Re: Possible new MRI protocol

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

Thanks for letting me know.

P

Patrick D. Lyden, MD, FAAN, FAHA, FANA
Professor of Physiology and Neuroscience
Professor of Neurology
Zilkha Neurogenetic Institute
Keck School of Medicine of USC
Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Ryan Cabeen** | ryan.cabeen@loni.usc.edu Tuesday, Apr 6, 3:14 PM

To: **Patrick Lyden** | plyden@usc.edu

Hi Pat,

We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California

2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
>
> The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
>
> Thanks for letting me know.
>
> P
>
> Patrick D. Lyden, MD, FAAN, FAHA, FANA
> Professor of Physiology and Neuroscience
> Professor of Neurology
> Zilkha Neurogenetic Institute
> Keck School of Medicine of USC
> Room 245
> MC2821
> 1501 San Pablo Street
> Los Angeles, CA 90089-2821
> plyden@usc.edu

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?

Can you send me a snapshot of a RARE image?

Thanks.

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
>
> Hi Pat,
>
> We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
>
> The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
>
> Thanks for letting me know.
>
> P
>
> Patrick D. Lyden, MD, FAAN, FAHA, FANA
> Professor of Physiology and Neuroscience
> Professor of Neurology
> Zilkha Neurogenetic Institute
> Keck School of Medicine of USC
> Room 245
> MC2821
> 1501 San Pablo Street
> Los Angeles, CA 90089-2821
> plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 3:40 PM

To: **Patrick Lyden** | plyden@usc.edu

How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology

Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: cabeen.io
> >
> > > From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
> > >
> > > The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

> > Thanks for letting me know.
>
> P
>
> Patrick D. Lyden, MD, FAAN, FAHA, FANA
> Professor of Physiology and Neuroscience
> Professor of Neurology
> Zilkha Neurogenetic Institute
> Keck School of Medicine of USC
> Room 245
> MC2821
> 1501 San Pablo Street
> Los Angeles, CA 90089-2821
> plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 4:43 PM

To: **Cenk Ayata** | CAYATA@mgh.harvard.edu

FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM
>
> How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging

USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM

Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?

Can you send me a snapshot of a RARE image?

Thanks.

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM

Hi Pat,

We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

> > Thanks for letting me know.
> >
> > P
> >
> > Patrick D. Lyden, MD, FAAN, FAHA, FANA
> > Professor of Physiology and Neuroscience
> > Professor of Neurology
> > Zilkha Neurogenetic Institute
> > Keck School of Medicine of USC
> > Room 245
> > MC2821
> > 1501 San Pablo Street
> > Los Angeles, CA 90089-2821
> > plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 4:47 PM

To: **Patrick Lyden** | plyden@usc.edu

By the way, I'll send along images to compare the contrasts once I'm at a computer. The RARE is the shorter of the bunch, which is why we kept it in despite not having a guaranteed use for it (from what I understand)

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM

Hi Pat,

We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
>
> The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
>
> Thanks for letting me know.
>
> P
>
> Patrick D. Lyden, MD, FAAN, FAHA, FANA
> Professor of Physiology and Neuroscience
> Professor of Neurology
> Zilkha Neurogenetic Institute
> Keck School of Medicine of USC
> Room 245
> MC2821
> 1501 San Pablo Street
> Los Angeles, CA 90089-2821
> plyden@usc.edu

From: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu Tuesday, Apr 6, 6:08 PM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

Yes you are correct. I'll talk to him.

Cenk

Sent from my iPhone

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 7:44 PM
>
> **External Email - Use Caution**
>
> FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: http://cabeen.io
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM
> >
> > How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: http://cabeen.io

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM

Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?

Can you send me a snapshot of a RARE image?

Thanks.

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
>
> Hi Pat,
>
> We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: http://cabeen.io
>
> > From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
> >
> > The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
> >
> > Thanks for letting me know.
> >
> > P
> >
> > Patrick D. Lyden, MD, FAAN, FAHA, FANA
> > Professor of Physiology and Neuroscience
> > Professor of Neurology
> > Zilkha Neurogenetic Institute
> > Keck School of Medicine of USC

Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu Wednesday, Apr 7, 9:16 AM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

A couple thoughts:
1) We have mentioned at the MRI meeting to run a some RARE images through your skull stripping vie neural network approach, and see how well it agrees with the T2/ADC brain volume calculations. Can you do this sooner than later?
2) Dan Thedens said that their ADC is not very good. Have you noticed any problems with CSF/ventricle identifications using the thresholding on their MRIs?
Thanks,
Cenk

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 7:43 PM
>
> **External Email - Use Caution**
>
> FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: http://cabeen.io
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM
> >
> > How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: http://cabeen.io
> >
> > > From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

> > > > The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
> > > >
> > > > Thanks for letting me know.
> > > >
> > > > P
> > > >
> > > > Patrick D. Lyden, MD, FAAN, FAHA, FANA
> > > > Professor of Physiology and Neuroscience
> > > > Professor of Neurology
> > > > Zilkha Neurogenetic Institute
> > > > Keck School of Medicine of USC
> > > > Room 245
> > > > MC2821
> > > > 1501 San Pablo Street
> > > > Los Angeles, CA 90089-2821
> > > > plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 9:54 AM

To: **Patrick Lyden** | plyden@usc.edu

Hi Pat,

Here are some images comparing RARE with the other T2 and ADC derived contrasts, with examples from each site. The T2 and ADC scans actually give us two contrasts each, the “base” for baseline and “rate” for the decay rate. The files are named accordingly.

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 4:47 PM

By the way, I'll send along images to compare the contrasts once I'm at a computer. The RARE is the shorter of the bunch, which is why we kept it in despite not having a guaranteed use for it (from what I understand)

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu

Web: cabeen.io

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

Thanks for letting me know.

P

Patrick D. Lyden, MD, FAAN, FAHA, FANA
Professor of Physiology and Neuroscience
Professor of Neurology
Zilkha Neurogenetic Institute
Keck School of Medicine of USC
Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 10:01 AM

To: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu

Hi Cenk,

For 1) I think this is a good idea, but it actually would require changing the approach slightly and redoing the neural network training. Presently the input to the network is a set of four images: the T2 baseline and rate, and the ADC baseline and rate. I think the idea of training will the RARE is interesting and worth doing, but just an FYI about the additional effort.

For 2) Maybe his comment was just about the motion from the rat stage two pilot scan? I think the issue there was that they didn't have a proper restraint, but will get one soon? Otherwise, the stage one ADC scans from Iowa are reasonably good and comparable to MGH and UT and JHU.

One more observation is that there is inhomogeneity of the image signal in the RARE, which the T2 and ADC scans can mitigate to some degree. This is especially clear from Yale data, since they use a surface coil, so the RARE has some dropout in the temporal lobe, which the adc_rate and t2_rate can fill out to some degree. Attached are some example images of all the contrasts from each site, in case they are helpful.

Ryan P. Cabeen, PhD

Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **CAYATA@mgh.harvard.edu** Wednesday, Apr 7, 9:16 AM
>
> A couple thoughts:
> 1) We have mentioned at the MRI meeting to run a some RARE images through your skull stripping vie neural network approach, and see how well it agrees with the T2/ADC brain volume calculations. Can you do this sooner than later?
> 2) Dan Thedens said that their ADC is not very good. Have you noticed any problems with CSF/ventricle identifications using the thresholding on their MRIs?
> Thanks,
> Cenk
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 7:43 PM
> >
> > **External Email - Use Caution**
> >
> > FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: http://cabeen.io
> >
> > > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM

How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu

Web: http://cabeen.io

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

Thanks for letting me know.

P

Patrick D. Lyden, MD, FAAN, FAHA, FANA
Professor of Physiology and Neuroscience
Professor of Neurology
Zilkha Neurogenetic Institute
Keck School of Medicine of USC
Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 10:22 AM

To: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu

Hi Cenk,

For 1) I think this is a good idea, but it actually would require changing the approach slightly and redoing the neural network training. Presently the input to the network is a set of four images: the T2 baseline and rate, and the ADC baseline and rate. I think the idea of training will the RARE is interesting and worth doing, but just an FYI about the additional effort.

For 2) Maybe his comment was just about the motion from the rat stage two pilot scan? I think the issue there was that they didn't have a proper restraint, but will get one soon? Otherwise, the stage one ADC scans from Iowa are reasonably good and comparable to MGH and UT and JHU.

One more observation is that there is inhomogeneity of the image signal in the RARE, which the T2 and ADC scans can mitigate to some degree. This is especially clear from Yale data, since they use a surface coil, so the RARE has some dropout in the temporal lobe, which the adc_rate and t2_rate can fill out to some degree. Let me know if it would be helpful to have some images showing the contrasts from some example scans too

Ryan P. Cabeen, PhD

Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **CAYATA@mgh.harvard.edu** Wednesday, Apr 7, 9:16 AM
>
> A couple thoughts:
> 1) We have mentioned at the MRI meeting to run a some RARE images through your skull stripping vie neural network approach, and see how well it agrees with the T2/ADC brain volume calculations. Can you do this sooner than later?
> 2) Dan Thedens said that their ADC is not very good. Have you noticed any problems with CSF/ventricle identifications using the thresholding on their MRIs?
> Thanks,
> Cenk
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 7:43 PM
> >
> > **External Email - Use Caution**
> >
> > FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: http://cabeen.io
> >
> > > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM

How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu

Web: http://cabeen.io

From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

Thanks for letting me know.

P

Patrick D. Lyden, MD, FAAN, FAHA, FANA
Professor of Physiology and Neuroscience
Professor of Neurology
Zilkha Neurogenetic Institute
Keck School of Medicine of USC
Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu Wednesday, Apr 7, 11:17 AM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

1) The question is whether we can rely on RARE alone for brain volume on day 30. Fahmeed thinks we can, and I asked him about the surface coil issue and he did not think it would cause a problem. But you have the images and can test. I also told him and Pat that neural network would have to be retrained which takes time. But if we can get away by just doing a RARE on day 30 (~5 min) rather than the full scan (~35 min), it will save a s..t load of time and money for all the sites; perhaps cutting the cost by almost 30-40%. And if they want, sites could use the time they saved to run additional sequences for their own research interests. So the time it would take to retrain would be amply repaid at the network level. Of course your time will not be amply compensated. But this could also be a valuable addition to the paper.

2) OK, thanks.

C

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 1:22 PM

Hi Cenk,

For 1) I think this is a good idea, but it actually would require changing the approach slightly and redoing the neural network training. Presently the input to the network is a set of four images: the T2 baseline and rate, and the ADC baseline and rate. I think the idea of training will the RARE is interesting and worth doing, but just an FYI about the additional effort.

For 2) Maybe his comment was just about the motion from the rat stage two pilot scan? I think the issue there was that they didn't have a proper restraint, but will get one soon? Otherwise, the stage one ADC scans from Iowa are reasonably good and comparable to MGH and UT and JHU.

One more observation is that there is inhomogeneity of the image signal in the RARE, which the T2 and ADC scans can mitigate to some degree. This is especially clear from Yale data, since they use a surface coil, so the RARE has some dropout in the temporal lobe, which the adc_rate and t2_rate can fill out to some degree. Let me know if it would be helpful to have some images showing the contrasts from some example scans too

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **CAYATA@mgh.harvard.edu** Wednesday, Apr 7, 9:16 AM
>
> A couple thoughts:
> 1) We have mentioned at the MRI meeting to run a some RARE images through your skull stripping vie neural network approach, and see how well it agrees with the T2/ADC brain volume calculations. Can you do this sooner than later?
> 2) Dan Thedens said that their ADC is not very good. Have you noticed any problems with CSF/ventricle identifications using the thresholding on their MRIs?
> Thanks,
> Cenk
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 7:43 PM
> >
> > **External Email - Use Caution**

FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM
>
> How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: http://cabeen.io
>
> > From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
> >
> > Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
> >
> > Can you send me a snapshot of a RARE image?
> >
> > Thanks.
> >
> > > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM

Hi Pat,

We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
>
> The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
>
> Thanks for letting me know.
>
> P
>
> Patrick D. Lyden, MD, FAAN, FAHA, FANA
> Professor of Physiology and Neuroscience
> Professor of Neurology
> Zilkha Neurogenetic Institute
> Keck School of Medicine of USC
> Room 245
> MC2821
> 1501 San Pablo Street
> Los Angeles, CA 90089-2821
> plyden@usc.edu

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 11:59 AM

To: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu

The savings do sound incredible. I think it's still an open question if RARE alone will work robustly across the dataset though, and we need to run some experiments to be sure.

For brain segmentation, I think the neural network will probably work fine, but it will take time to retool things (the code needs to be changed in addition re-running the training). I also worry about the addition of rats, since we may need a separate module for them, and I needed the ADC scan as a reference to train the network, even if we ultimately only use the RARE in practice. But I can try the mouse pipeline on the stage two pilot to see how it works out.

The other important issue is CSF segmentation, which I am less optimistic about with the RARE. Attached are examples of RAREs from each site, where you can see the variability in CSF/tissue contrast. I think the signal inhomogeneity is a bigger challenge for the algorithm than our eyes (fyi, these scans already include some bias field correction). For example, if you look at the UT scan, you can see that dorsal cortical surface has signal that is just as bright as CSF, and in the YL scan, the CSF is barely discernible in some parts.

So given that, I wonder if maybe RARE + ADC for second timepoint could be a good compromise?

One more consideration, if we use different sequences for the early and late timepoint, it might be hard to compare them quantitatively. Do you think we will need to make direct comparison between early and late scans? Continuing to collect RARE at the first timepoint would address that issue, I suppose.

Do we happen to have the timeline with deciding on these changes to the protocol? It will take time to run these tests, and that will help me plan accordingly

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **CAYATA@mgh.harvard.edu** Wednesday, Apr 7, 11:17 AM
>
> 1) The question is whether we can rely on RARE alone for brain volume on day 30. Fahmeed thinks we can, and I asked him about the surface coil issue and he did not think it would cause a problem. But you have the images and can test. I also told him and Pat that neural network would have to be retrained which takes time. But if we

can get away by just doing a RARE on day 30 (~5 min) rather than the full scan (~35 min), it will save a s..t load of time and money for all the sites; perhaps cutting the cost by almost 30-40%. And if they want, sites could use the time they saved to run additional sequences for their own research interests. So the time it would take to retrain would be amply repaid at the network level. Of course your time will not be amply compensated. But this could also be a valuable addition to the paper.

2) OK, thanks.

C

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 1:22 PM
>
> **External Email - Use Caution**
>
> Hi Cenk,
>
> For 1) I think this is a good idea, but it actually would require changing the approach slightly and redoing the neural network training. Presently the input to the network is a set of four images: the T2 baseline and rate, and the ADC baseline and rate. I think the idea of training will the RARE is interesting and worth doing, but just an FYI about the additional effort.
>
> For 2) Maybe his comment was just about the motion from the rat stage two pilot scan? I think the issue there was that they didn't have a proper restraint, but will get one soon? Otherwise, the stage one ADC scans from Iowa are reasonably good and comparable to MGH and UT and JHU.
>
> One more observation is that there is inhomogeneity of the image signal in the RARE, which the T2 and ADC scans can mitigate to some degree. This is especially clear from Yale data, since they use a surface coil, so the RARE has some dropout in the temporal lobe, which the adc_rate and t2_rate can fill out to some degree. Let me know if it would be helpful to have some images showing the contrasts from some example scans too
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: cabeen.io

From: **CAYATA@mgh.harvard.edu** Wednesday, Apr 7, 9:16 AM

A couple thoughts:
1) We have mentioned at the MRI meeting to run a some RARE images through your skull stripping vie neural network approach, and see how well it agrees with the T2/ADC brain volume calculations. Can you do this sooner than later?
2) Dan Thedens said that their ADC is not very good. Have you noticed any problems with CSF/ventricle identifications using the thresholding on their MRIs?
Thanks,
Cenk

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 7:43 PM
>
> **External Email - Use Caution**
>
> FYI in the copied thread, Pat is asking about removing ADC and T2 scans, maybe due to some miscommunication? I gathered we were discussing dropping the RARE, right?
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: http://cabeen.io
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:40 AM
> >
> > How odd, thanks for clarifying. Perhaps I'll email him and Cenk to get in the same page?
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033

Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: http://cabeen.io
> >
> > > From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM
> > >
> > > The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.
> > >
> > > Thanks for letting me know.
> > >
> > > P

Patrick D. Lyden, MD, FAAN, FAHA, FANA
Professor of Physiology and Neuroscience
Professor of Neurology
Zilkha Neurogenetic Institute
Keck School of Medicine of USC
Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Patrick Lyden** | plyden@usc.edu Wednesday, Apr 7, 2:23 PM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

Fascinating, thank you.

> From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Wednesday, Apr 7, 9:54 AM
>
> Hi Pat,
>
> Here are some images comparing RARE with the other T2 and ADC derived contrasts, with examples from each site. The T2 and ADC scans actually give us two contrasts each, the “base” for baseline and “rate” for the decay rate. The files are named accordingly.
>
> Ryan P. Cabeen, PhD
> Chan Zuckerberg Imaging Scientist
> Assistant Professor of Research Neurology
> Laboratory of Neuro Imaging
> USC Stevens Neuroimaging and Informatics Institute
> Keck School of Medicine of USC
> University of Southern California
> 2025 Zonal Ave.
> Los Angeles, CA 90033
> Tel: (323) 44-BRAIN
> Email: rcabeen@loni.usc.edu
> Web: cabeen.io
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Tuesday, Apr 6, 4:47 PM
> >
> > By the way, I’ll send along images to compare the contrasts once I’m at a computer. The RARE is the shorter of the bunch, which is why we kept it in despite not having a guaranteed use for it (from what I understand)

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: http://cabeen.io

> From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:32 PM
>
> Interesting. Fahmeed was clear on this: everything you need is in the RARE. Which sequence takes longer?
>
> Can you send me a snapshot of a RARE image?
>
> Thanks.
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu To: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:15 PM
> >
> > Hi Pat,
> >
> > We had an MRI call this morning, and we discussed this change, and I think they might actually be imagining it the other way around. That is, the RARE would be dropped, leaving only the ADC and T2 scans. That works on the analytics side, as the RARE isn't used for anything at the moment. Happy to discuss more if that's helpful
> >
> > Ryan P. Cabeen, PhD
> > Chan Zuckerberg Imaging Scientist
> > Assistant Professor of Research Neurology
> > Laboratory of Neuro Imaging
> > USC Stevens Neuroimaging and Informatics Institute
> > Keck School of Medicine of USC
> > University of Southern California
> > 2025 Zonal Ave.
> > Los Angeles, CA 90033
> > Tel: (323) 44-BRAIN
> > Email: rcabeen@loni.usc.edu
> > Web: http://cabeen.io
> >
> > > From: **Patrick Lyden** | plyden@usc.edu Tuesday, Apr 6, 3:00 PM

The mri committee asked me a question about the Day 30 MRI (aka Day28). There is a sequence called RARE. Can you get the morphometrics (hemisphere volume, lesion volume) from the RARE sequence alone? If you can then we can delet th ADC and T2 and insert some other things.

Thanks for letting me know.

P

Patrick D. Lyden, MD, FAAN, FAHA, FANA
Professor of Physiology and Neuroscience
Professor of Neurology
Zilkha Neurogenetic Institute
Keck School of Medicine of USC
Room 245
MC2821
1501 San Pablo Street
Los Angeles, CA 90089-2821
plyden@usc.edu

From: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu Wednesday, Apr 7, 2:51 PM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

These concerns are too numerous, my instinct is that the trade off is pretty even and does not clearly favor the proposed change. We should debate. I will arrange a chat between us and Fahmeed, who brought up RARE-only day 30 scan. You can lay out all these concerns with examples. I hope you don't mind another zoom… I will circulate some dates/times.
Cenk

From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 2:59 PM

<YL_AM3680_late_rare_anatomy.png>

From: **Ryan Cabeen** | ryan.cabeen@loni.usc.edu Wednesday, Apr 7, 2:58 PM

To: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu

Thanks, glad to share these in another zoom chat. I'm actually enthusiastic about the idea of using only RARE with some deep learning magic, but also cautious about backing ourselves into a corner...

Ryan P. Cabeen, PhD
Chan Zuckerberg Imaging Scientist
Assistant Professor of Research Neurology
Laboratory of Neuro Imaging

USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **CAYATA@mgh.harvard.edu** Wednesday, Apr 7, 2:51 PM
>
> These concerns are too numerous, my instinct is that the trade off is pretty even and does not clearly favor the proposed change. We should debate. I will arrange a chat between us and Fahmeed, who brought up RARE-only day 30 scan. You can lay out all these concerns with examples. I hope you don't mind another zoom… I will circulate some dates/times.
> Cenk
>
> > From: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Wednesday, Apr 7, 2:59 PM
> >
> > <YL_AM3680_late_rare_anatomy.png>
