Database & Methods Cyberseminar Series

Session #11. *Applying Comorbidity Measures Using VA and CMS (Medicare/Medicaid) Data*
This session is dedicated to

James F. Burgess, Jr., PhD
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
Session roadmap

• Background on comorbidity measurement
• Finding comorbidity information in VA & 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
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Definition: Comorbidity

- A concomitant but unrelated pathological or disease process¹
- Several variations on this concept have emerged²
- Assuming focal condition, comorbidities are unrelated and specific, separate from health status

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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- **Finding comorbidity information in VA & 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
Types of Comorbidity Information Available in Commonly Used Datasets (Examples)

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
Types of Comorbidity Information Available in Commonly Used Datasets (Examples)

**Medications**
- 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**
- e.g., elevated glycohemoglobin indicates diabetes
- MCA Laboratory Results National Data Extract (NDE)
- CDW LabChem data
Types of Diagnosis Codes

- ICD-9-CM/ICD-10-CM Diagnosis Codes
  - International Classification of Diseases, Ninth Revision, Clinical Modification
  - Medicare and Medicaid transitioned to ICD-10 October 1, 2015 (beginning of FY16)
  - 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
  • Used for inpatient and other services in Medicaid claims
• AMA Current Procedural Terminology (CPT®)¹
  • Current Procedural Terminology
  • Used for outpatient services in VA

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: https://www.cms.gov/Medicare/Coding/MedHCPCSGenInfo/index.html
## VA MedSAS Datasets: Diagnosis & 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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<tbody>
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<td>Outpatient Visit</td>
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09/2018
## VA CDW Datasets: Diagnosis & Procedure Codes

<table>
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<td>InpatientCPTProcedure</td>
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<td>FeeServiceProvided</td>
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## Non-VA Medical Care Files: Diagnosis & Procedure Codes

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

<table>
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<th></th>
<th>Admitting Diagnosis Code</th>
<th>Primary Diagnosis Code</th>
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<td>Hospice</td>
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<td>Home Health</td>
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<td>Carrier</td>
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<td>X</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>X*</td>
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<td>Inpatient</td>
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<td>X</td>
<td>X*</td>
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<tr>
<td>Long Term Care</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

*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)
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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)
Carefully Consider Inclusion and Exclusion criteria

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 criteria¹:

- 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

### Identifying Non-Clinician-Assigned Diagnoses

<table>
<thead>
<tr>
<th>Example</th>
<th>Code</th>
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<tbody>
<tr>
<td>X-ray</td>
<td>105</td>
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<tr>
<td>Laboratory</td>
<td>108</td>
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<tr>
<td>Diagnostic radiology</td>
<td>30</td>
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<tr>
<td>Mammography screening center</td>
<td>45</td>
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<tr>
<td>Clinical laboratory</td>
<td>69</td>
</tr>
</tbody>
</table>
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 Data

• 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 datasets\(^2\) and programs\(^3\) available

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\(^2\) SAS datasets available for FY2006-2014 at \\vhacdwapp15\RiskScores

\(^3\) SAS 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. 2006

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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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.

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

- 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

09/2018

**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.
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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?
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Measuring Comorbidity Using VA and Medicare Data

Overview

Measures of patient comorbidity are important in evaluating the potential uses in research. For example, a confounding variable, predictor, or outcome for many risk and criterion for a cohort selection. In general, comorbidity can be assessed, studied, and analyzed by selected outcomes, risk factors, and other risk factors. Researchers can use a variety of measures, such as age, sex, race, and ethnicity, along with existing comorbidity measures to assess the relevance of various healthcare studies.

Methods for Measuring Comorbidity

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

+ Expand All

- 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

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<tr>
<th>HSRData Listserv</th>
<th>HelpDesk</th>
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<tbody>
<tr>
<td>• Community knowledge sharing</td>
<td>• Individualized support</td>
</tr>
<tr>
<td>• ~1,360 VA data users</td>
<td><a href="mailto:virec@va.gov">virec@va.gov</a></td>
</tr>
<tr>
<td>• Researchers, operations, data stewards, managers</td>
<td>(708) 202-2413</td>
</tr>
<tr>
<td>• Subscribe by visiting</td>
<td></td>
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<tr>
<td><a href="http://vaww.virec.research.va.gov/Support/HSRData-L.htm">http://vaww.virec.research.va.gov/Support/HSRData-L.htm</a> (VA Intranet)</td>
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Quick links for VA data resources

- **Quick Guide: Resources for Using VA Data**

- **VIReC**: [http://vaww.virec.research.va.gov/Index.htm](http://vaww.virec.research.va.gov/Index.htm) (VA Intranet)


- **CDW**: [https://vaww.cdw.va.gov/Pages/CDWHome.aspx](https://vaww.cdw.va.gov/Pages/CDWHome.aspx) (VA Intranet)

- **Archived cyberseminar: What can the HSR&D Resource Centers do for you?**
Contact information

Denise M. Hynes, MPH, PhD, RN
Denise.Hynes@va.gov
Next session:
October 1, 2018 @1 pm Eastern

Database & Methods Cyberseminar Series

Overview of VA Data, Information Systems, National Databases and Research Uses

Maria Souden, MSI, PhD
Acting Director
VA Information Resource Center