

The National Consortium on Alcohol and Neurodevelopment in Adolescence (NCANDA): A Framework Supporting Neuroimaging Data Integration and Analysis



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National Consortium

Traditional Research Lab



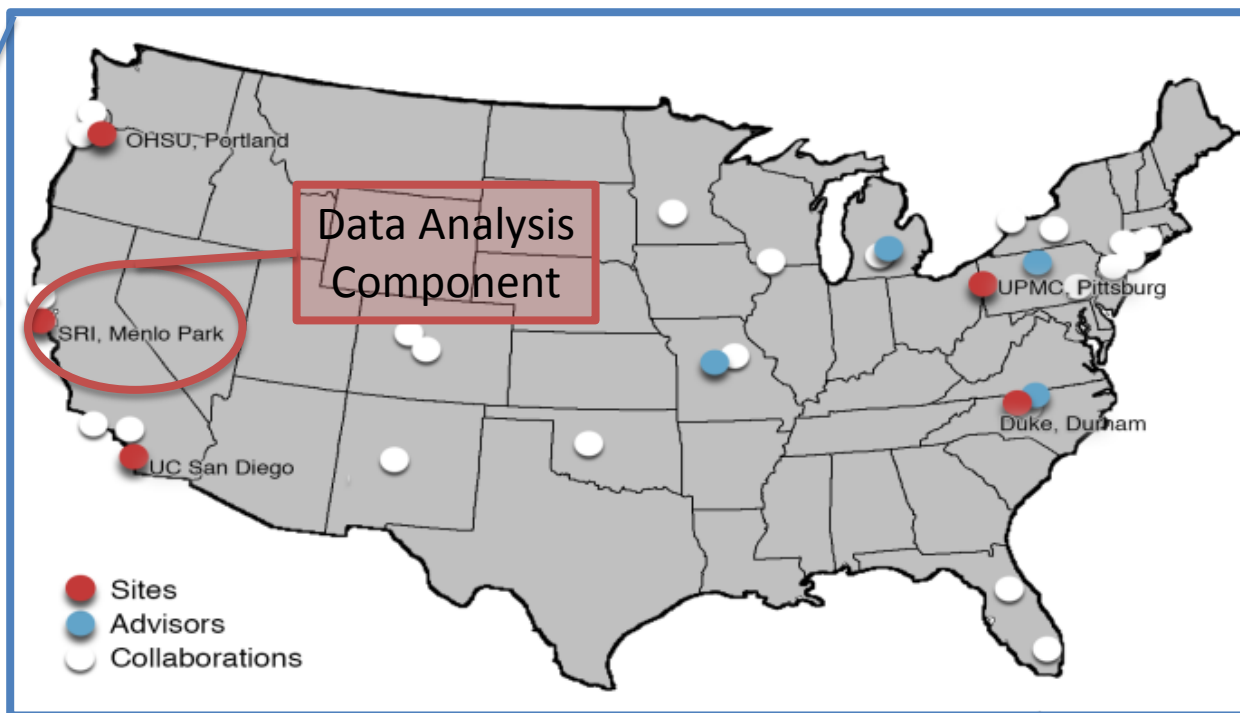
Scaling up

Multi-Site

Longitudinal

Multi-Modal

The Challenge



- Five sites across the US
- Total of 808 enrolled participants
- Baseline, 1 year, and 2 year follow-ups
- Data collection initiated in 6 months
- Limited resources for development
- What are the system requirements?

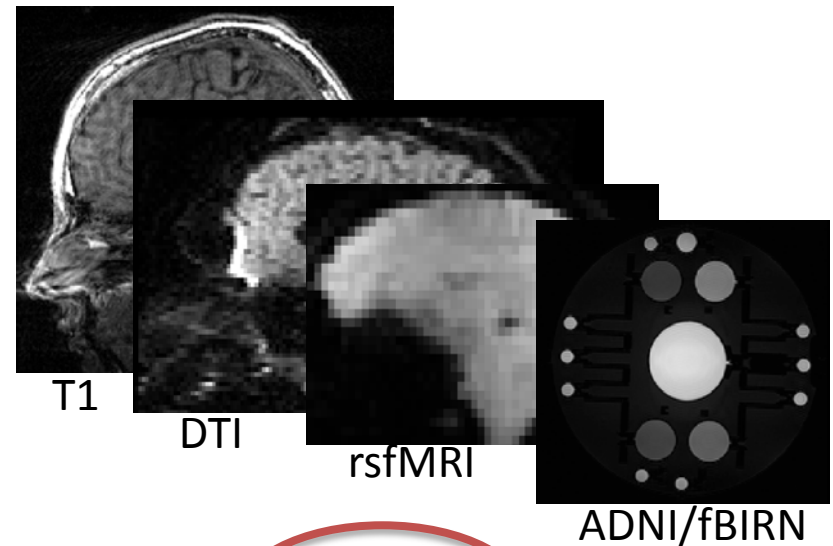
Requirements

Clinical and Neuropsychological Instruments

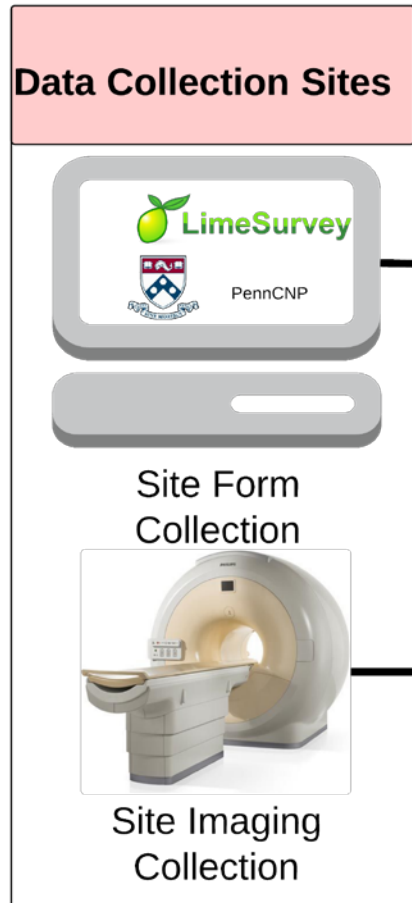


- Accommodate heterogeneous instruments
- Validate data capture protocols
- Maintain ongoing data quality
- Ensure longitudinal visit time windows
- Automate as much as possible
- What Neuroinformatics resources to reuse, circa 2012?

Multimodal Imaging and Phantoms



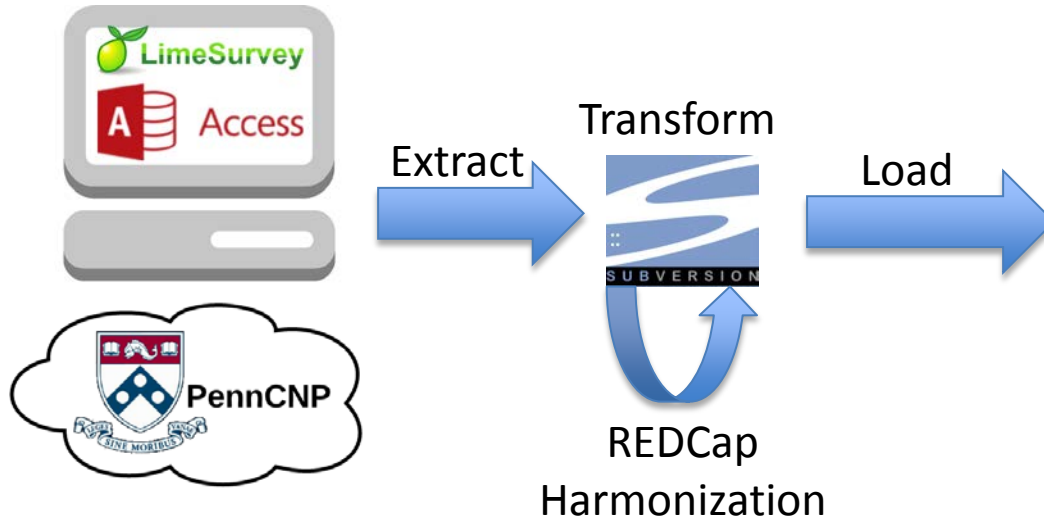
Overview and Approach



Sites collect:

- Demographic Information
- Clinical Data
- Neuropsychological Test Scores
- MRI
 - Anatomical
 - Diffusion
 - Functional

Clinical and Neuropsych Assessments

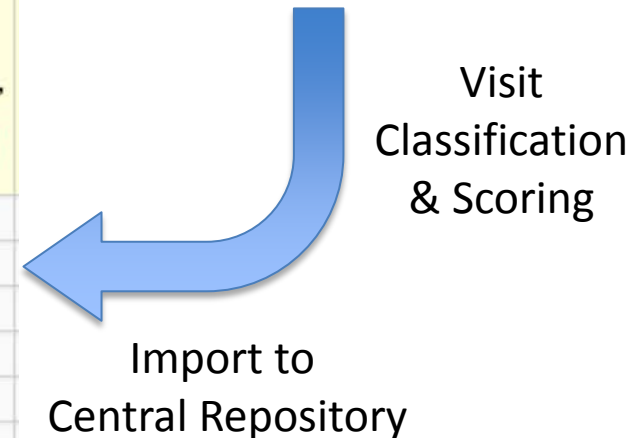


Record ID	Visit Information	Delayed Discounting, \$1000	Delayed Discounting, \$100	Paced Auditory Serial Addition Test (PASAT)
2013-03-13	●	●	●	●
2013-02-07	●	●	●	●
2013-02-26	●	●	●	●
2013-02-18	●	●	●	●
2013-02-21	●	●	●	●
2013-02-22	●	●	●	●
2013-04-01	●	●	●	●
2013-03-15	●	●	●	●
2013-03-18	●	●	●	●
2013-07-02	●	●	●	●

Cross-sectional REDCap Project

Subject ID	Basic Demographics Baseline visit (Arm 1: Standard Protocol)	Visit Date and Notes Baseline visit (Arm 1: Standard Protocol)	Visit Date and Notes 6-month follow-up (Arm 1: Standard Protocol)	Visit Date and Notes 1y visit (Arm 1: Standard Protocol)	Delayed Discounting, \$1000 Baseline visit (Arm 1: Standard Protocol)	Delayed Discounting, \$1000 1y visit (Arm 1: Standard Protocol)	Delayed Discounting, \$100 Baseline visit (Arm 1: Standard Protocol)	Delayed Discounting, \$100 1y visit (Arm 1: Standard Protocol)
	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●

Longitudinal REDCap Project



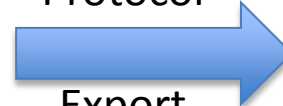
Multi-Modal Imaging



Upload



Protocol



Export



Sites Scans

T1, T2, DTI, rsfMRI,
ADNI/fBIRN Phantoms

Scans

Scan	Type	Series Desc	Usability
1	ncanda-localizer-v1	ncanda-localizer-v1	unknown
2	ncanda-calibration-v1	ncanda-calibration-v1	unknown
3	ncanda-t1spgr-v1	ncanda-t1spgr-v1	usable
4	ncanda-t2fse-v1	ncanda-t2fse-v1	usable
6	ncanda-dti6b500pepolar-v1	ncanda-dtib500pepolar-v1	usable
7	ncanda-dti60b1000-v1	ncanda-dtib1000-v1	usable
8	ncanda-grefieldmap-v1	ncanda-grefieldmap-v1	usable
9	ncanda-rsfmri-v1	ncanda-rsfmri-v1	usable

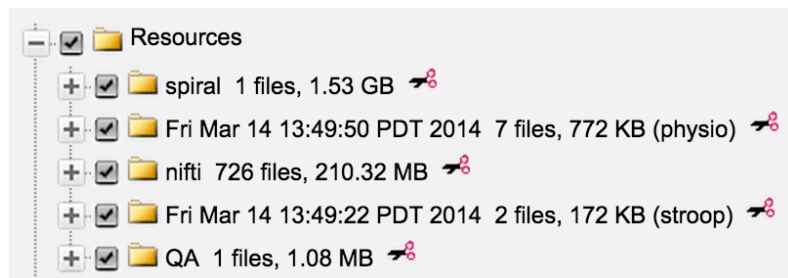
T1w MRI Scan Date	2015-05-28 Today Y-M-D
Date of T1w image acquisition	
Age at T1w MRI Scan	21.9416167911
* must provide value Age at T1w image acquisition	
DTI Scan Date	2015-05-28 Today Y-M-D
Date of DTI image acquisition	
Age at DTI MRI Scan	21.9416167911
* must provide value Age at DTI image acquisition	
Rs-fMRI Scan Date	2015-05-28 Today Y-M-D
Date of rs-fMRI image acquisition	
Age at rs-fMRI Scan	21.9416167911
* must provide value Age at rs-fMRI image acquisition	

Reading

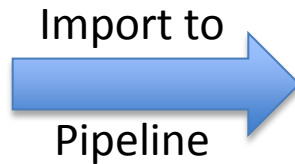
DateToDVD 2013-07-11
FindingsDate 2013-08-13
Findings normal

QA Flags (TO BE SET ONLY BY QA STAFF)

NIfTI
Conversion



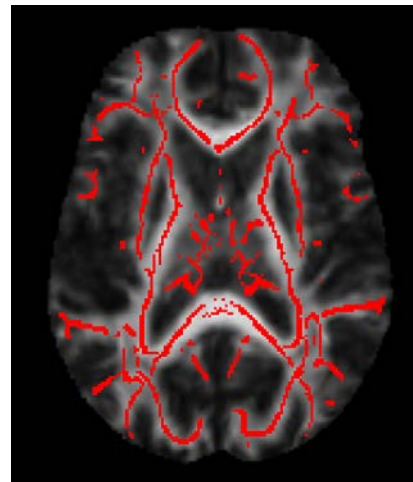
- Semi-automatic QA
- Neuroradiologist readings
- Hourly/nightly QA reports
- Event-based workflow to populate image processing pipeline



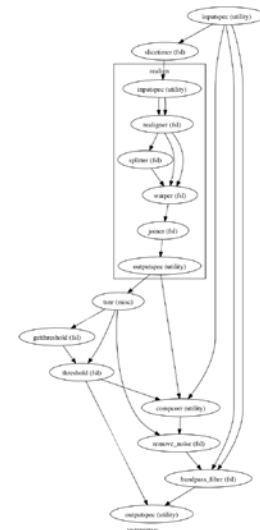
<http://www.nitrc.org/projects/lwdp>



Diffusion

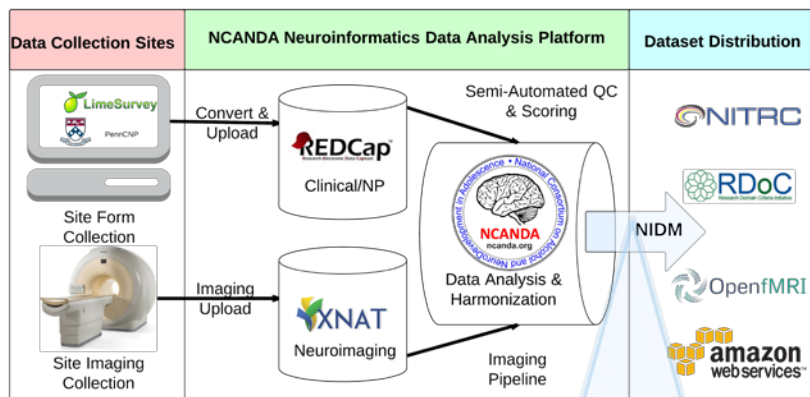


Resting State

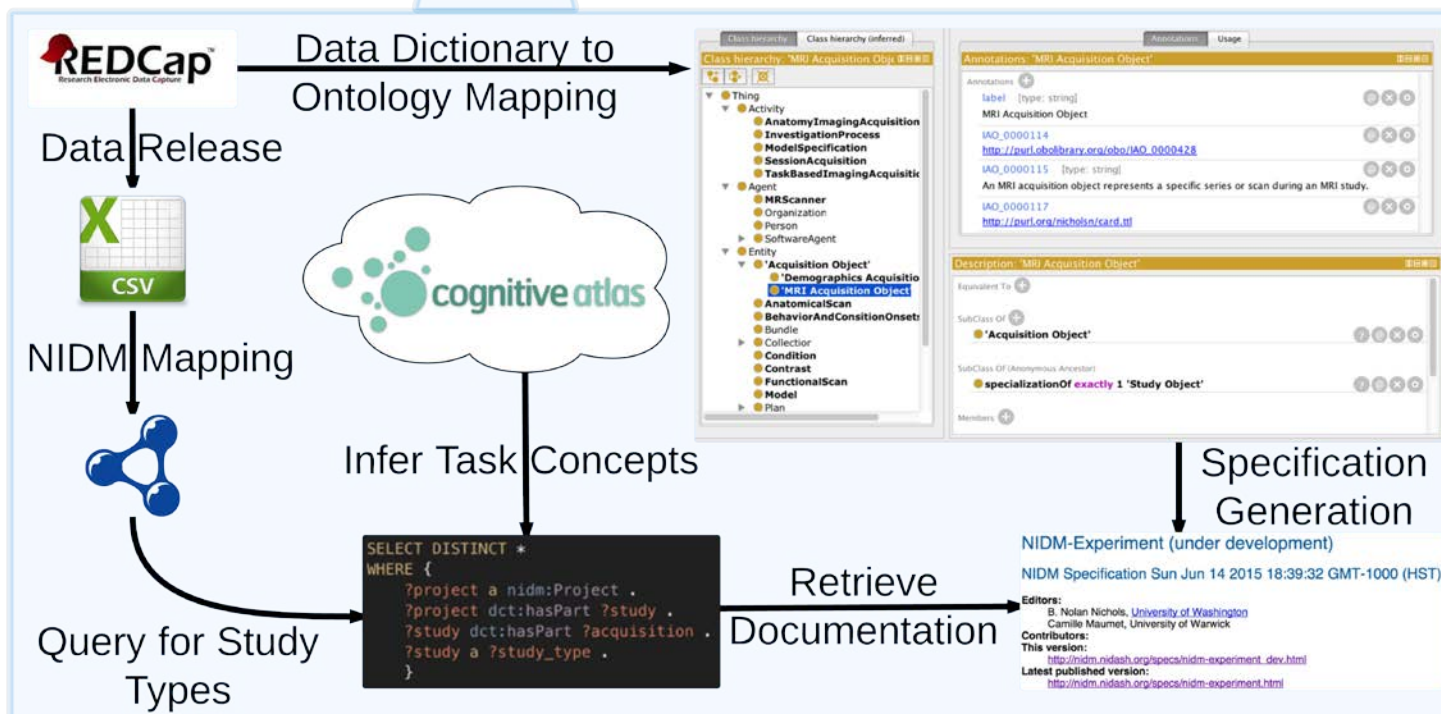


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Next Steps and Data Sharing

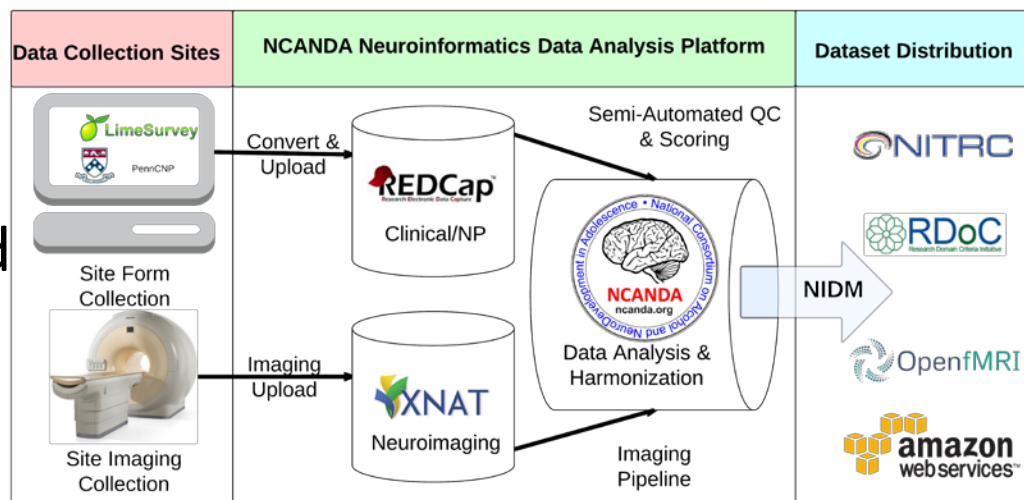


- Curated with REDCap data dictionaries
- Use Case for NIDM and BIDS Standards
- Adopt the NIDM process to curate data
- Develop object models of clinical, neuropsych, and imaging measures
- Demonstrate usage of NIDM for distributing NCANDA datasets



Conclusions and Lessons Learned

- The ecosystem of Neuroinformatics software for imaging studies is mature
- Neuroinformatics tools can be reused and extended to develop scalable Neuroinformatics platforms
- Early involvement of informaticians may be able to simplify system architecture using common platforms
- Version Control Systems are an innovative way to capture data asynchronously before a data management system implementation
- Demonstrated the reuse of neuroinformatics tools to provide data integration and analysis hub for a multi-site, longitudinal study on adolescent development



<https://www.nitrc.org/projects/ncanda-datacore>

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Data Analysis Component

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Dolf Pfefferbaum	



Data Sharing Task Force

Satra Ghosh
Chris Gorgolewski
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... and many others!

References

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<http://doi.org/10.1016/j.neuroimage.2013.05.094>