

VIReC Database & Methods Cyberseminar Series

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

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**Presented by:**

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# Session 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 using VA and CMS (Medicare/Medicaid) data together to assess comorbidities

# Roadmap

## **This session will:**

- Focus on use of VA and CMS data to obtain information for comorbidity measurement
- Build on previous seminars, e.g.,
  - *Clinical Epidemiology Research using National MCA and CDW Laboratory Data: Perspectives from the Frontline*
  - *Assessing Race and Ethnicity*
  - *Examining Veterans' Pharmacy Use with VA and Medicare Pharmacy Data*

# Roadmap

## **This session will not:**

- Discuss theoretical or statistical issues related to accounting for comorbidities in health research
- Examine in detail specific comorbidity indices or scales

# Session Outline

- Overview
- 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
- Where to Go for More Help

# Poll Question #1

**I am interested in VA data primarily due to my role as:**

- Research investigator
- Data manager
- Project coordinator
- Program specialist or analyst
- Other (specify)

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# Comorbidity

- A concomitant but unrelated pathological or disease process<sup>1</sup>
- Several variations on this concept have emerged<sup>2</sup>
- Assuming focal condition, comorbidities are unrelated and specific, separate from health status

<sup>1</sup>American Heritage Medical Dictionary

<sup>2</sup>Valderas, JM, Starfield, B, Sibbald, B, et al., Defining Comorbidity: Implications for Understanding Health and Health Services. *Ann Fam Med.* 2009 July; 7(4): 357–363.



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# Comorbidities

- Important component in evaluating
  - 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

## Poll Question #2:

**Rate your experience with using administrative data to capture comorbidities.**

- Novice
- Some experience
- Expert

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# 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))
    - Medicare Part D claims
    - Medicaid Prescription Drug claims

- Laboratory Results

- MCA Laboratory Results National Data Extract (NDE)
    - 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<sup>1</sup>
  - International Classification of Diseases, Ninth Revision, Clinical Modification
  - Move to ICD-10
  - 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

# 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
- CPT<sup>®</sup> Procedure Codes (AMA control)<sup>1</sup>
  - Current Procedural Terminology
  - Used for outpatient services in VA
  - Used for inpatient and other services in Medicaid claims



<sup>1</sup> <http://www.ama-assn.org/ama/pub/physician-resources/solutions-managing-your-practice/coding-billing-insurance/cpt.shtml>

# Types of Procedure Codes (cont'd)

- HCPCS (Healthcare Common Procedure Coding System) Codes<sup>1</sup>
  - Used in Medicare/Medicaid billing
  - Level 1: CPT<sup>®</sup> 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)

<sup>1</sup> <http://www.cms.gov/Medicare/Coding/MedHCPCSGenInfo/index.html>



# VA MedSAS Datasets: Diagnosis and Procedure Codes

|                      | Principal Admitting Diagnosis Code | Primary Diagnosis Code | Secondary Diagnosis Codes | ICD-9/10 Procedure Codes | CPT Procedure Codes |
|----------------------|------------------------------------|------------------------|---------------------------|--------------------------|---------------------|
| Inpatient Main       | X                                  | X                      | X                         |                          |                     |
| Inpatient Bedsection | X                                  | X                      | X                         |                          |                     |
| Inpatient Procedure  | X                                  | X                      |                           | X                        |                     |
| Inpatient Surgery    | X                                  | X                      |                           | X                        |                     |
| Outpatient Visit     |                                    |                        |                           |                          |                     |
| Outpatient Event     |                                    | X                      | X                         |                          | X                   |
| Inpatient Encounters |                                    | X                      | X                         | X                        | X                   |

## Non-VA Medical Care Files: Diagnosis and Procedure Codes

|                                | <b>Discharge<br/>Diagnosis<br/>Codes</b> | <b>Secondary<br/>Diagnosis<br/>Codes</b> | <b>ICD-9/10<br/>Procedure<br/>Codes</b> | <b>CPT<br/>Procedure<br/>Codes</b> |
|--------------------------------|--|--|---|------------------------------------|
| <b>Inpatient</b>               | X  | X  | X                                       |                                    |
| <b>Inpatient<br/>Ancillary</b> | X*                                       |  |   | X                                  |
| <b>Outpatient</b>              | X  |  |   | X                                  |

\*Beginning FY2009

## Medicare Data: Diagnosis and Procedure Codes

|                    | <b>Admitting<br/>Diagnosis<br/>Code</b> | <b>Primary<br/>Diagnosis<br/>Code</b> | <b>Secondary<br/>Diagnosis<br/>Codes</b> | <b>ICD-9/10<br/>Procedure<br/>Codes</b> | <b>HCPCS<br/>Procedure<br/>Codes</b> |
|--------------------|---|---------------------------------------|--|---|--------------------------------------|
| <b>MedPAR</b>      | X                                       |                                       | X  | X                                       |                                      |
| <b>Inpatient</b>   | X                                       |                                       | X  | X                                       | X                                    |
| <b>SNF</b>         | X                                       |                                       | X  | X                                       | X                                    |
| <b>Outpatient</b>  |   | X                                     | X  |   | X                                    |
| <b>Hospice</b>     |   | X                                     | X  | X                                       | X                                    |
| <b>Home Health</b> |   | X                                     | X  |   | X                                    |
| <b>Carrier</b>     |   | X                                     | X  |   | X                                    |
| <b>DME</b>         |   | X                                     | X  |   | X                                    |

## Medicaid Data: Diagnosis and Procedure Codes

|                           | Principal<br>Diagnosis<br>Code | Secondary<br>Diagnosis<br>Codes | ICD-9/10<br>Procedure<br>Codes | CPT<br>Procedure<br>Codes | HCPCS<br>Procedure<br>Codes |
|---------------------------|--------------------------------|---------------------------------|--------------------------------|---------------------------|-----------------------------|
| <b>Other<br/>Services</b> | X                              | X                               | X*                             | X*                        | X*                          |
| <b>Inpatient</b>          | X                              | X                               | X*                             | X*                        | X*                          |
| <b>Long Term<br/>Care</b> | X                              | X                               |                                |                           |                             |

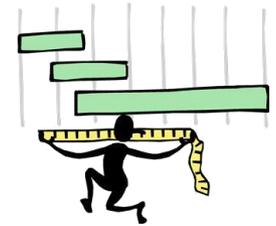
\*Procedure coding system variable (ICD-9, CPT-4, or HCPCS) accompanies the procedure code variables

# 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)



# Session Outline



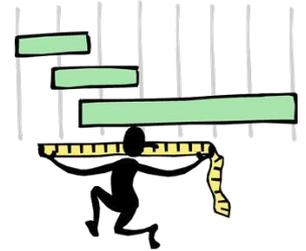
- Overview
- Finding Comorbidity Information in VA and CMS Data
- **Important Measurement Considerations When Using Administrative Data to Assess Comorbidities**
- Case Study: Example of VA Study that Used VA and/or Medicare Data to Construct Comorbidities
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# 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
  - (e.g., 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
- 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<sup>1</sup>

- 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

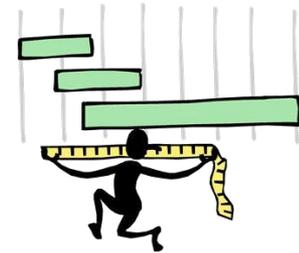
<sup>1</sup> Klabunde CN, Harlan LC, Warren JL. Data sources for measuring comorbidity: a comparison of hospital records and Medicare claims for cancer patients. *Med Care* 2006; 44: 921-28

# Identifying Non-Clinician-Assigned Diagnoses



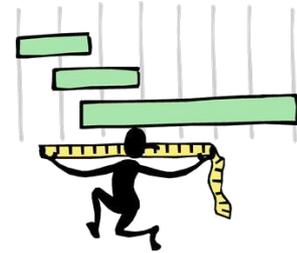
- Examples of VA Stop Codes used to identify records for exclusion
  - X-ray 105
  - Laboratory 108
  - Telephone 103, 147, 178 (and others)
- Examples of Medicare Provider Specialty codes used to identify claims for exclusion
  - Diagnostic radiology 30
  - Mammography screening center 45
  - Clinical laboratory 69

# Measurement time period



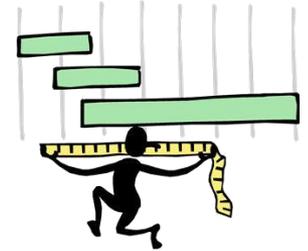
- Active diagnoses
- Temporal relationship between comorbidity measurement and outcome measurement
- Anchor
  - Date
  - Event

# 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

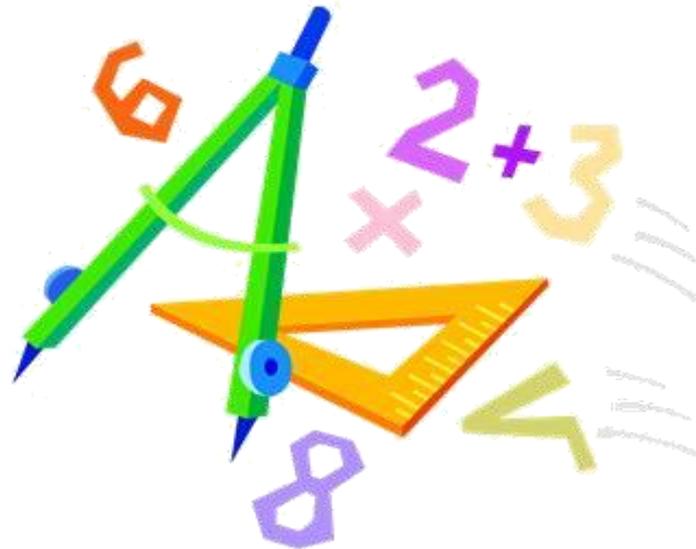


i.e., electronic health record -- data is tied to healthcare use

- 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<sup>1</sup>

- Ordinal
- Weighting
- Categorical



<sup>1</sup> Lash TL, Mor V, Wieland D, Ferrucci L, Satariano W, Silliman RA. Methodology, design, and analytic techniques to address measurement of comorbid disease. *J Gerontol A Biol Sci Med Sci.* 2007;62(3):281-285.

# 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
- Quan, Hude, Vijaya Sundararajan, Patricia Halfon, Andrew Fong, Bernard Burnand, Jean-Christophe Luthi, L. Duncan Saunders, Cynthia A. Beck, Thomas E. Feasby, and William A. Ghali. "Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data." *Medical Care* (2005): 1130-1139

# 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 D<sub>x</sub>CG (HCC) Risk Solutions model
- CMS V21 based on the CMS 189 HCC Prospective Risk Model
- Nosos<sup>1</sup> 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<sup>2</sup> and programs<sup>3</sup> available

<sup>1</sup>See: Todd Wagner, presentation, *Risk Adjustment for Cost Analyses: Development and Implementation of the V21 and Nosos Systems* February 18, 2015 HERC Health Economics Seminar

<sup>2</sup>SAS datasets available for FY2006-2014 at \\vhacdwap15\RiskScores

<sup>3</sup>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



See Sloan KL, et al. Construction and characteristics of RxRisk-V: a VA-adapted pharmacy-based case-mix instrument. *Med Care* 2003; 41(6): 761-74

# 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<sup>1</sup>  
*Effect of using information from only one system for dually eligible health care users*

- **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

<sup>1</sup> 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



## Byrne, et al., 2006

- 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.

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## Case Study: Pugh, et al. (2014)

**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

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

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

# Case Study: Pugh, et al. (2014)

## Comorbidity data sources

- VA MCA <DSS> NDEs
- Inpatient and Outpatient

## Comorbidity measurement

- Measurement period: FY2008-2009
- 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

# Case Study: Pugh, et al. (2014)

## 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

# Case Study: Pugh, et al. (2014)

- 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
- 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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# Comorbidity Resources

- Tutorial providing step-by-step guidance on constructing a comorbidity index
  - <http://vaww.virec.research.va.gov/Tutorials/CALC-CCI/Tutorial-CALC-CCI-CY15.pdf> (VA Intranet only)
- “Risk Adjustment for Cost Analyses: The Development and Implementation of a New System” (HERC Cyberseminar)
  - [http://www.hsrdr.research.va.gov/for\\_researchers/cyber\\_seminars/archives/video\\_archive.cfm?SessionID=933](http://www.hsrdr.research.va.gov/for_researchers/cyber_seminars/archives/video_archive.cfm?SessionID=933)
- 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)
- ICD-10 Transition
  - <http://vaww.virec.research.va.gov/ICD-10/Overview.htm> (VA Intranet only)

# VIReC Resources

- VIReC Website
  - <http://vaww.virec.research.va.gov> (VA Intranet only)
  - Provides Information on VA data sources and how to access data
  - Documentation on most commonly used VA datasets, i.e., Medical SAS Datasets, MCA Clinical National Data Extracts, CDW, and VA/CMS Data available through VIReC
- HSRData Listserv
  - Join at the VIReC Website
  - Discussion among >1140 data stewards, managers, and users
  - Past messages in archive (VA Intranet)
- VIReC HelpDesk
  - VIReC staff will answer your question and/or direct you to available resources on topics
  - [VIReC@va.gov](mailto:VIReC@va.gov)
  - (708) 202-2413

# Questions?