Introduction

* 1. ADNI purpose and motivation
     1. Natural history study of AD
     2. Development test bed for clinical trials
        1. Site selection is driven by clinical recruitment not imaging acumen
        2. FDA cleared sequences only
        3. (minor mention) MR as partner for PET
  2. ADNI MRI history and evolution of imaging 2004-2020
     1. ADNI-1: tightly focused on consistent structural imaging across vendors/models/sites – mostly 1.5T, some 3T; phantom per study. Very constant protocols. (Total imaging time?)
     2. ADNI-2: 3T focus, can you do acceleration and keep the performance on structural metrics holding geometry constant? Add one (or two HRH) “experimental” sequence per vendor – somewhat driven by who can do what sequences. Constant protocols except for N sites that switched vendors, HW failures etc. (Total imaging time about the same.)
     3. ADNI-3: Upgrade every sequence. Put all the experimental sequences on all the platforms. Bifurcation for the EPI sequences based on ability to accelerate.
  3. General neuro MR changes 2004-present
     1. Main field strength 1.5 -> 3.0T
     2. Gradients are often faster and stronger – may come with a trade-off of increased non-linearity and different artifacts
     3. Receiver channel counts increased
        1. Leads to more complexity in the reconstruction
        2. Different artifacts
  4. Importance of stable measures (light touch – serious discussion in companion paper)
     1. Cross sectional – combine across vendors/models
     2. Cross sectional – combine across major study revisions
     3. Cross sectional -- combine across studies
     4. Longitudinal – across vendor/model/software (MR doesn’t drive site selection)
     5. Longitudinal – across protocol changes

1. Materials and Methods
   1. ADNI-1,2/GO,3 enrollment
   2. MRI scanners: ADNI-1, 2/Go, 3.
      1. Big table: by field strength, head coil count, make and model. Possibly color coded by ADNI-phase or something else useful like “can run advanced protocol”
   3. MRI Sequences
      1. Big table of parameters or table per section or table per sequence?
      2. Images for gross anatomy (typical measures are “how much” and not contrast quantitation or MR telling you quantitative tissue properties, single acquired volume)
         1. T1-weighted MP-RAGE and IR-fSPGR. (may include info about workhorse utility for all anatomic alignments?)
            1. ADNI-1 significant effort to get MP-RAGE on all (1x1x1.2)
            2. ADNI-2 allow IR-FSPGR and introduce unacc/acc pairs (1x1x1.2 – even at 3T)
            3. ADNI-3 1x1x1
         2. T2->2DFLAIR ->3DFLAIR
            1. 3D FLAIR timing matched on T1/T2 arrays in phantom between 2DFLAIR and 3DFLAIR
         3. High Res Hippo
            1. T2-weighted – what did we do to control cross-vendor variability (I don’t remember – Bret? Arvin?)
      3. Images for local tissue properties
         1. T2\*GRE -> 3TE GRE
            1. ME GRE (re/im or mag/phase) to get SWI and QSM maps

Ref’s in the Chunlei’s stuff?

* + - * 1. Back compatible if you pick out the right echo time and only look at mag.
      1. Diffusion SE-EPI. (Evolution)
         1. Rob Reid?
      2. fMRI GR-EPI (Evolution)
         1. Began on Philips only in ADNI-2
         2. Moved onto all scanners

Siemens 32/64 channel systems w/ SMS licensing are running a faster TR.

Choice of fast vs higher spatial resolution

Philips artifacts and long term continuity suggested not changing to SMS there

SMS on GE?

* + - 1. ASL (all flavors)
         1. ADNI-2 was 3D PASL on Siemens only
         2. ADNI-3 was 2D PASL on older Philips; 3D PASL on Siemens, 3D pCASL (GRASE) on all GE and (SE?) pCASL on Philips
  1. Visual and Numeric QC
     1. This mirrors each of the sections under MRI sequences
  2. Processing
     1. This mirrors each of the sections under MRI sequences
  3. Visual Grading
     1. CMBs
     2. Infarcts (UCD is doing that?)

1. Results
   1. QC break down
   2. Visual Grading results
2. Discussion
   1. Change is inevitable (tending toward improvements)
   2. Cross-over in longitudinal studies w/o direct overlaps limits what you can measure