NACC Legacy MRI

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UC DAVIS ALZHEIMER'S DISEASE CENTER

IDeA Lab
Imaging of Dementia and Aging

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BACKGROUND

- First meeting 6/13/2011—Dr. Silverberg
  - Major effort to identify and make use of available MRI
  - Combine with other unique resources available from ADC Centers Program
- ADC Center's Program Neuroimaging Working Group formed 3/9/2012
  - Mission: assess the availability of neuroimaging studies amongst the subjects of the ADC Center's program. In addition, the members plan to seek funding that will enable convenient warehousing and combined utilization of NACC data by members of the ADC research community.
  - Vision: To make progress in Alzheimer's research through *in vivo* biological measures

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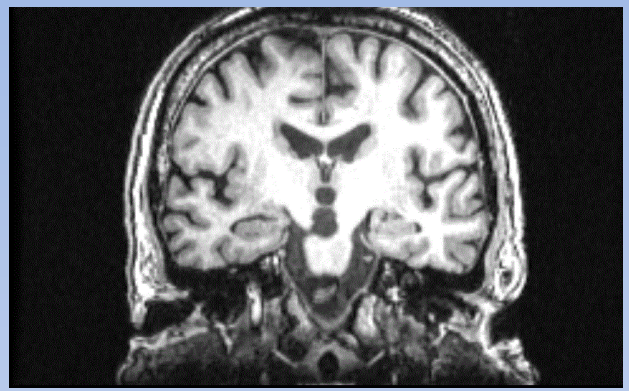
RESEARCH STRUCTURAL MRI

Data collection



- Subject population
  - UDS subjects
  - 2005 – present
- IRB approval and consent
  - All ADC research data
  - MRI or imaging data

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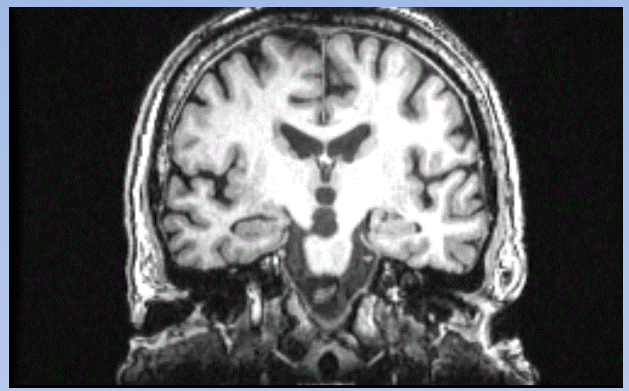

- Research structural MRI
- Scan types
  - 3D T1-weighted (e.g., MPRAGE, FSPGR)
  - FLAIR (e.g., turbo, fast, TSE)
  - DTI (e.g., 2.5mm/1300b/40dir, applicable gradient table)
  - T2
  - Additional scan types
- DICOM format
  - .zip by PTID and scan date

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NACC Tracking Database

- Status table
  - e.g., PTID, ADC ID, acquisition date, type of scans included in file, study description, manufacturer, model name, device serial number.
  - flag for cleaned image file
- Protocol table
  - e.g., NACCID, MRI date, series description, slice thickness, repetition time, echo time.

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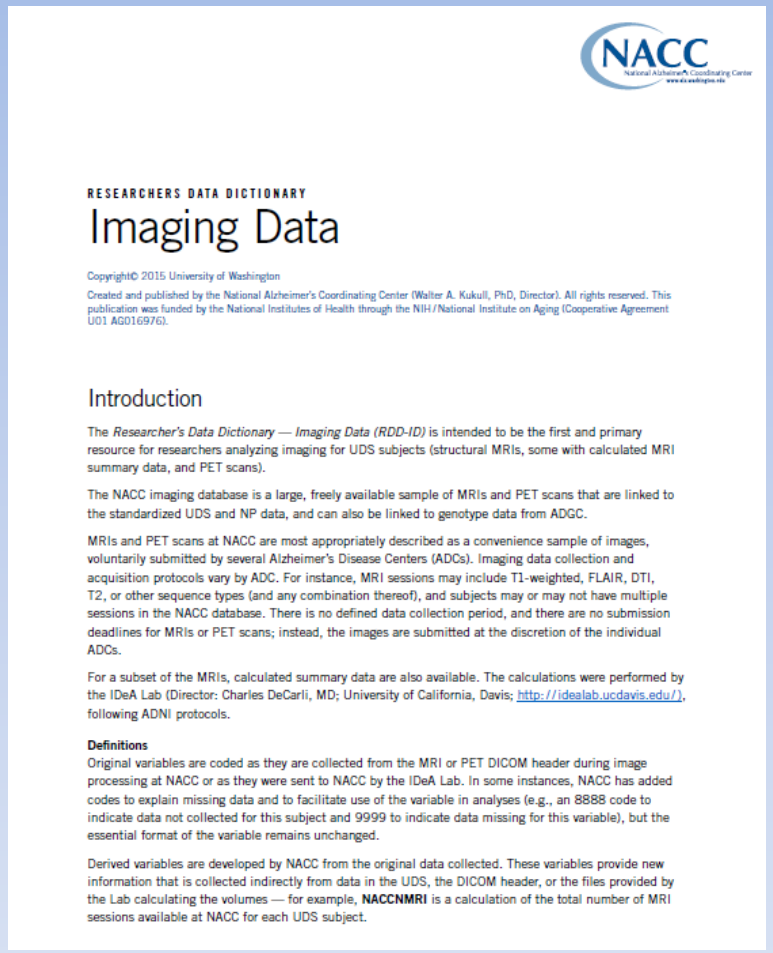
MRI Summary Variables

- Supratentorial Intracranial volume
- Gray/White/CSF volumes
  - Cortical
  - Regional (lobar, DKT atlas)
- White matter hyperintensity volume
- Hippocampal volume



RESEARCHERS DATA DICTIONARY

Imaging Data

Introduction

The *Researcher's Data Dictionary — Imaging Data (RDD-ID)* is intended to be the first and primary resource for researchers analyzing imaging for UDS subjects (structural MRIs, some with calculated MRI summary data, and PET scans).

The NACC imaging database is a large, freely available sample of MRIs and PET scans that are linked to the standardized UDS and NP data, and can also be linked to genotype data from ADGC.

MRIs and PET scans at NACC are most appropriately described as a convenience sample of images, voluntarily submitted by several Alzheimer's Disease Centers (ADCs). Imaging data collection and acquisition protocols vary by ADC. For instance, MRI sessions may include T1-weighted, FLAIR, DTI, T2, or other sequence types (and any combination thereof), and subjects may or may not have multiple sessions in the NACC database. There is no defined data collection period, and there are no submission deadlines for MRIs or PET scans; instead, the images are submitted at the discretion of the individual ADCs.

For a subset of the MRIs, calculated summary data are also available. The calculations were performed by the IDeA Lab (Director: Charles DeCarli, MD; University of California, Davis; http://idealab.ucdavis.edu/), following ADNI protocols.

Definitions

Original variables are coded as they are collected from the MRI or PET DICOM header during image processing at NACC or as they were sent to NACC by the IDeA Lab. In some instances, NACC has added codes to explain missing data and to facilitate use of the variable in analyses (e.g., an 8888 code to indicate data not collected for this subject and 9999 to indicate data missing for this variable), but the essential format of the variable remains unchanged.

Derived variables are developed by NACC from the original data collected. These variables provide new information that is collected indirectly from data in the UDS, the DICOM header, or the files provided by the Lab calculating the volumes — for example, **NACCNMRI** is a calculation of the total number of MRI sessions available at NACC for each UDS subject.

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Current Data-MR? Image Sessions

- Total number of scan sessions from 28 sites
  - 11,273 as of March 2022
- Total number of unique individuals
  - 7328 as of March 2022
    - Some longitudinal data

Boston University	291
Columbia University	362
Massachusetts ADRC	95
Indiana University	748
Johns Hopkins University	50
Mayo Clinic	258
Mount Sinai	80
New York University	1346
Northwestern University	45
Oregon Health & Science University	1015
University of California, Davis	1283
University of California, San Diego	730
University of Pennsylvania	610
University of Pittsburgh	95
University of Southern California	514
University of California, Irvine	204
Arizona ADC	42
University of California, San Francisco	2
University of Wisconsin	1397
University of Kansas	310
Stanford2	352
Yale University	34
1Florida ADRC	381
Wake Forest	699
U Michigan ADC	305
Duke/UNC ADRC	1
Cleveland ADRC	24

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Current Data Description

NACCMRIA - Participant age at time of MRI				
N participants with at least one scan	Mean	Std Dev	Minimum	Maximum
7328	71.03	10.39	18	102

MRIFIELD	Frequency	Percent
1.5	4143	36.75
3	5791	51.37
Other	48	0.43
Varies across images	785	6.96
Missing/unknown	506	4.49
Total scans		11273

MRIMANU - Manufacturer		
MRIMANU	Frequency	Percent
GE	6839	60.67
Siemens	3583	31.78
Phillips	616	5.46
Missing/unknown	235	2.08
Total scans		11273

MRIMODL - Manufacturer's model name		
MRIMODL	Frequency	Percent
DISCOVERY MR 750	1574	13.96
SIGNA HDxt	353	3.13
Trio Tim	779	6.91
Allegra	30	0.27
SIGNA EXCITE	127	1.13
SIGNA	3869	34.32
GEMINI	10	0.09
Ingenuity	3	0.03
Sonata	115	1.02
Skyra	1257	11.15
Signa HDx	287	2.55
Achieva	387	3.43
Prisma	974	8.64
Verio	54	0.48
Missing/unknown	1454	12.9
Total scans		11273

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Current MR Summary Data

- Total number of scan sessions
  - 4,530 as of 10/27/2020
  - 15 Sites contributing between 2-1349 unique subjects
- Total number of unique individuals
  - 2,775 as of 10/27/2020
    - Some longitudinal data
      - Mean 1.6 scans
      - Range 1-10

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Sites and MRI Machine Information

- Field Strength
  - 1.5 T: 58%
  - 3 T: 42%
  - Other (3)
- Manufacturers
  - GE: 72%
  - Siemens: 17%
  - Philips:11%
- Model
  - DISCOVERY MR 750: 28%
  - GENESIS SIGNA
  - SIGNA HDxt
  - Trio Tim
  - Eclipse 1.5T
  - Allegra
  - SIGNA EXCITE
  - SIGNA: 48%
  - GEMINI
  - Ingenuity
  - Sonata
  - Skyra
  - Signa HDx
  - Achieva
  - Prisma

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Subject Demographics

- Age: 71 ± 12.8 years
  [21-100]
- Education: 15 ± 3 years
  [0-25]
- 58% Female
- 10% Hispanic

- Diagnoses
  - NL: 2580 (57%)
  - QCI: 114 (3%)
  - MCI: 926 (20%)
  - Dementia: 910 (20%)
- ApoE
  - 3: 2981 (66%)
  - 4: 1302 (29%)
  - 4/4: 247 (5%)

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Data Utilization

YEAR	MRI image files	MRI calculated values
2016	16	28
2017	40	65
2018	62	95
2019	67	95
2020	76	115
2021	62	95
2022	13	20
Total	336	513

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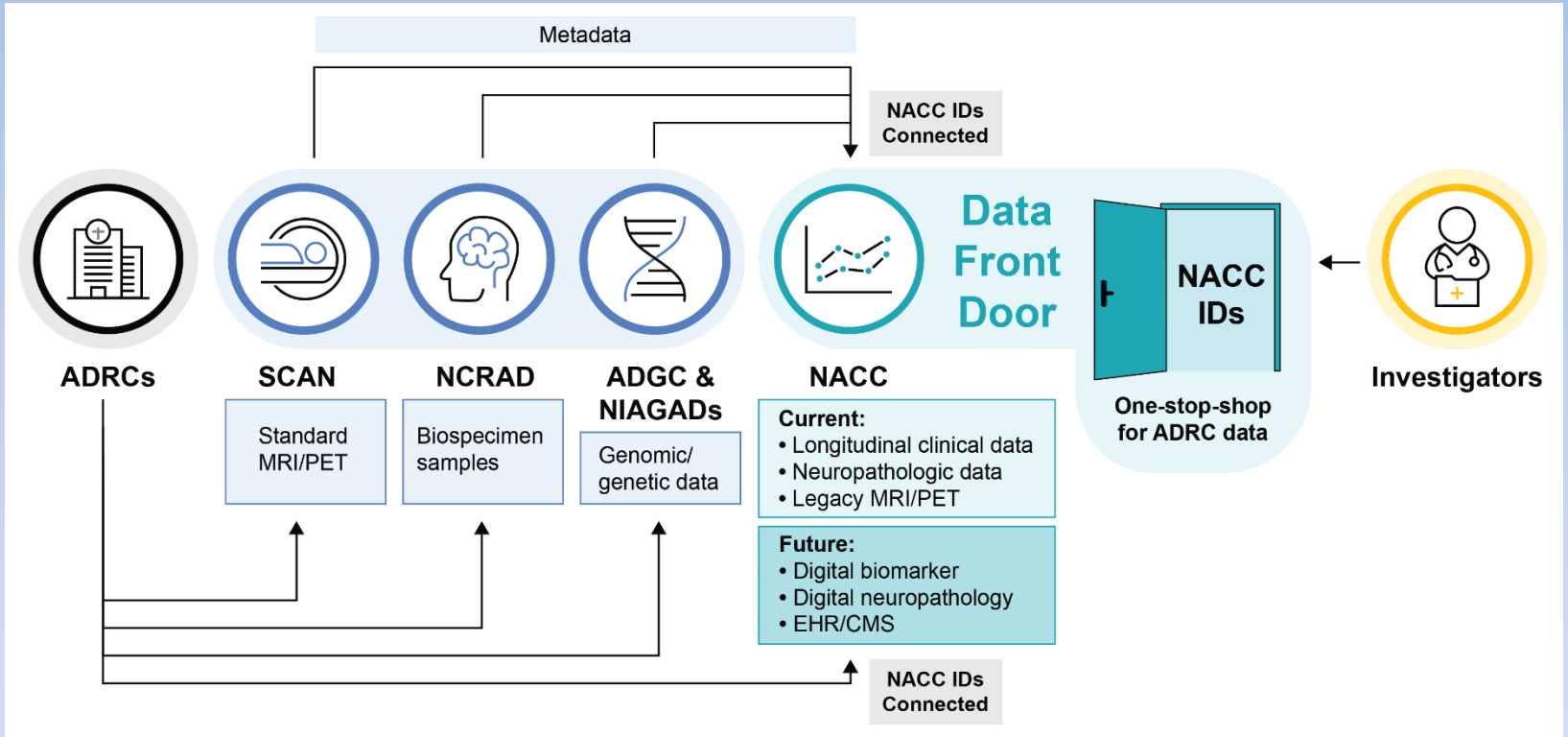
Moving Forward
The Data Front Door

Curate and utilize invaluable imaging data from last 20 years by applying QA/QC, metadata, connecting to NACC IDs and making it searchable through the Data Front Door



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Designated
Alzheimer's Disease Research Center

Thank you

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