see Klabunde 2000; Wang 2000)
What conditions to capture?

Identify clinician-assigned diagnoses.

- Avoid clinical laboratory, diagnostic imaging (radiology, x-ray), and other ancillary test/service events; DME/prosthetics; telephone encounters

- VA – MCA (formerly DSS) Primary Stop Codes, Berenson-Eggers Type of Service (BETOS) categories, Place of Service codes

- Medicare – DME File, Physician Specialty codes, Claim type code, BETOS, Place of Service codes
Exclude ‘rule-out’ diagnoses

Operational definition: Any diagnosis that does not meet the following criteria\(^1\):

- Appears at least once on a record/claim for inpatient care, or
- Appears on at least two records/claims for outpatient care with visit/claim dates at least 30 days apart
- Most common approach, but could have reasons for doing things differently

\(^1\) Klabunde CN, Harlan LC, Warren JL. Data sources for measuring comorbidity: a comparison of hospital records and Medicare claims for cancer patients. Med Care 2006; 44: 921-28
## Identifying Non-Clinician-Assigned Diagnoses

<table>
<thead>
<tr>
<th>Examples of VA stop codes used to identify records for exclusion</th>
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<tr>
<td>X-ray</td>
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<td>Laboratory</td>
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<td>Telephone</td>
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<table>
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<tr>
<th>Examples of Medicare Provider Specialty codes used to identify claims for exclusion</th>
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<td>Diagnostic radiology</td>
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<td>Mammography screening center</td>
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<tr>
<td>Clinical laboratory</td>
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Measurement time period

- Active diagnoses
- Temporal relationship between comorbidity measurement and outcome measurement
- Anchor
  - Date
  - Event
Special Challenges

• Measuring functional status
• Measuring severity of disease
• Undiagnosed conditions
  • You need to have an encounter with a provider in order to have an identifiable diagnosis
Comorbidity measurement using administrative data

Electronic Health Record (EHR) -- data is tied to healthcare use:

- In VA: no healthcare encounter -> no record generated -> no diagnosis recorded
- Non-VA data sources, other than those in Non-VA Medical Care [formerly Fee Basis], may generate procedure and diagnosis codes not available in VA data
- More frequent use of healthcare -> more opportunities for diagnoses made and recorded
Analytic Strategies in Comorbidity Measurement Using Administrative Data¹

- Ordinal
- Weighting
- Categorical

Commonly Used Comorbidity Measures Using Administrative Data

- Charlson
  - Deyo-Charlson
  - Romano adaptation
- Quan (Charlson and Elixhauser methods – 2005 Medical Care)
- Elixhauser

- HCC/DCG
- RxRisk
- Nosos
- ACG
- Functional Comorbidity Index
- Others
Charlson Comorbidity Index

- Developed to predict mortality
- 19 chronic conditions
- Each has a weight
- Score = sum of weights
- Extended/adapted by Deyo, Romano independently
Charlson vs. Elixhauser (Quan)

- ICD-9-CM and ICD-10 algorithms for Charlson and Elixhauser (Quan version) yielded similar results.

HCC/DCG Method

• Developed to predict costs
• 15,000 ICD-9 diagnosis codes put into
  • 185 buckets of homogeneous conditions
• Homogeneous condition categories (buckets) arranged hierarchically
  • Within single organ system
  • Patients falling into more than one bucket within an organ system assigned to one with highest resource use
• HCC/DCG risk scores calculated
Nosos and CMS V21 Measures

• VA developed tailored solution built off of DXCG (HCC) Risk Solutions model
• CMS V21 based on the CMS 189 HCC Prospective Risk Model
• Nosos1 from Greek for “Chronic Disease” adds VA specific registry and other factors to the CMS V21 model and generates prospective/concurrent models
• Models with SAS datasets² and programs³ available

²SAS datasets available for FY2006-2014 at \vhacdwapp15\RiskScores
³SAS Programs available on VINCI SAS Grid at /data/ops/OPES_CMSHCCV21/nososmacros
Why Nosos?

- VA specific and validated improvements to base CMS V21 model
- Adds VA relevant demographics, including VA priority
- Employs VA Registries (e.g. Spinal Cord Injury, PTSD, Hepatitis C, Transplant, ESRD, Homeless)
- Uses 26 of the 29 PBM Drug Classes (the ones commonly used in VA)
- Employs 46 Rosen psychiatric condition categories
Pharmacy Data
VA Chronic Disease Score

• VA-based version of RxRisk
  • Includes 45 chronic disease categories identified through prescription data

Combining VA and CMS Data to Measure Comorbidities

Main Pitfall: Not using both data sources

• Issues:
  • Differing incentives to record complete information
  • Differing dates-of-service issues may impact measurement time period
    • VA and Medicare inpatient care: exact diagnosis date usually not captured
    • Medicare: some services billed periodically, e.g., home health
  • Differing types of codes used
Importance of Complete Data

Incomplete health status information: Byrne, et al. 2006¹

• Objective: Determine whether all diagnoses and total illness burden of patients who use both the VA and Medicare health care systems can be obtained from examination of data from only one of these systems

• Calculated risk scores using VA only, Medicare only, and both VA and Medicare data

¹ Byrne MM, Kuebeler M, Pietz K, Petersen LA. Effect of using information from only one system for dually eligible health care users. Med Care. 2006;44(8):768-773
Importance of Complete Data

• On average for a given patient who used both VA and Medicare services, more diagnoses were recorded in Medicare (~13–15) than in the VA system (~8) for dual users.

• On average only 2 diagnoses were common to both the VA and Medicare.

• Medicare data alone accounted for approximately 80% of individuals’ total illness burden, and VA data alone captured one-third of the total illness burden (Medicare more severe).

• The ratio of RRSs when calculated using Medicare and VA separately was approximately 2.4.

Byrne et al.(2006)
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• Case study: Example of VA Study that used VA and/or Medicare data to construct comorbidities

• Additional Resources

Complex Comorbidity Clusters in OEF/OIF Veterans
The Polytrauma Clinical Triad and Beyond

Mary Jo V. Pugh, PhD, RN, Erin P. Finley, PhD, MPH†, Laurel A. Copeland, PhD†, Chen-Pin Wang, PhD‡, Polly H. Noel, PhD§, Megan E. Ameran, MPH‡, Helen M. Parsons, PhD, MPH†, Margaret Wells, BA†, Barbara Elizondo, BA† and Jacqueline A. Pugh, MD‡

Background: A growing body of research on US Veterans from Afghanistan and Iraq (Operations Enduring and Iraqi Freedom, and Operation New Dawn (OEF/OIF)) has described the polytrauma clinical triad (PCT); traumatic brain injury (TBI), posttraumatic stress disorder (PTSD), and pain. Extant research has not explored comorbidity clusters in this population more broadly, particularly co-occurring chronic diseases.

Objectives: The aim of the study was to identify comorbidity clusters among diagnoses of deployment-specific (TBI, PTSD, pain) and chronic (eg, hypertension, diabetes) conditions, and to examine the association of these clusters with health care utilization and adverse outcomes.

Sample Design: This was a retrospective cohort study.

Sample: OEF/OIF Veterans who received care in the Veterans Health Administration in fiscal years (FY) 2008-2010.

Note: Comorbidity indicators used in latent class analysis (trying to group or categorize Veterans)

Background: Extant research has not explored comorbidity clusters in OEF/OIF Veterans more broadly, particularly co-occurring chronic diseases.

Objective: To identify comorbidity clusters among diagnoses of deployment-specific and chronic conditions.

Sample: OEF/OIF Veterans who received care in the VHA in FY2008-2010.

- Comorbidity data sources
  - VA MCA <DSS> NDEs
  - Inpatient and Outpatient

- Comorbidity measurement
  - Excluded diagnoses from ancillary care: laboratory, radiology, etc.
  - Used ICD-9-CM codes previously validated for use in administrative data (including Charlson, Elixhauser) to create dichotomous indicators for 32 conditions
Physical/mental health and post deployment conditions examined

- TBI
- Inner Ear
- Hearing
- Vision Problems
- Headache
- Low Back Pain
- Other Pain
- Sleep
- PTSD
- Depression
- Anxiety
- Bipolar Disorder
- Substance Abuse/Dependence
- Cardiac
- Hypertension
- Diabetes
- Obesity
- Osteoarthritis
- Burns
- Amputation
- Spinal Injury
- IBD
- PVD
- CVD
- Seizures
- Cognitive Impairment/Dementia
- Other neurological conditions
- Fatigue
- Schizophrenia
- Other Mental Health
- Rheumatoid Arthritis/Collagen Disease
- Cancer

Results

- 6 Comorbidity clusters (Latent Class Analysis) were identified
  - PCT (Polytrauma Clinical Triad) + Chronic Disease
  - PCT alone
  - Mental Health + Substance Abuse
  - Sleep, Amputation, Chronic Disease
  - Pain, Moderate PTSD
  - Relatively Healthy

Limitation

- Data do not reflect non-VA care or diagnoses received in non-VA settings, probably very significant in this younger population.
Summary

• Selecting the right method always depends on the research questions and the conceptual role of comorbidities affecting your particular study

• There is no one-size-fits-all approach!!!

• You want to consider pros and cons of particular approaches you are considering carefully
Summary

• Make sure you understand the frailty and possible inconsistencies in coding from the data you use…

• So think about the data generating process of your data, does it come solely from the VA (so you have VA registries, e.g.) or are you combining with Medicare or Medicaid data? Why are you using the data you are using?
Session Outline

• Background on comorbidity measurement

• Finding comorbidity information in VA and CMS Data

• Using administrative data to assess comorbidities: Important measurement considerations

• Case study: Example of VA Study that used VA and/or Medicare data to construct comorbidities

• Additional Resources
http://vaww.virec.research.va.gov/Index.htm

VIReC Home
VA/CMS Home
About Us
New Users of VA Data
FAQs
Acronyms
HelpDesk
Report Broken Link

New from VIReC

CDW Health Factor Factbook
Describes tables, columns, and values in the Health Factor Domain.

Geocoded Data
Discover which data sources contain geocoded data.

ICD-10 Implementation
Learn how the ICD-10 code set was implemented in datasets commonly used by VA researchers.

What's in the Literature?

VIReC Resources

Learn about VA data:

• Data Sources
• Data Topics
• Data Tools

VA/CMS Data for Research Project: Data custodian for CMS and USRDS data for VA research.

Factbooks: Describe tables, columns, and values in select CDW Domains.

Research User Guides: Detailed information on select topics.
Measuring Comorbidity Using VA and Medicare Data

Overview

Measures of patient comorbidity are important in every multiple potential uses in research. For example, a dependent variable, predictor, tool for partial risk adjustment criteria for a cohort selection. In general, comorbidity can quantify, and study the complexity of comorbidity data. Researchers can use research question or objective. Researchers can use observational healthcare studies.

Methods for Measuring Comorbidity

Researchers should keep in mind that all measures have strengths and weaknesses. Some measures are inherently incomplete. The most appropriate comorbidity measure for a study will depend on the research question, population of interest, data availability, and researcher's knowledge of comorbidity. Since these measures vary (a) in their definition of comorbid conditions; (b) in the populations and/or outcomes on which they have been validated; (c) the inclusion of exclusions of various disorders (and the weights assigned to them); and (d) other parameters, it is important to evaluate the comorbidity measure under consideration. The following are examples of comorbidity measures.

- Charlson Comorbidity Index
- Elixhauser Comorbidity Index
- Quan Comorbidity Measure
- HCC/DCG Comorbidity Measure
- V21 and Nosos Risk Scores Program
- RxRisk

Data for Assessing Comorbidity

Many data sources contain data that can be used for assessing comorbidity, such as diagnosis and procedure codes, pharmacy and laboratory test data, etc. The following data sources have been used by VA researchers in comorbidity studies. Select a data source from the table below to learn more.

- Corporate Data Warehouse
- Medical SAS Datasets
- Non-VA Medical Care

What's in the Literature?

A Bibliography on Comorbidity Measurement

Calculating a Comorbidity Index for Risk Adjustment Using VA or Medicare Data

Revised comorbidity tutorial
http://vaww.virec.research.va.gov/Index.htm
ICD-10 Implementation

Overview

On October 1, 2015, VA implemented structural changes to include ICD-10 codes in the Veterans Health Information Systems & Technologies Architecture (VistA), which is the origin of data in many VA databases. VA datasets commonly used by the research community have been modified to accommodate these codes.

- Diagnostic and procedural variables within these sources will use the ICD-10 code set.
- ICD-9 codes will remain in datasets prior to October 1, 2015.
- Episodes of care completed before October 1, 2015, used ICD-9 codes.
- Episodes of care that began before and continued after October 1, 2015, used ICD-10 codes.

Impact on VA Datasets

Select a data source for more information on how ICD-10 was implemented.

- Corporate Data Warehouse (CDW)
- Medical SAS Datasets
- Non-VA Medical Care File

Mapping ICD-9 to ICD-10

- Centers for Medicare and Medicaid Services (CMS) provides General Equivalence Mappings (GEMS) and guidance, including GEM frequently asked questions.
- VIREC provides a SAS Program for Mapping ICD-9 to ICD-10. Follow the CMS GEMS guide for variables description.
Cyberseminars and Technical Report

Tutorial providing step-by-step guidance on constructing a comorbidity index


Risk Adjustment for Cost Analyses: The Development and Implementation of a New System (HERC Cyberseminar)

Risk Adjustment: Guide to the V21 and Nosos Risk Score Programs
http://www.herc.research.va.gov/include/page.asp?id=technical-report-risk-adjustment (HERC Website)
VIReC Options for Specific Questions

**HSRData Listserv**
- Community knowledge sharing
- ~1,200 VA data users
- Researchers, operations, data stewards, managers

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