NIA IMPACT COLLABORATORY
TRANSFORMING DEMENTIA CARE

Health-generated Data to Identify People Living with Dementia for IMPACT

*(**I**mbedded **P**ragmatic **A**lzheimer's and other Dementia **C**linical **T**rials)*

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Housekeeping

- All participants will be muted
- Enter **all questions** in the Zoom **Q&A/chat box** and send to Everyone
- Moderator will review questions from chat box and ask them at the end
- Want to continue the discussion? Associated podcast released about 2 weeks after Grand Rounds
- Visit impactcollaboratory.org
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Learning Objectives

Upon completion of this presentation, you should be able to:

- Understand the use of data to achieve pragmatic study aims
- Identify strengths & challenges when using Healthcare-generated data (billing or electronic health record data) for participant identification
- Identify threats to Health Equity and Generalizability related to choices about data use

Pragmatic vs. Explanatory Trials

"***Pragmatic*** randomized trial is undertaken in the "real world" and with usual care and is intended to help support a decision on whether to deliver an intervention."

"***Explanatory*** randomized trial is undertaken in an idealized setting, to give the initiative under evaluation its best chance to demonstrate beneficial effect."

What does this distinction mean for what and how data is used in a trial?

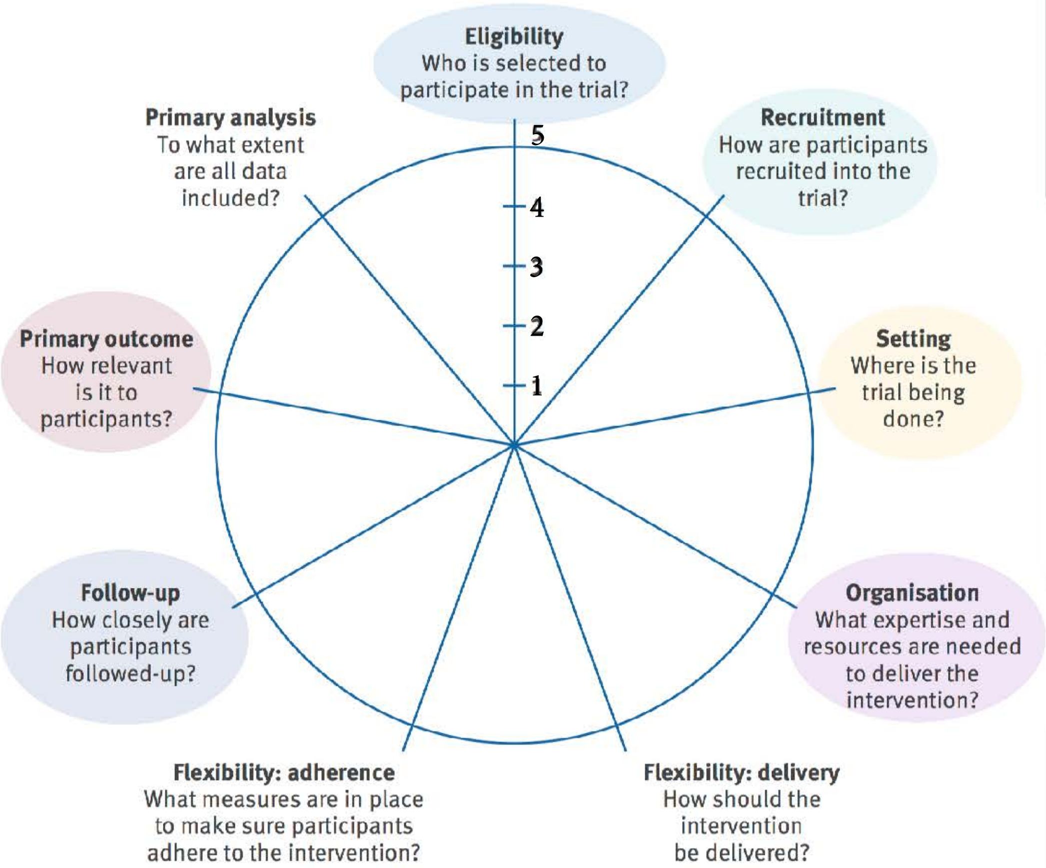
Loudon et al. PRECIS-2 Tool. BMJ 2015.

PRagmatic Explanatory Continuum Indicator Summary-2 Tool (PRECIS-2 Tool)

Eligibility: Who is selected to participate in the trial?

Primary outcome: How relevant is it to participants?

Follow-up: How closely are participants followed-up?



Recruitment: How are participants recruited into the trial?

Setting: Where is the trial being done?

Organization: What expertise and resources are needed to deliver the intervention?

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Loudon et al. PRECIS-2 Tool. BMJ 2015.

Healthcare-Generated Data

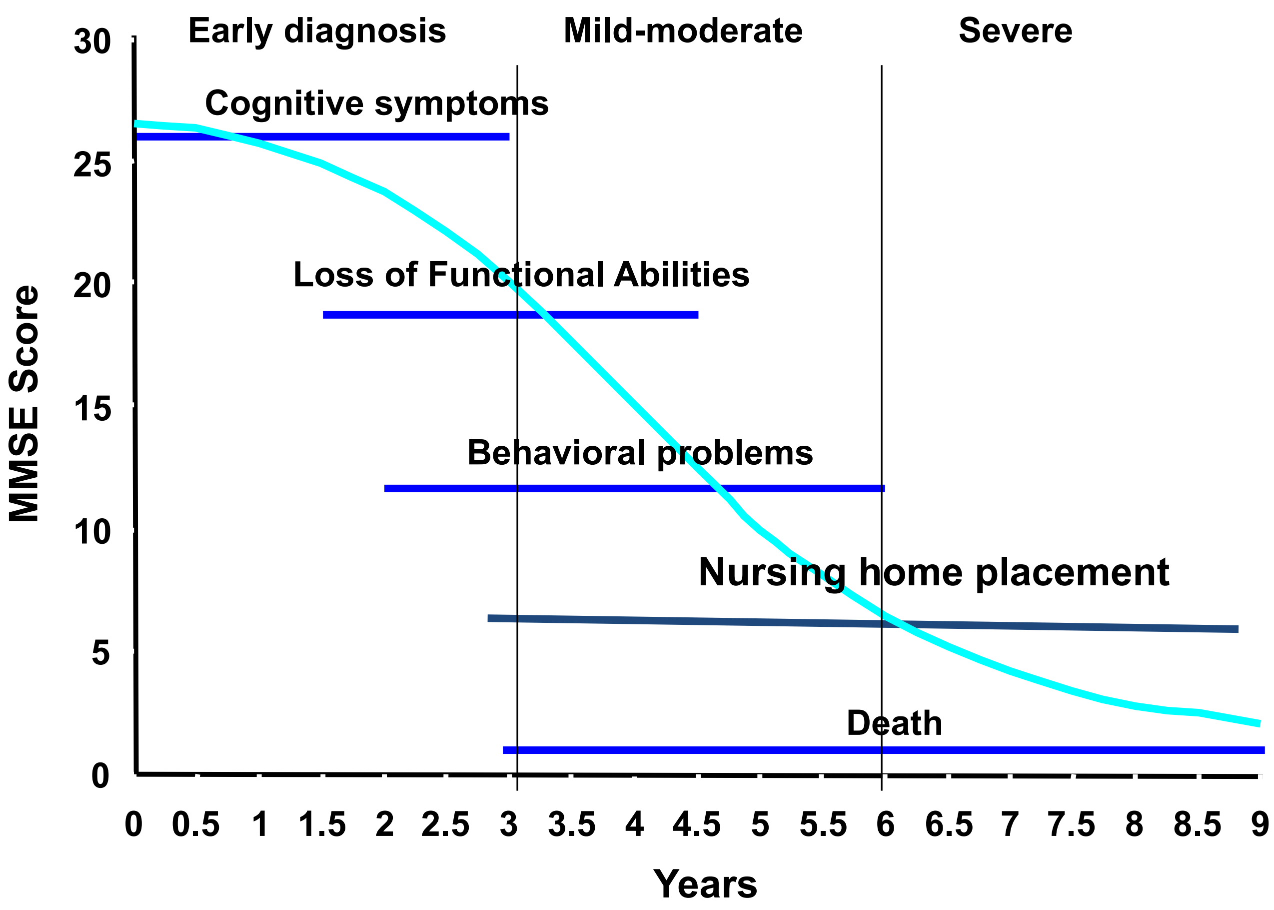
Data collected in the process of health care service delivery for payment or clinical record:

- ✓Medicare Fee-for-Service (CMS)
- ✓Medicare Advantage (CMS)
- ✓Commercial Insurance (OPTUM, Sentinel/DRN, other payers)
- ✓Medicaid (CMS, state)
- ✓Minimum Dataset/OASIS (CMS)
- ✓Electronic Health Record

Eligibility: *Who is your target population?*

What is meant by People Living with dementia?

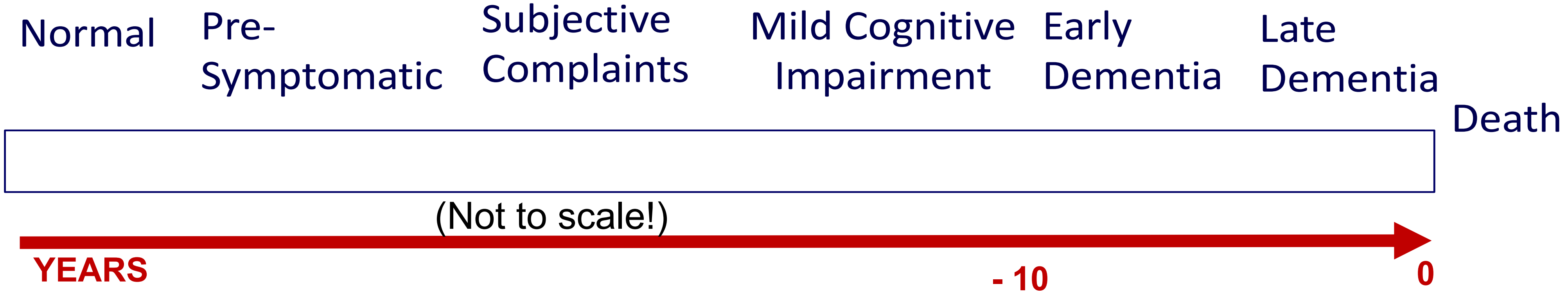
People living with an acquired syndrome of memory loss and other cognitive abilities serious enough to interfere with daily life.



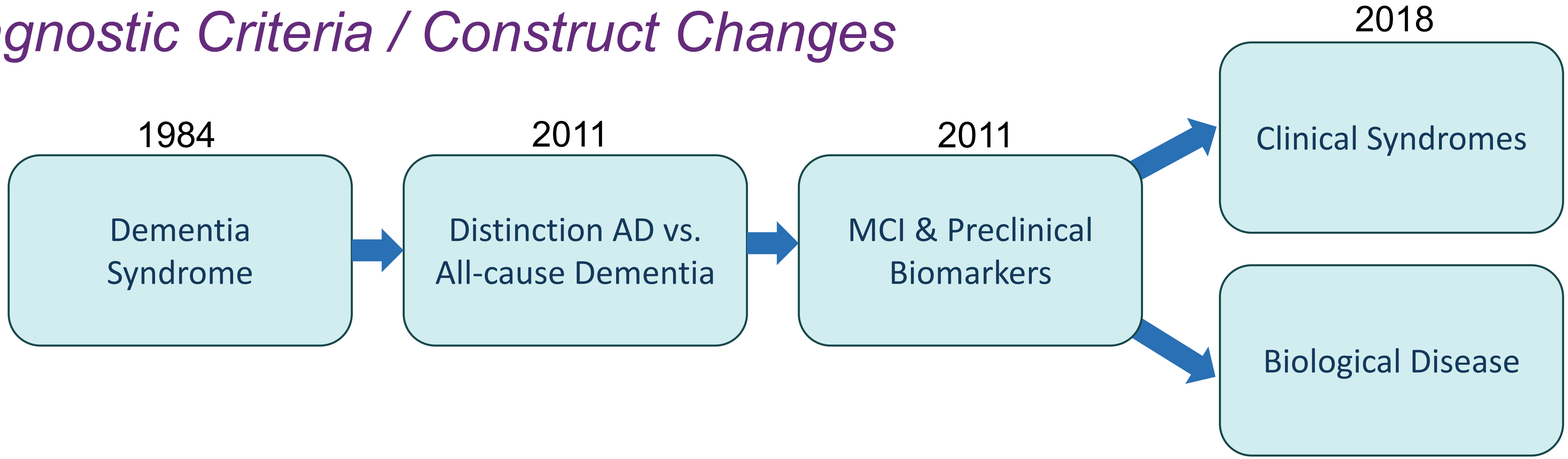
Feldman, H, Gracon S. In: *Clinical Diagnosis and Management of Alzheimer's Disease*. 1996: 239-253

TODAY: Conceptualization of Disease has changed over time

A. *Earlier Stages Now Recognized*



B. *Diagnostic Criteria / Construct Changes*



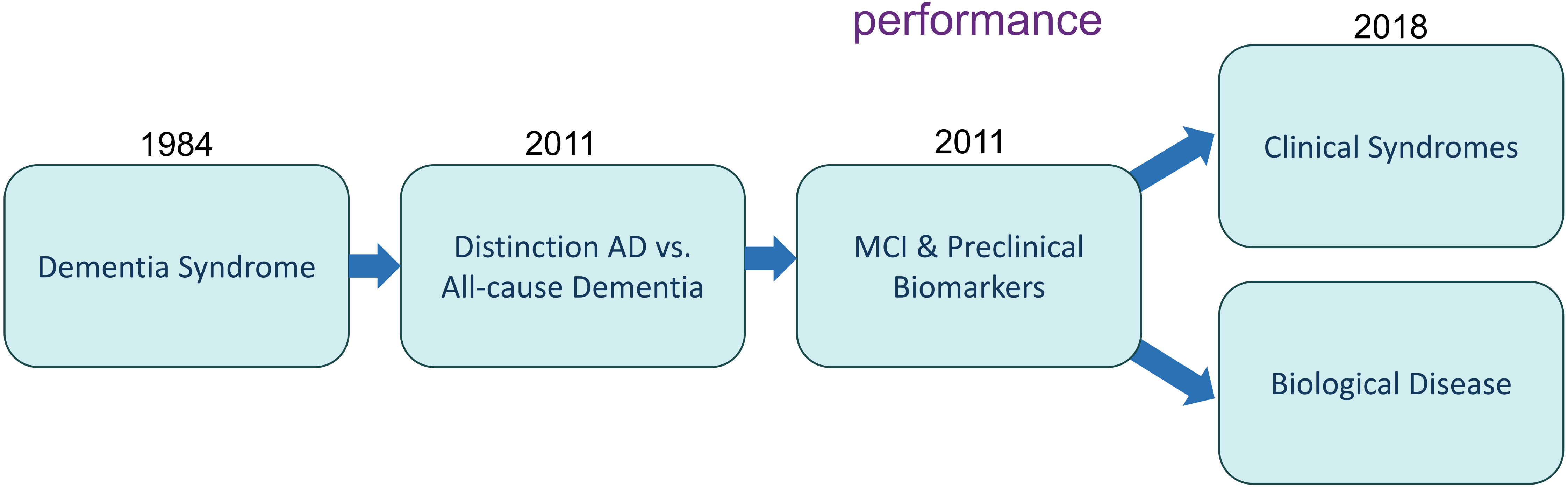
Target Disease Construct Determines Data Need

Measures Cognitive & Functional Performance

Clinical Evaluation for Cause

Measures of Cognition or neuropath & functional performance

Distinction of Biological Disease & Clinical Syndrome



Eligibility: *Considerations for Target Population*

- Does type of dementia matter?
  - Alzheimer's Disease
  - Vascular Dementia
  - Frontotemporal Dementia
  - Lewy Body Disease
  - Mixed forms

- Does severity/stage matter?
- Does presence of behavioral symptoms matter?
- Does whether cognitive impairment is due to a dementia matter?

What data elements are needed to identify your target population?

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Recruitment: *How will participants be identified?*

Traditional Approach:

- One-by-One referral/volunteer
- Study Staff Collect Detailed Information

Pragmatic Approach:

- Using existing data
- Often randomize by site rather than individual participant

?

How can the approach can be scalable to hundreds of sites for purposes of the study?

*****

What information will be available to use in ”real world” when intervention is embedded into usual care?

<u>Setting</u>: *Where will the intervention occur?*

- Hospital
- Emergency Room
- Nursing home
- Area Agency on Aging
- Home Care Agencies
- Clinic - primary care, specialty

What data sources already exist in the setting?

Does the data strategy integrate into the workflow, or will it require changing the workflow?

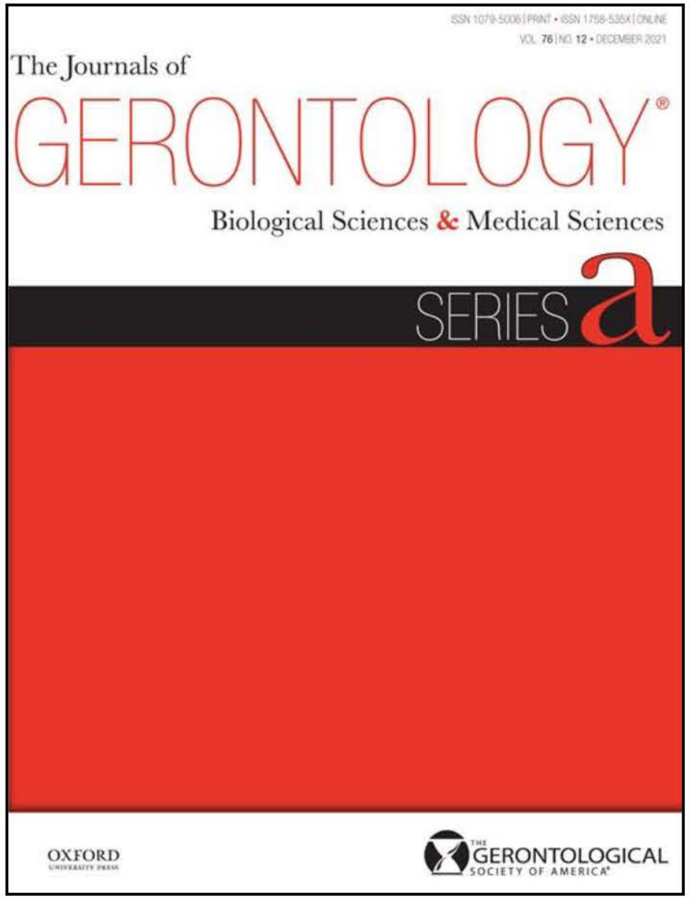
Setting 2:
Which health care system?

- Academic medical center
- Integrated Health System
- Veteran's administration
- Area Agency on Aging sites
- Independent Nursing homes or part of a chain

What is the system's readiness for using healthcare-generated data for research?

Does anything about the organizational strategy have impact on study generalizability?

How important is diagnostic accuracy?
Example of Participants Identified in Medicare Claims



Validation of Claims Algorithms to Identify Alzheimer's Disease and Related Dementias

Ellen P McCarthy, Ph.D., MPH, Chiang-Hua Chang, Ph.D., MS, Nicholas Tilton, Ph.D, Mohammed U Kabeto, MS, Kenneth M Langa, MD, Ph.D, Julie P W Bynum, MD, MPH

The Journals of Gerontology: Series A, glab373, https://doi-org.proxy.lib.umich.edu/10.1093/gerona/glab373

Identification Of Dementia In Recent Medicare Claims Data, Compared To Rigorous Clinical Assessments

Francine Grodstein, ScD ✉, Chiang-Hua Chang, PhD, Ana W Capuano, PhD, Melinda C Power, ScD, David X Marquez, PhD, Lisa L Barnes, PhD, David A Bennett, MD, Bryan D James, PhD, Julie P W Bynum, MD Author Notes

The Journals of Gerontology: Series A, glab377, https://doi-org.proxy.lib.umich.edu/10.1093/gerona/glab377

In Press, Journal of Gerontology: Medical Science

Statement of the Problem

- Claims data routinely used to identify people with ADRD for multiple purposes: research, public health surveillance, payment policy, increasingly for pragmatic trials

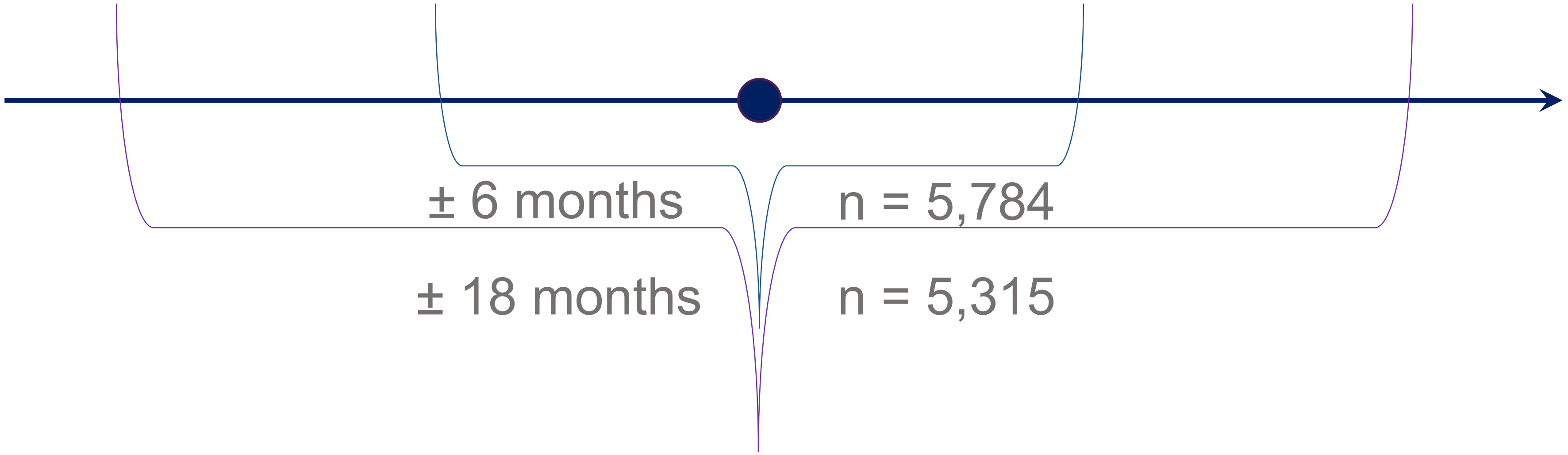
- CCW algorithm based on Taylor 2009
  - ❖ Based on 1990s clinical practice and last validated on 2001 claims against ADAMS and requires 3 years of data

- Assess accuracy and validity based on more contemporary practice
  - ❖ Pragmatic trials require shorter reference or look back
  - ❖ Improve understanding of misclassification

CCW: Chronic Conditions Warehouse

Health and Retirement Study Cohort, 2006-2012

- Participants age ≥65.5 in 2012, continuously enrolled in Parts A & B fee-for-service
- Medicare enrollment and claims data 2010-2014 (last full year ICD-9)
  - 88% of participants consented to Medicare linkage
- Constructed 1-yr & 3-yr reference periods around 2012 interview date



McCarthy, Journal of Gerontology: Medical Science, In Press

Reference Standard: HRS Cognitive Status

- Langa-Kebato-Weir method, cutpoints validated against ADAMS
  - Self: Modified TICS assessed immediate & delayed word recall, serial-7, and backward counting from 20
  - Proxy cognition score derived from proxy's assessment of participant's memory, difficulties with 5 IADLS, and interviewer rating of whether cognition was reason for proxy response

Dementia	• Self TICS-m: 0-6 • Proxy cognition score: 6-11
CIND	• Self TICS-m: 7-11 • Proxy cognition score: 3-5
Normal	• Self TICS-m: 12-27 • Proxy cognition score: 0-2

CIND: cognitive impairment not dementia
TICS-m: Modified Telephone Interview Cognitive Status

McCarthy, Journal of Gerontology: Medical Science, In Press

ADRD Algorithms

3-years	1-year and 3-year	
CCW	**Bynum E&M**	**Bynum Standard**

• CCW ICD-9 Dx Codes
• Any claim inpatient, SNF, HHA, HOF, and
• Carrier claims
  • Types 71- 72 (non-DME)
  • Excl. BETOS for DME & ambulance
	• CCW **plus**
	  • 331.82: Lewy body dem
	  331.89: Cerebral ataxia
	  290.8: Senile psychosis NEC
	• Any inpatient, SNF, HHA, **hospice**
	  • HOF: **RHC, FQHC, & CAH**
	  • Carrier: Types 71-72 (non-DME) + **BETOS for E&M**
		• CCW + **added codes**
		• Any claim inpatient, SNF, HHA, **hospice**
		• HOF & Carrier claims
		  • **2 claims > 7 days**
		  • HOF: **RHC, FQHC, CAS**
		  • Carrier: Types 71-72 (non-DME)

McCarthy, Journal of Gerontology: Medical Science, In Press

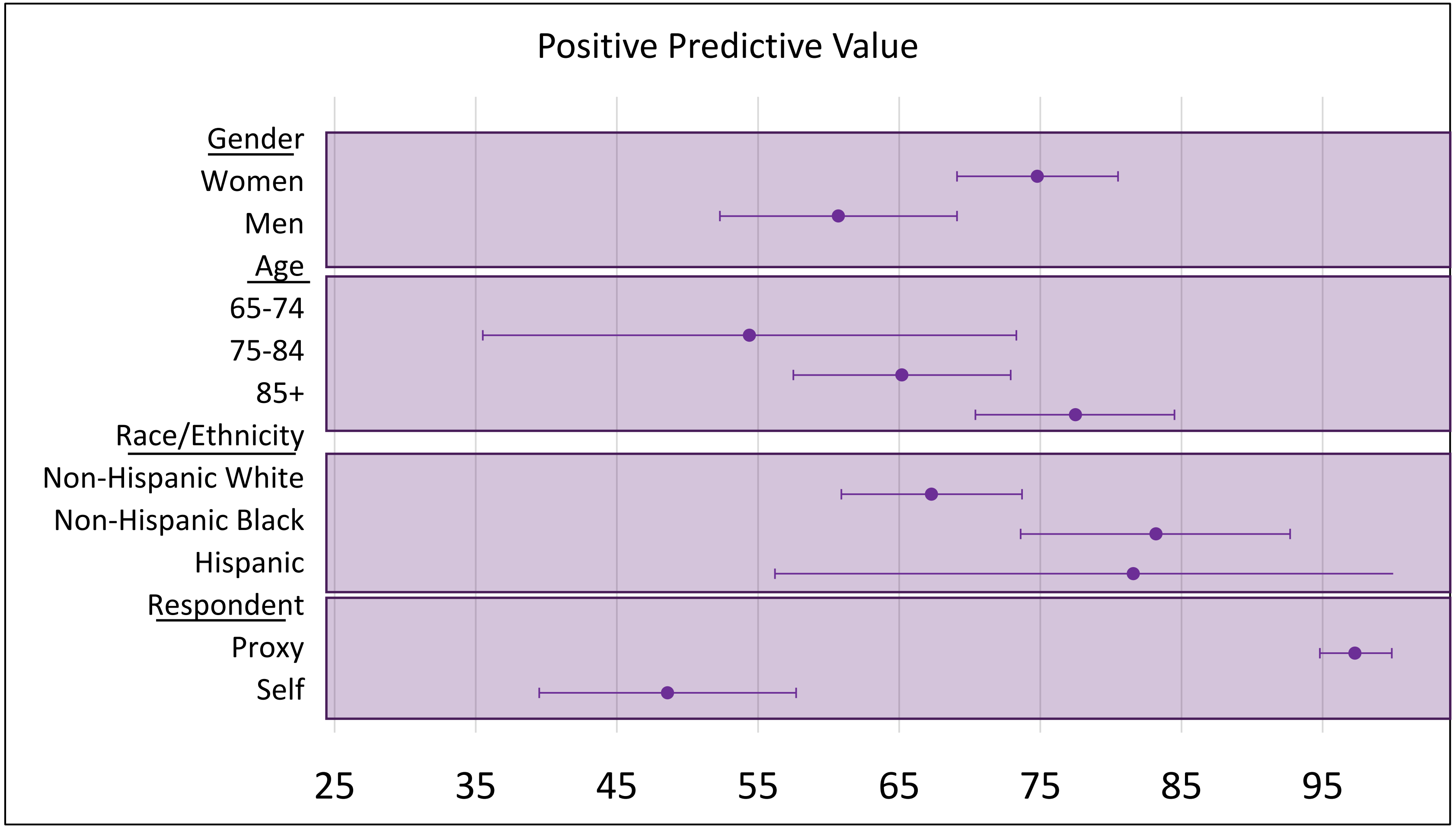
PPV of Claims-Based Algorithms relative to HRS Cognitive Status

ADRD Algorithm	Positive Predictive Values (PPV)	Sensitivity	Specificity
CCW, 3-year	53.8 (49.4-58.2)	56.8	92.3
Bynum E&M, 3-year	56.2 (51.5-60.8)	52.2	93.5
Bynum Standard, 3-year	60.2 (55.2-65.1)	48.8	94.9
Bynum E&M, 1-year	64.5 (59.1-69.8)	35.4	97.1
Bynum Standard, 1-year	70.3 (65.0-75.6)	31.3	98.0

Sample sizes: 1-year (n=5,784)
3-years (n=5,315)

McCarthy, Journal of Gerontology: Medical Science, In Press

Standard 1-Year Algorithm PPV by Subgroup



Positive Predictive Value is:

- Higher with older age
- Higher if person uses proxy in HRS
- Higher black or Hispanic (CI wide)

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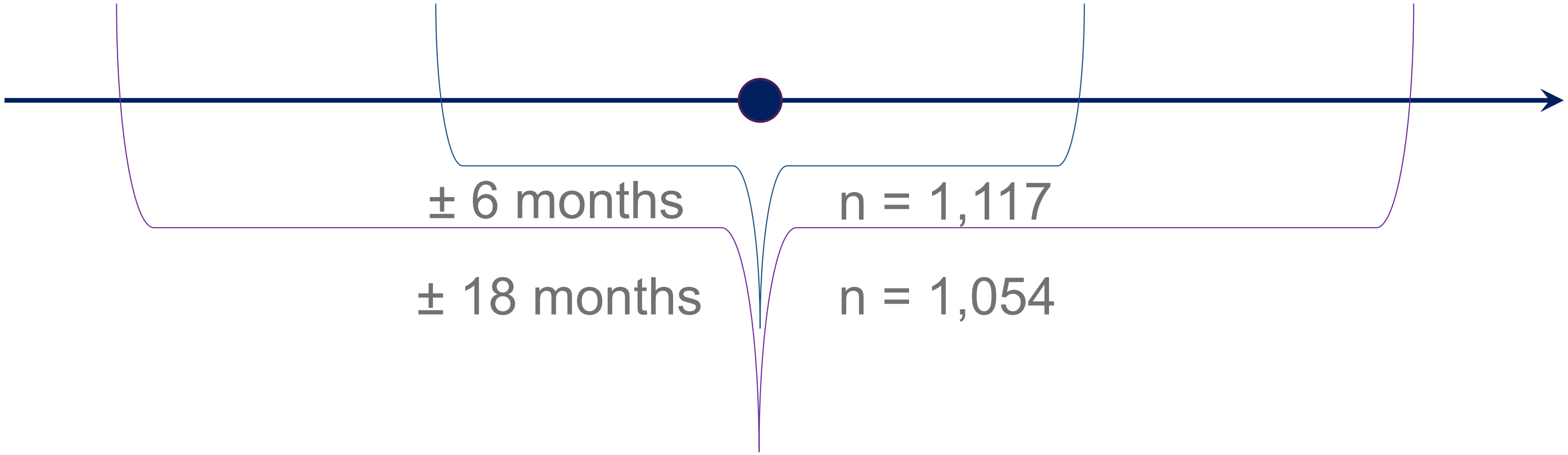
McCarthy, Journal of Gerontology: Medical Science, In Press

Rush ADC Cohorts

***5 Rush Cohort Studies**
Religious Orders Study
Rush Memory and Aging Project
Minority Aging Research Study
Rush African American Clinical Core
Rush Latino Core

- Participants in all 5 Cohorts* age ≥65
- Medicare enrollment and claims data for year 2016
  - 84% of participants consented to Medicare linkage
  - 70% continuously enrolled in Parts A & B fee-for-service
- Constructed 1-yr & 3-yr reference periods around 2016 interview date



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Gold Standard: RADC Cognitive Status

- Annual, uniform, structured clinical evaluation harmonized across Cohorts
  - Neuropsychological and neurological evaluation
  - 18 cognitive tests
  - Severity rated across 5 domains
- Neuropsychologist blinded to sociodemographics renders clinical judgment on presence of dementia
- Experienced clinician reviews all data renders final clinical diagnosis

Dementia
- Also if Alzheimer's Disease
- Use Joint criteria of the NINCDS/ADRDA

MCI
- Neuropsychologist report of cognitive impairment
- Clinician does not report dementia

Normal
- Neuropsychologist reports no cognitive impairment

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NINCDS/ADRDA: Natl Institute of Neurology & Communication Disorders / Alzheimer's Disease & Related Dis Assoc.
MCI: Mild Cognitive Impairment

Grodstein, Journal of Gerontology: Medical Science, In Press

ADRD Algorithm: Chose "Standard"

1 & 3-years

Bynum Standard

- CCW + **added codes**
- Any claim inpatient, SNF, HHA, hospice
- HOF & Carrier claims
  - **2 claims > 7 days**
  - HOF: **RHC, FQHC, CAS**
  - Carrier: Types 71-72 (non DME)

- Allowed both ICD-9 and ICD-10 codes
  - –ICD-10 began Oct 2015
  - –Note that all cases had ICD-10 dementia claims diagnoses on record
- Also ran same study in 2012 interview year

Grodstein, Journal of Gerontology: Medical Science, In Press

PPV of Claims-Based Algorithm relative to RADC and HRS Cognitive Status

ADRD Algorithm	Comparator	Positive Predictive Values (PPV)	Sensitivity	Specificity
Bynum Standard, 1-year	RADC	58 (51-66)	64 (56-72)	93 (92-95)
Bynum Standard, 3-year	RADC	50 (43-56)	79 (73-86)	88 (86-90)
Bynum Standard, 1-year	HRS	70 (65-76)	31 (32-39)	98 (97-98)
Bynum Standard, 3-year	HRS	60 (55--65)	49 (46-52)	95 (94-96)

RADC Sample sizes: 1-year (n=1,184)
3-years (n=1,054)

HRS Sample sizes: 1-year (n=5,784)
3-years (n=5,315)

Grodstein, Journal of Gerontology: Medical Science, In Press

Who are the False Positives?

DX in Claims	DX in Cohort Eval: Yes	No	Total
Yes	92	66	158
No	52	908	960
Total	144	974	1118

Selected in, but <u>no dementia</u>

- Older
- More comorbidity
- More functional impairment
- Lower MMSE
- More MCI
- Frequent subjective complaints

False positives meet criteria for dementia in subsequent years: @ 1 year 16%; @ 2 years 30%

	False Positives (N=66)	True Negatives (N=908)
Age	85 yrs	81 yrs
Male	24%	22%
White	78%	77%
Mean Education	16 yrs	17 yrs
MMSE	26.6	28.2
Subj Memory Concerns	51%	29%
Cohort DX MCI	72%	44%
ADL limitations, 3+	11%	5%
iADL limitations, 3+	34%	15%
Number Comorbidities	7	4
Hospitalized in year	59%	36%

$p < 0.001$

Grodstein, Journal of Gerontology: Medical Science, In Press

Who are the False Negatives?

	DX in Cohort Eval		
DX in Claims	Yes	No	Total
Yes	92	66	158
No	52	908	960
Total	144	974	1118

Missed cases, with dementia

- More likely Non-White
- Less functional impairment
- But no difference in subjective complaints or education

	False Negatives (N=52)	True Positives (N=92)
Age	89	90
Male	suppressed	19
White	75	90
Mean Educ	16	17
MMSE	20	15.4
Subj Memory Concerns	41	45
ADL limitations, 3+	suppressed	48
iADL limitations, 3+	52	82
Number Comorbidities	4	5
Hospitalized in year	39	56

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$p < 0.001$

Claims-based ADRD Diagnostic Accuracy

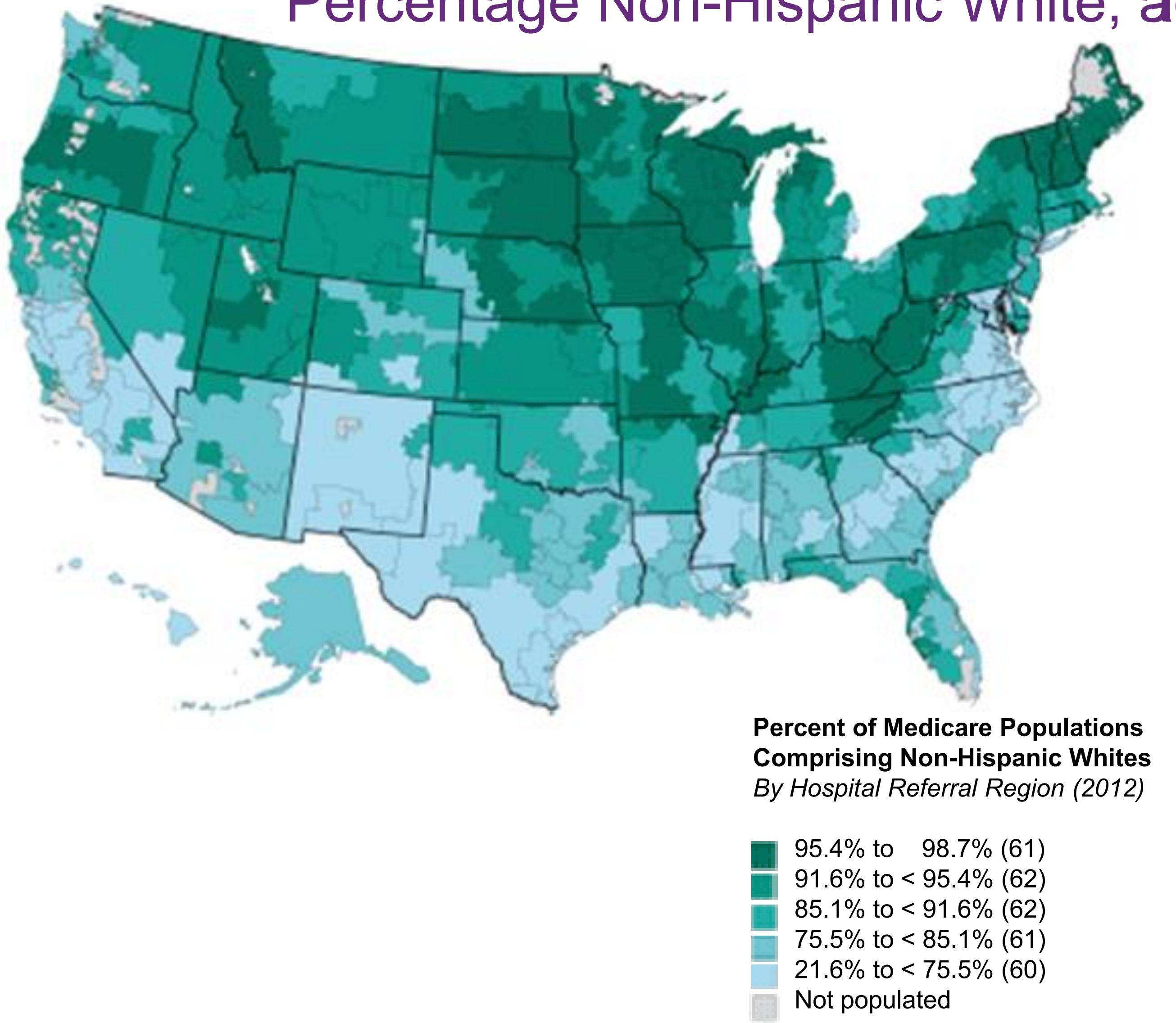
Interpretation

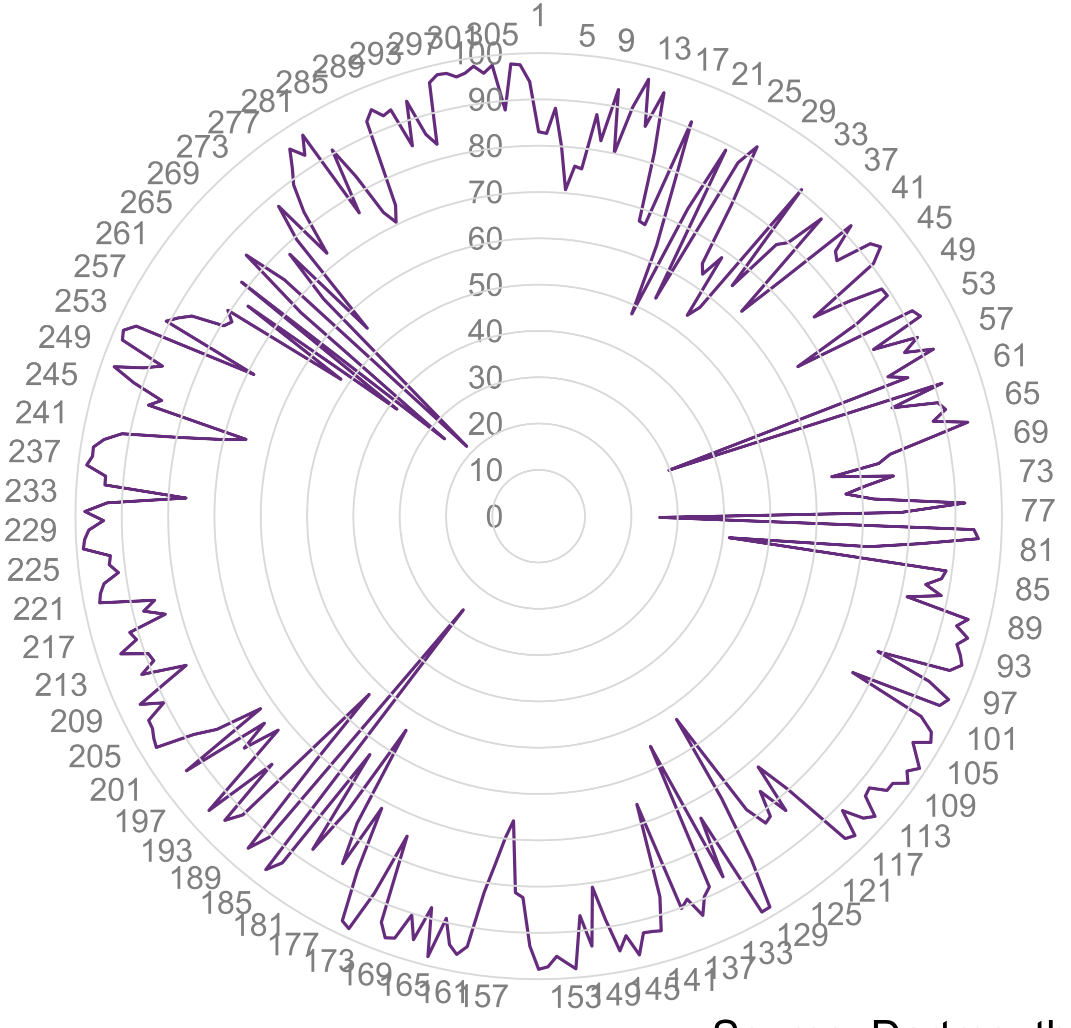
- Use of 1 year of data with algorithm like standardly used across many disease performs well. Appears worse with gold standard for comparison likely because our clinical diagnostic accuracy is not precise.
- Sensitivity is the weakness of claims data
- Certain subgroups when flagged with ADRD are more likely to be accurately identified (older, uses a proxy, Black race, more severe disease)
- False positives are not normal cognitively or functionally
- False negatives more likely to be non-White and less functionally impaired.

How important is population representation?

Geographic Distribution of FFS Medicare

Percentage Non-Hispanic White, age 65+ by HRR (2012)



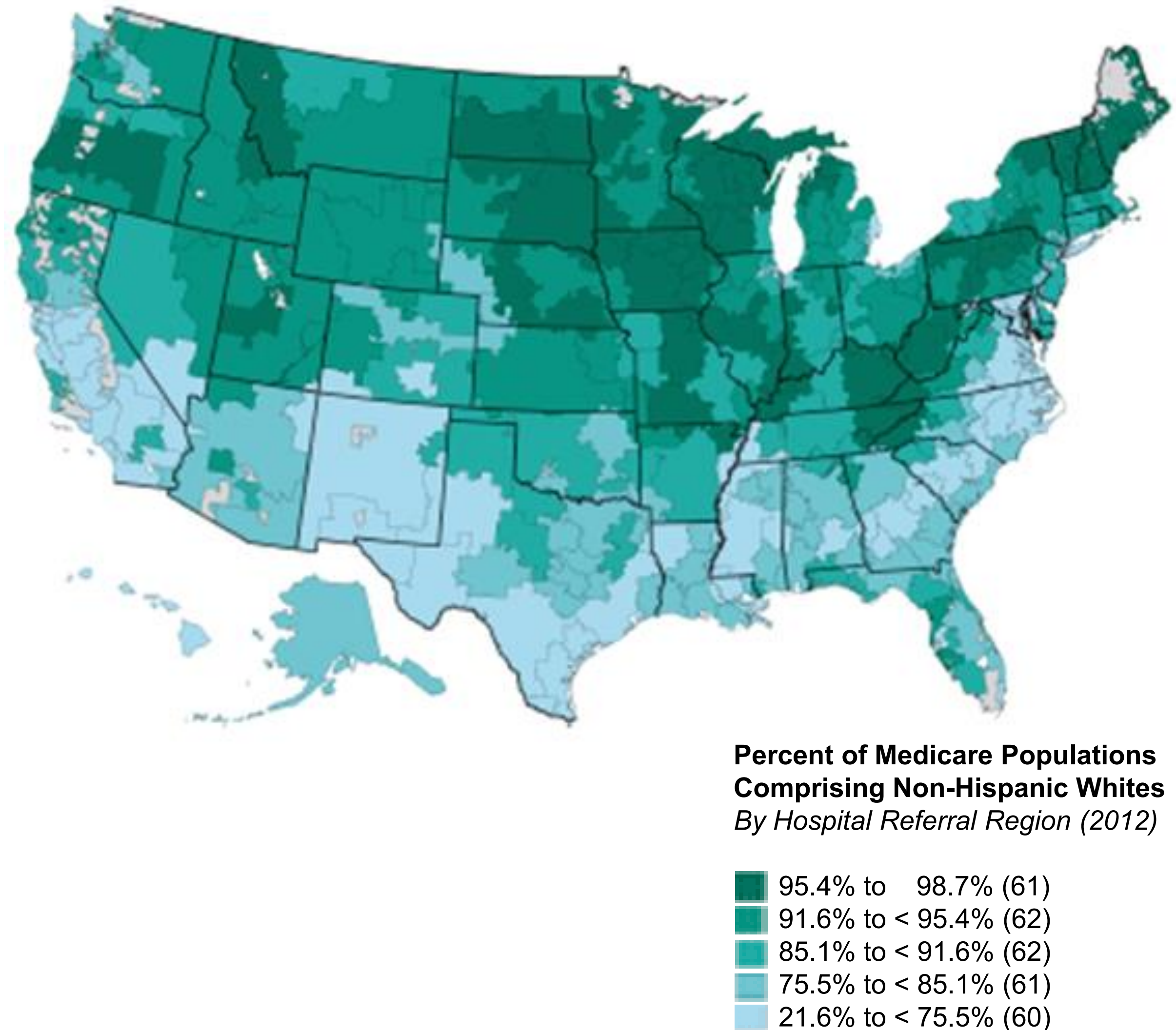


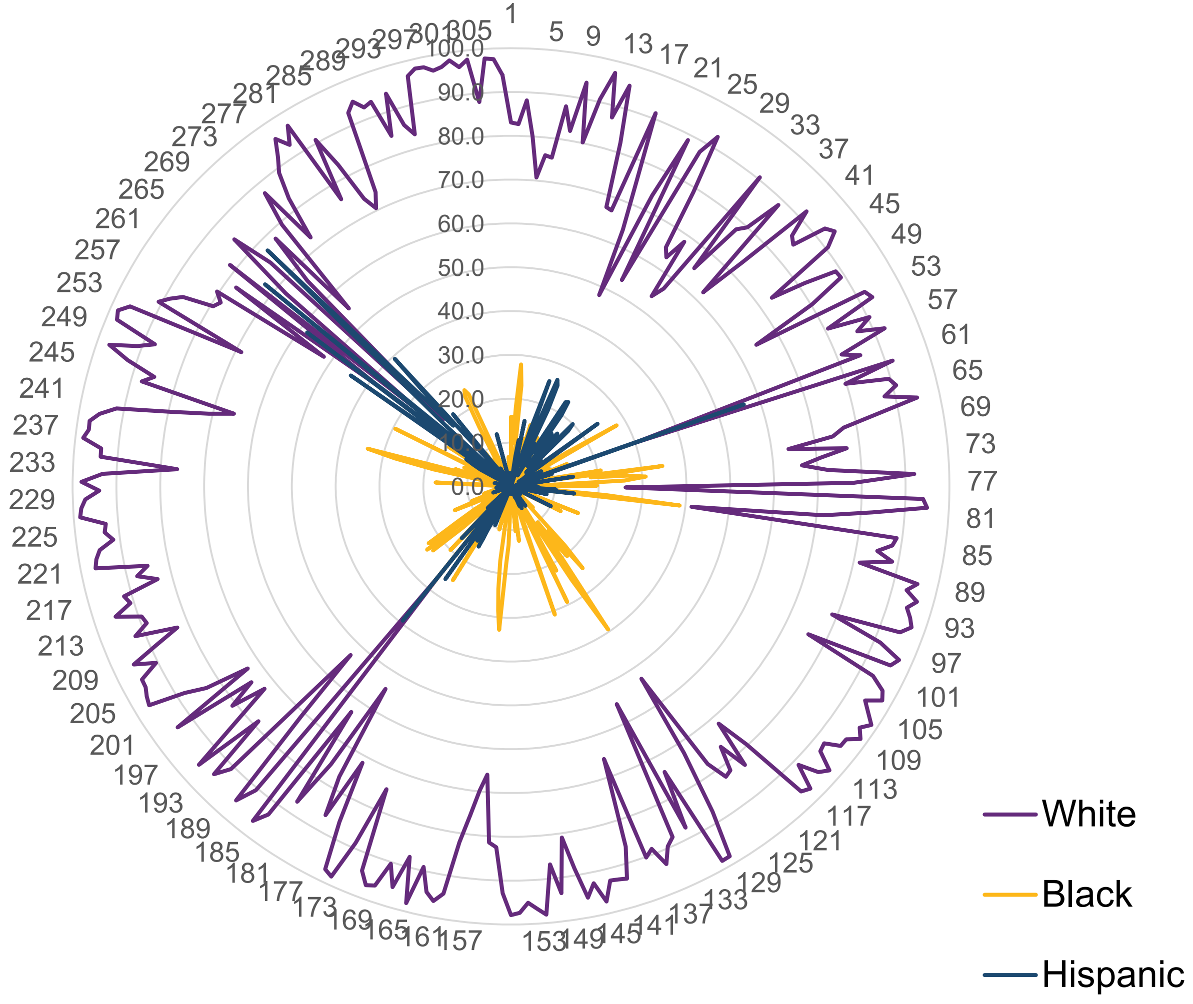
Source: Dartmouth Atlas

Place Important for Representation

Geographic Distribution of FFS Medicare

Percentage by Race, age 65+ by HRR (2012)





Regional Data Created by Technical Data Core

ADRD Cases identified in FFS Medicare 2018

Methods

- Age 65+
- In Medicare Parts A & B (no HMO)
- Algorithm in:
  - McCarthy E.P et al (in press) Validation of Claims Algorithms to Identify Alzheimer's Disease and Related Dementias. *J. Gerontol.*
- Based on zip code of residence

We identify the number of beneficiaries with diagnosed dementia by age, sex, race for each:

- ✓ State
- ✓ Hospital Referral Region (HRR)
- ✓ Hospital Service Area
- ✓ Primary Care Service Area

NOTE: We can query this data for investigators interested in knowing potential sample sizes

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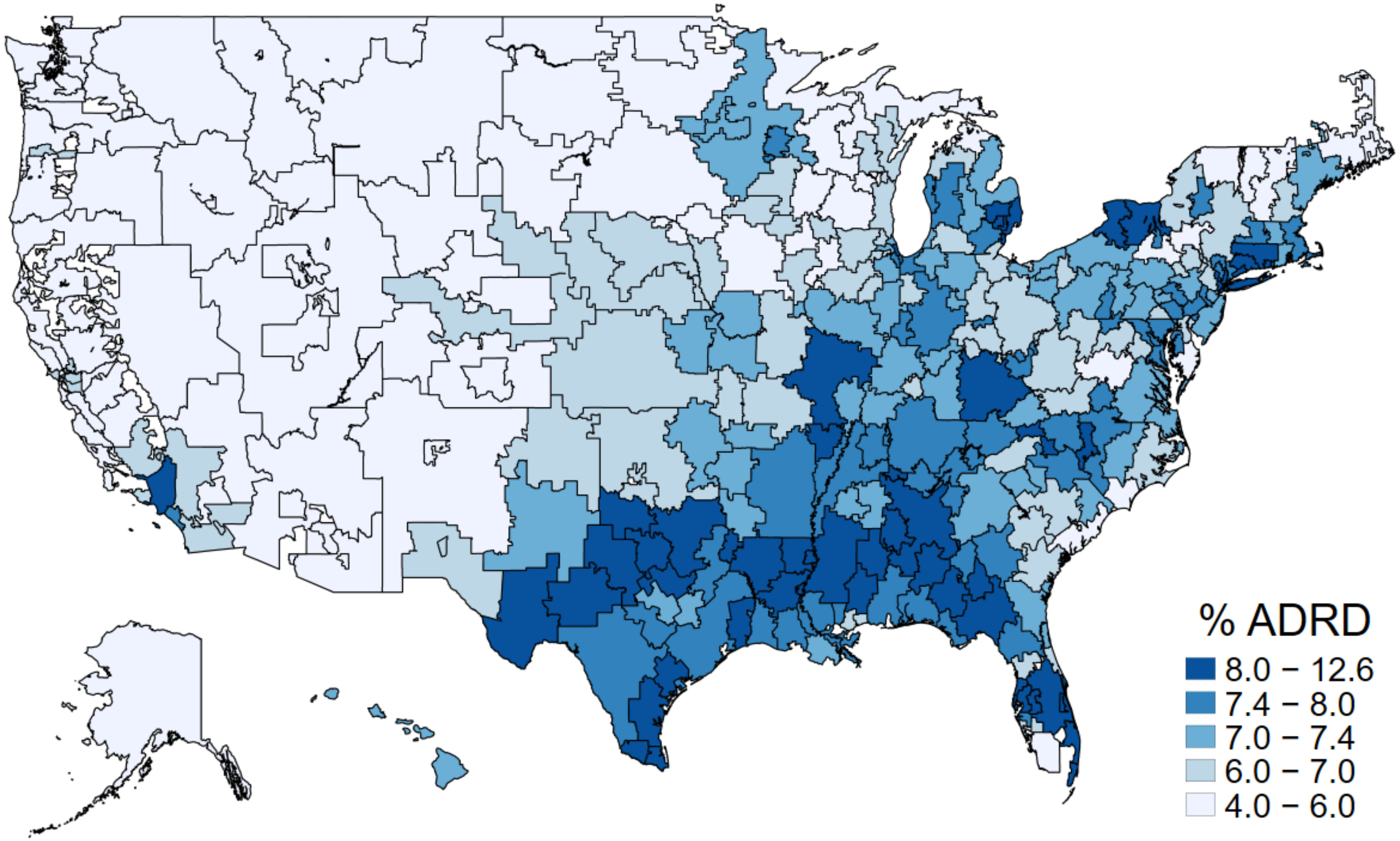
Crude Proportion of Medicare FFS Benes, age 65+ with diagnosed dementia by HRR, 2018



Source: IMPACT TDC Analysis

Informing health equity and generalizability

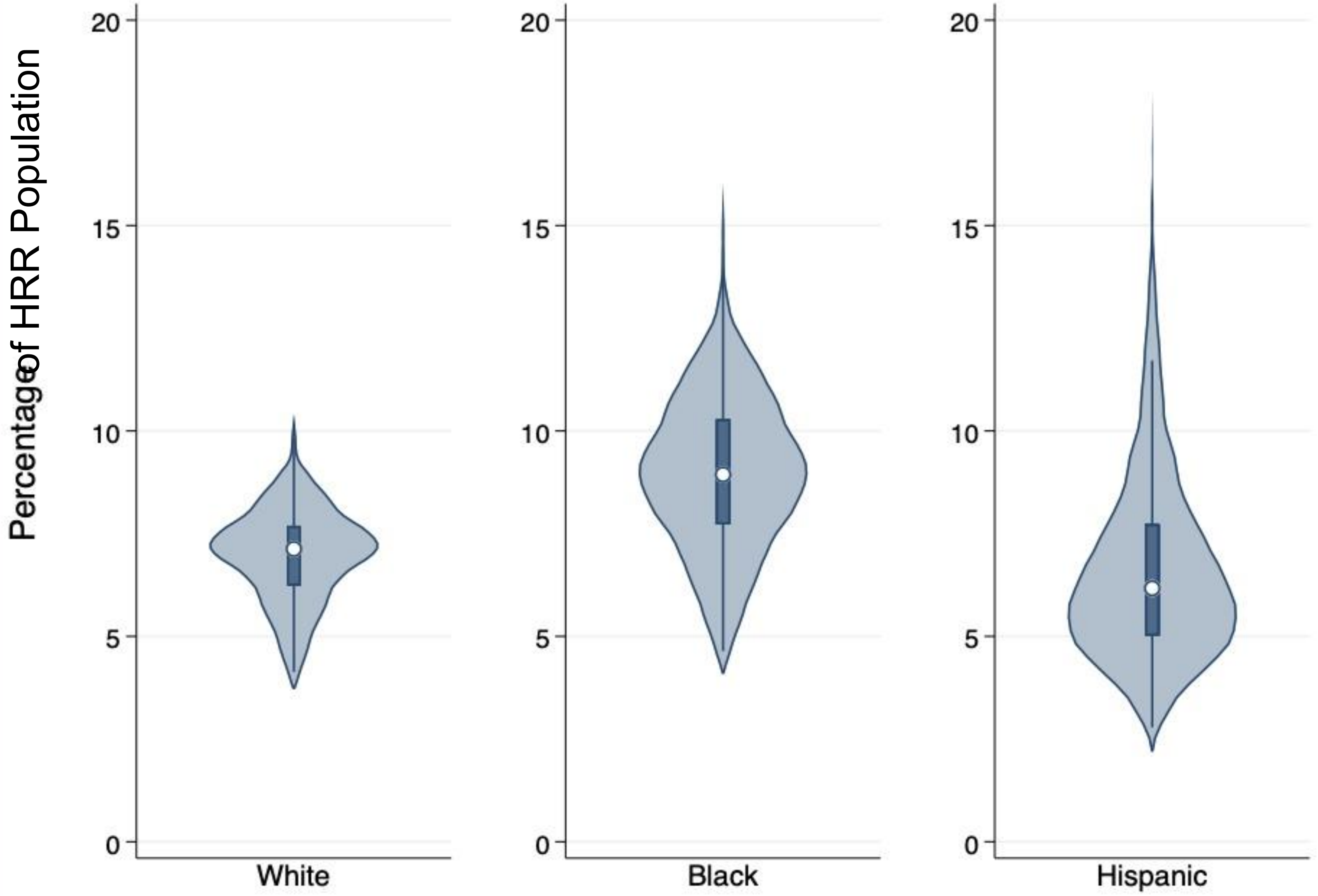
Variation in diagnosed cases across place and race

Why would proportion of population with ADRD be different across place?

❖Warranted variation

❖Unwarranted variation

Proportion of Medicare FFS Benes age 65+ with diagnosed dementia by race, 2018



Source: IMPACT TDC Analysis

Informing health equity and generalizability

Variation in diagnosed cases across place and race

- Epidemiological studies indicate higher risk in Blacks & Hispanics but result different using claims diagnosis
- Average proportion higher in Blacks than Whites
- Average proportion lower in Hispanics than White

Facility Data created by Technical Data Core

ADRD Cases identified in FFS Medicare 2018

Methods

- Age 65+
- In Medicare Parts A & B (no HMO)
- Algorithm in:
  - McCarthy E.P et al (in press) Validation of Claims Algorithms to Identify Alzheimer's Disease and Related Dementias. *J. Gerontol.*
- Determine by facility number of people for each facility

We identify the number of beneficiaries with diagnosed dementia by age, sex, race for each:

- ✓ Hospital
- ✓ Emergency Department
- ✓ Post-acute SNF Facility
- ✓ Long-stay Nursing Facility

NOTE: We can query this data for investigators interested in knowing potential sample sizes

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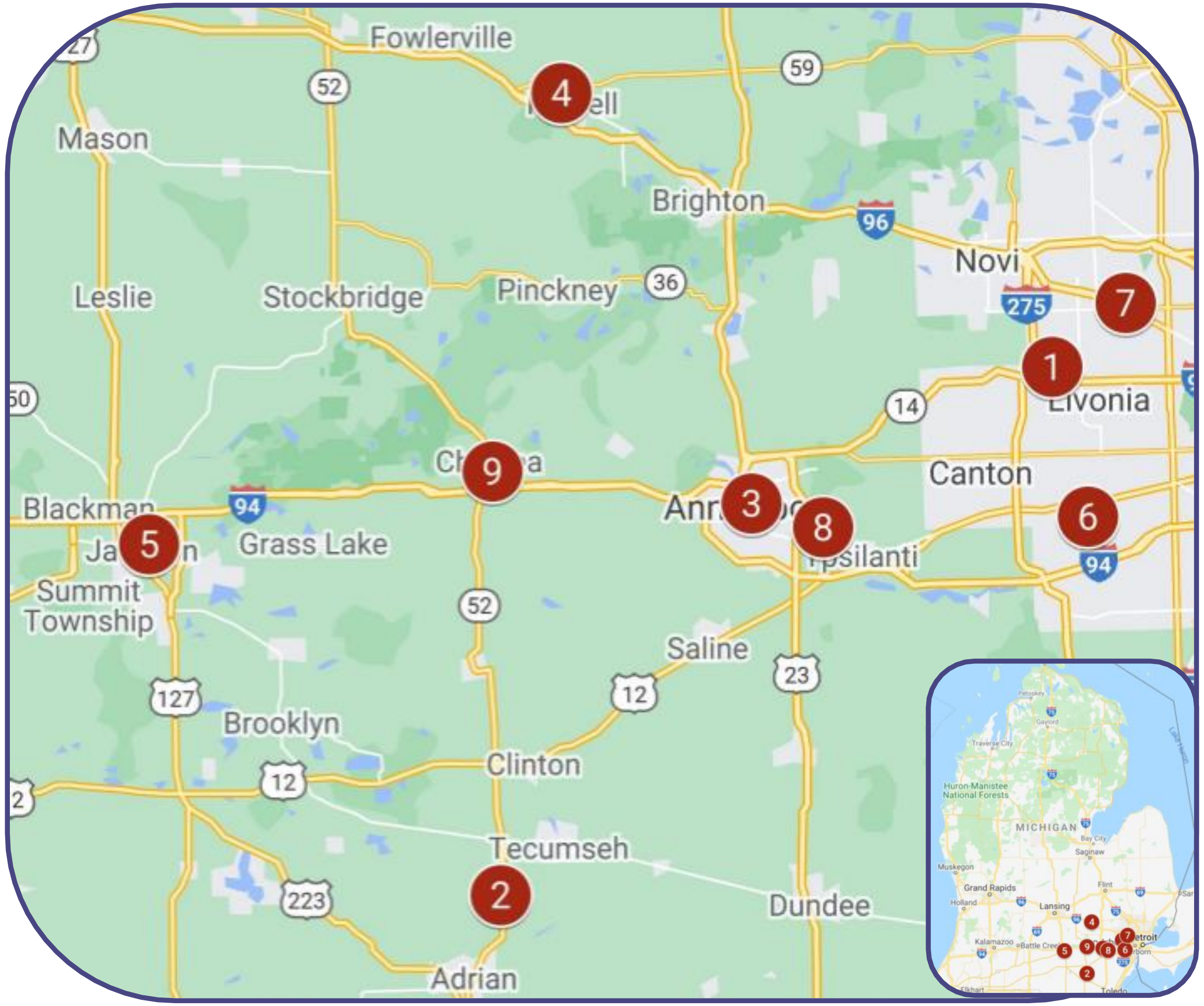
Informing health equity and generalizability

Variation in diagnosed admitted cases across settings



1
2
3
4
5
6
7
8
9

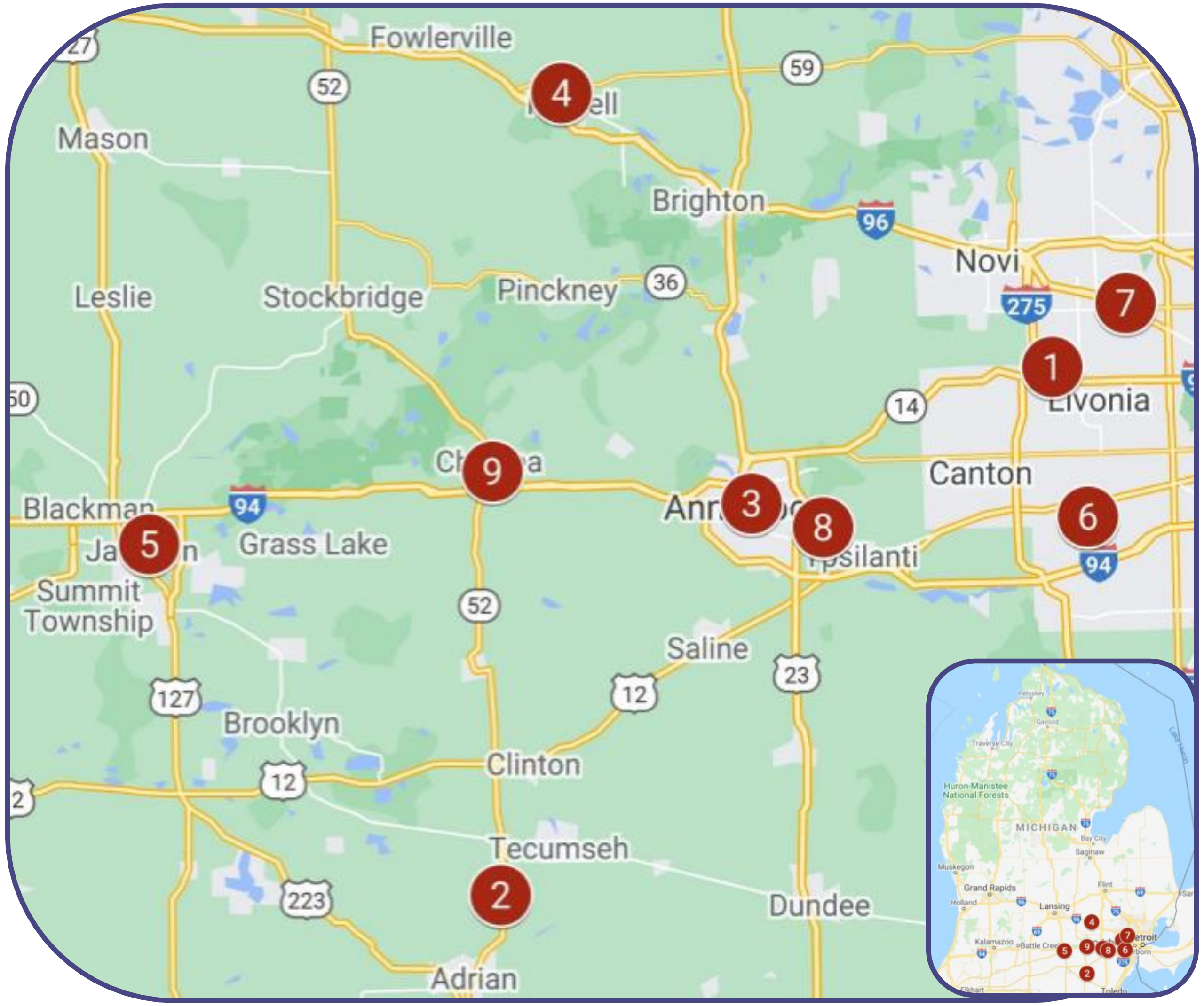
Do patients with different characteristics seek or receive care in different sites within a setting?

EXAMPLE: HRR 232 - Ann Arbor, Michigan

Source: IMPACT TDC Analysis

Informing health equity and generalizability

Variation in diagnosed admitted cases across settings



EXAMPLE: HRR 232 - Ann Arbor, Michigan

	HRR 232 - Ann Arbor, MI Hospital Label	Admits (n)	Percent Admits for Person with Dementia
1	St. Mary Mercy Hospital	6,130	31.9%
2	Promedica Charles and Virginia Hickman Hospital	1,197	22.5%
3	University of Michigan Health System	9,411	12.5%
4	St. Joseph Mercy Livingston Hospital	1,262	21.5%
5	Henry Ford Allegiance Health	5,977	17.8%
6	Beaumont Hospital – Wayne	1,927	33.8%
7	Beaumont Hospital – Farmington Hills	4,240	37.2%
8	St. Joseph Mercy Hospital	9,215	20.5%
9	St. Joseph Mercy Chelsea	1,588	16.9%

Source: IMPACT TDC Analysis

Medicare Claims for Participant Identification

Strengths

- Participants and non-participants included
- Uniform data elements allow use same algorithm across sites with ease
- Uniform data use agreement across all sites if CMS source
- Validated algorithms

Weaknesses

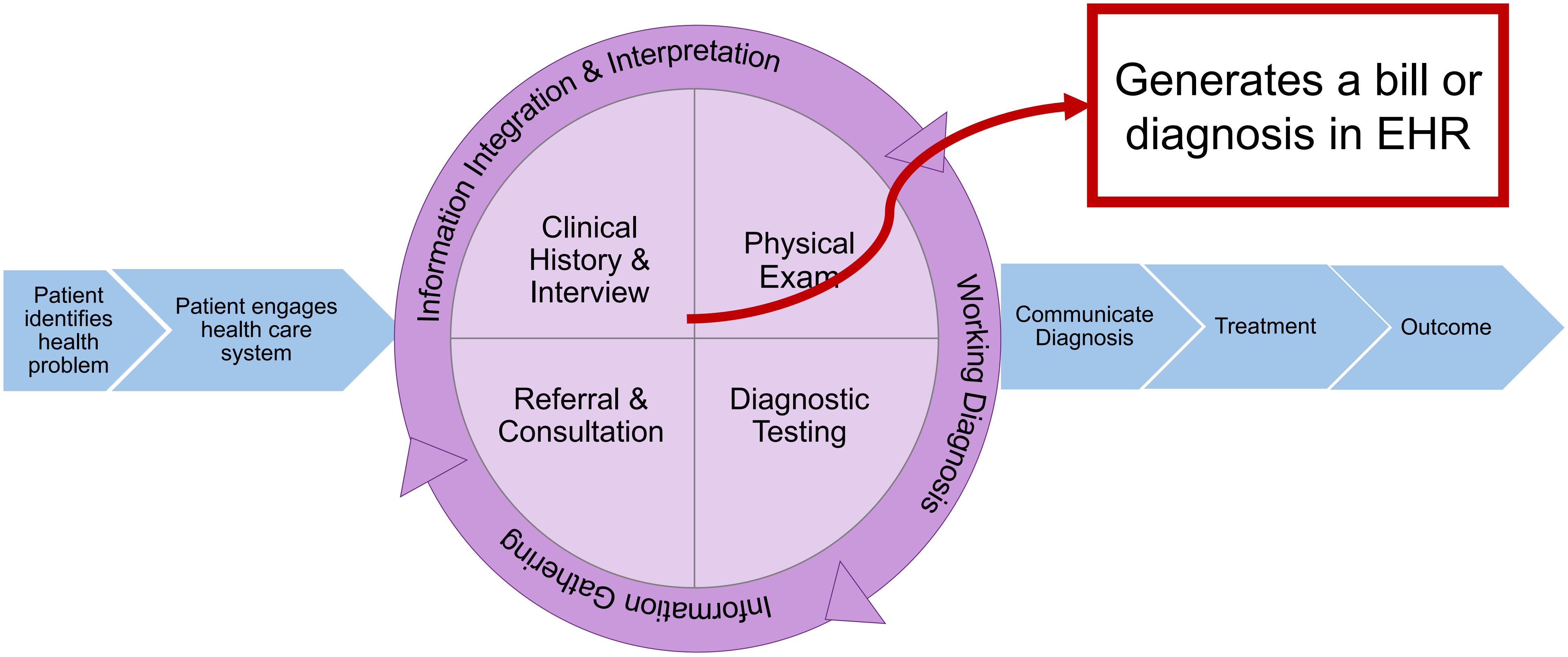
- Inherent biases and equity issues present in usual care
- Depends on quality of diagnosis in usual care
- Managed care? Encounter data not yet validated
- Issues of timeliness are dissipating with VRDC

Electronic Health Records: Panacea or Pandora?

Comparison to claims:

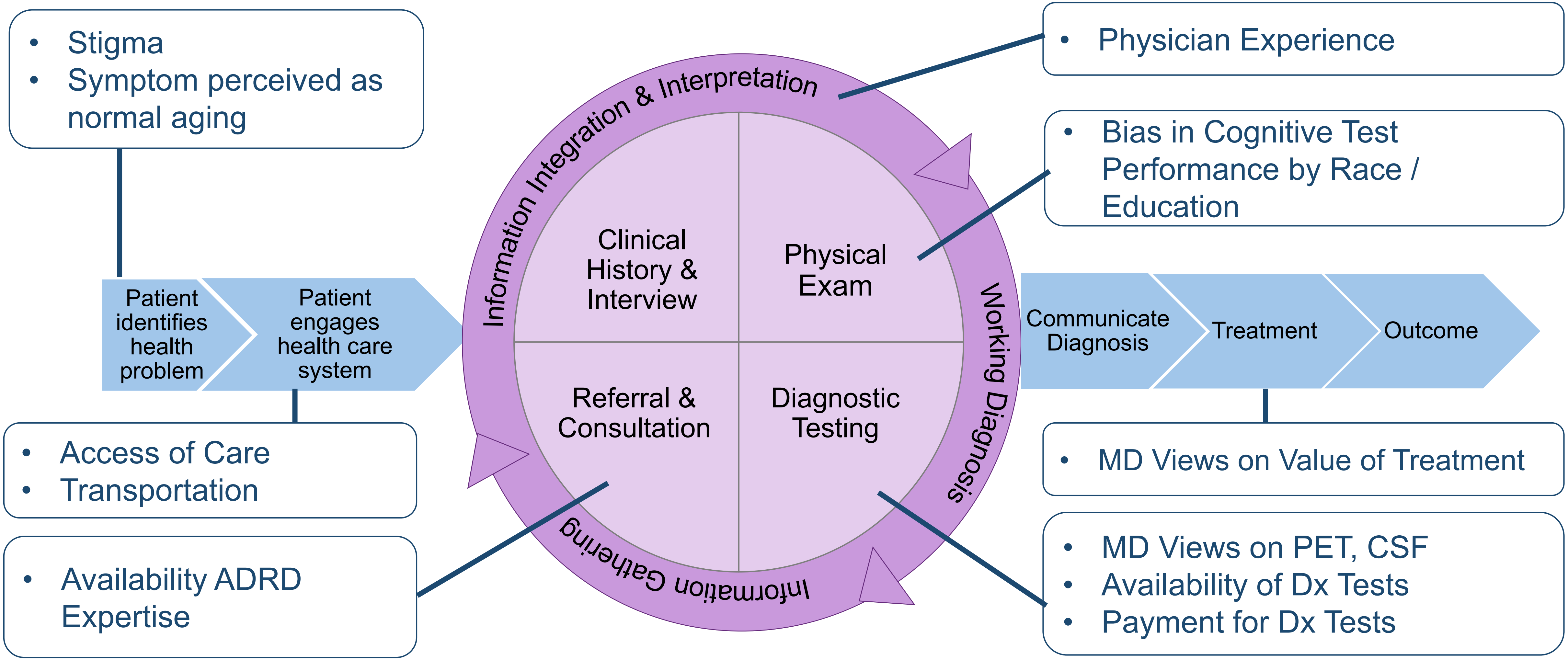
- Contains all payers and ages
- Same inherent biases and quality of diagnosis quality
- Typically need permission each site or system separately

Process of Obtaining a Diagnosis



Conceptual Process of Diagnosis, NAM, 2014

Many Challenges Obtaining a Diagnosis



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Conceptual Process of Diagnosis, NAM, 2014

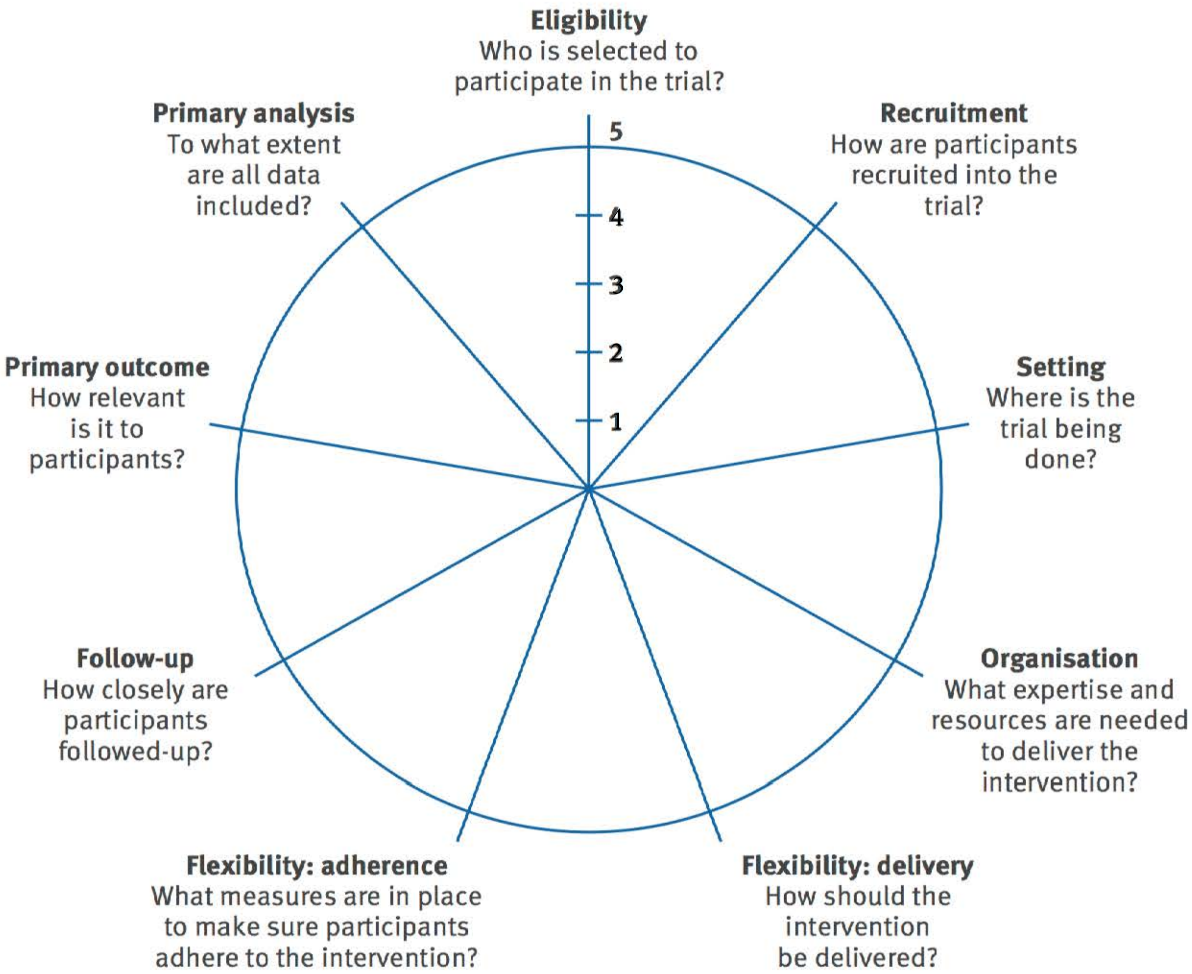
Electronic Health Record and Health Equity

Many discussions, publications, workshops on how data itself and how it is processed can induce inequities

New algorithms & validation

- Access to unstructured data elements creates opportunity for new methods of identification (text, ML)
- Algorithms typically validated against billing diagnoses
- Validation of algorithms not available across sites, must be evaluated at each site

Electronic Health Record



Organization:

What are the capabilities of your planned organization to do this data work? And what does it mean for future dissemination?

Follow-up/Outcomes:

Opportunity to use functions in EHR for monitoring recruitment, delivery, adherence, and person-centered outcome collection

Loudon et al. PRECIS-2 Tool. BMJ 2015.

Closing

- Healthcare-generated data in pragmatic trial design can enhance scalability and intervention application in the ”real world.”
- Dependency on billing and EHR data for identification of subjects presents limitations for accuracy of case identification and detail in characteristics which need to be considered as trade-offs in the design.
- Consider how inherent bias in underlying data, the settings chosen, analytic methods used (such as ML) can contribute to creating health equity challenges.

Thanks

Team at Michigan

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Questions?