



# Real-world applications of Artificial Intelligence in pre-dementia diagnostics and treatment administration



Esten H. Leonardsen

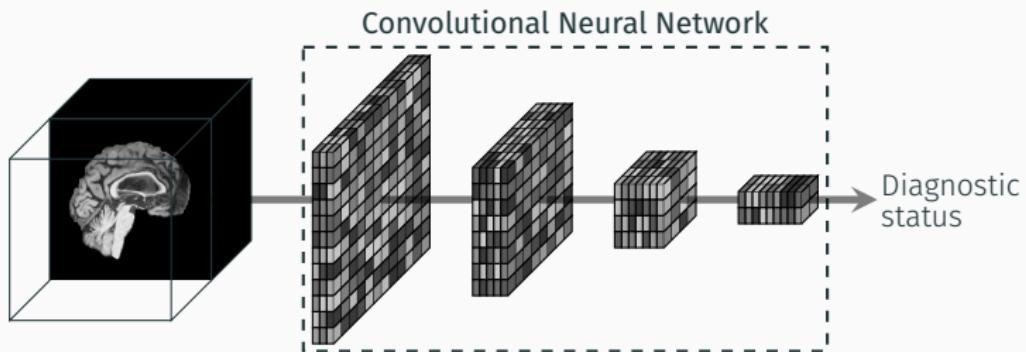
Chief Scientific Officer, baba.vision

Post-doc at the Department of  
Psychology, Universitet i Oslo

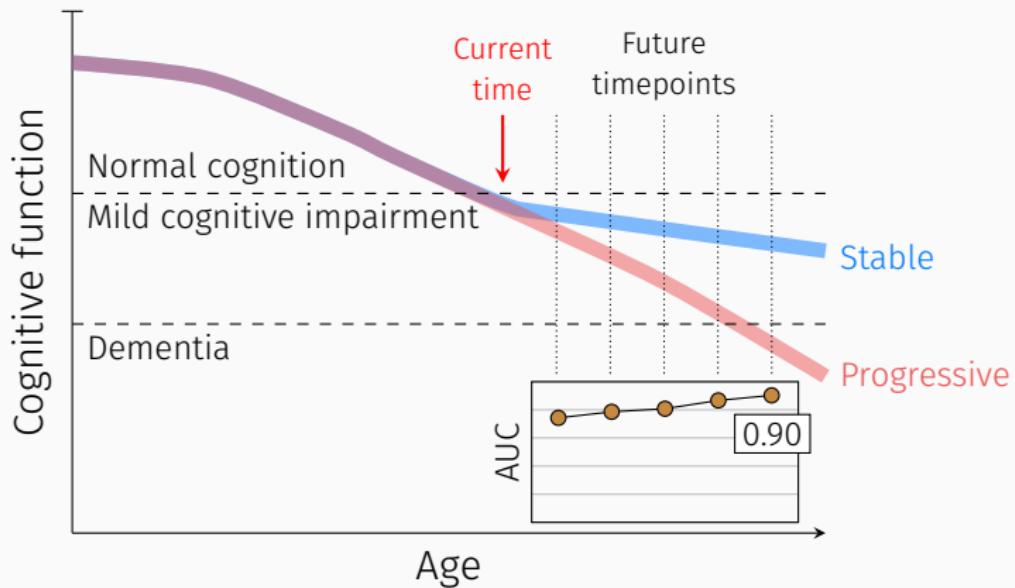


baba.vision

# Background



# Background



# Background

## Deep neural networks learn general and clinically relevant representations of the ageing brain

*Deep neural networks learn general and clinically relevant representations of the ageing brain*, Leonardsen et al., 2022. *NeuroImage*, 256, 119210

linked to cognitive performance in multiple domains. While further validations in clinical contexts are needed, our XAI pipeline for dementia demonstrates how advanced predictive technology can be employed by clinicians to monitor and characterize disease development for individual patients.

*Constructing personalized characterizations of structural brain aberrations in patients with dementia using explainable artificial intelligence*,  
Leonardsen et al., 2024. *npj Digital Medicine*, 7(1), 110

# Background

 estenhl Merge pull request #26 from estenhl/packaging ··· 7671d00 · 4 months ago 123 Commits

 citations	Finished READMEs for now	9 months ago
 docker	Updated docker containers, small linting fixes, fixed bug ...	9 months ago
 notebooks	Updated docker containers, small linting fixes, fixed bug ...	9 months ago
 preprocessing	Finished models, pre/postprocessing and example from ...	10 months ago
 pyment	Tried moving data folder (although I don't want to)	5 months ago
 scripts	Updated docker containers, small linting fixes, fixed bug ...	9 months ago
 tests	Removed redundant data folder	5 months ago
 .gitignore	More tests and comments, modified README	9 months ago
 CHANGELOG.md	More tests and comments, modified README	9 months ago
 LICENSE.md	Added license and citation	2 years ago
 README.md	Finished READMEs for now	9 months ago
 requirements.txt	Fixed docker containers	10 months ago
 setup.py	Tried moving data folder (although I don't want to)	5 months ago

No description, website, or topics provided.

 Readme  
 View license  
 Activity  
 33 stars  
 2 watching  
 15 forks  
Report repository

**Releases** 2

 v2.0.0 (Latest) on Feb 17, 2023 + 1 release

**Packages**  
No packages published

**Languages**

 jupyter Notebook 99.5%  Other 0.5%

This is a repository containing pretrained models for neuroimaging data used in various scientific publications. The publications are listed [here](#), and all the models are listed [here](#). After version 3.0.0 the nature of this repo changed, a description of which can be found in the [changelog](#). The models posted here try to mimic the behaviour and interface of the [pretrained models in the Keras applications package](#). Besides the possibility of importing this library in Python and interacting with the models as Python-objects, we demonstrate three use cases for interaction here:

- [Jupyter notebooks](#)
- [Command-line scripts](#)
- [Docker containers](#)

<https://github.com/estenhl/pyment-public>

# Background

1. Showcase the **general efficacy** of artificial intelligence for demonstrative clinical use-cases

## Background

1. Showcase the **general efficacy** of artificial intelligence for demonstrative clinical use-cases
2. Build predictive models to solve specific **real-world clinical problems** using **commercially available data**
3. Ensure the **robustness and utility** of the models through extensive validation
4. Collaborate with clinicians to package the models in **user-friendly interfaces** integrating smoothly into **standardized clinical workflows**

# Background



**Per Wessel Nore**  
CEO baba.vision

# Background



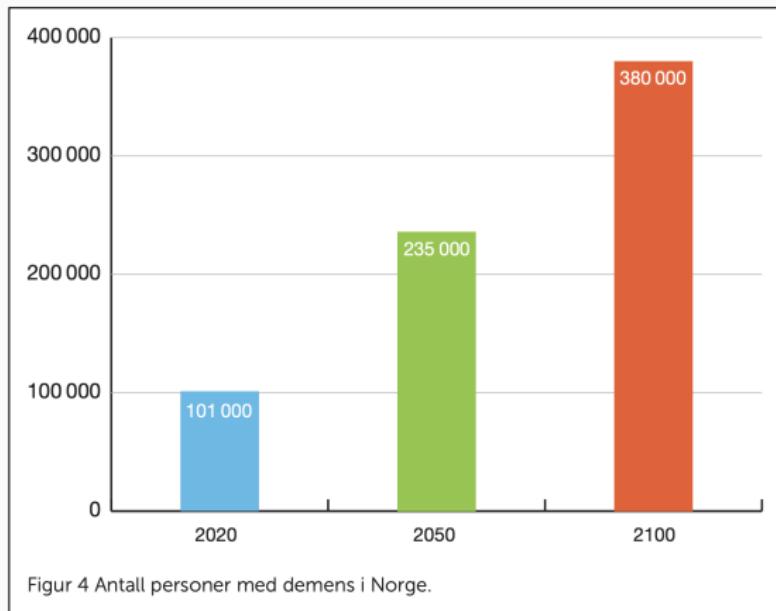
Per Wessel Nore  
CEO babavision



# Decision support for neuroradiological examinations in dementia pre-diagnosis

---

# Neuroradiological decision support



# Neuroradiological decision support



"However, in practice, this [referral for neuroimaging] concerns a very small number of patients, judiciously selected, as to not overwhelm the radiology services which was commented upon as being *exceptionally limited and often available off-site in another larger regional hospital!*"

# Neuroradiological decision support

	1	2	3	4	5
1	38	273	17	4	0
2	0	92	144	12	0
3	0	6	89	31	2
4	0	0	3	19	5
5	0	0	0	0	5

# Neuroradiological decision support

Generate draft report with AI

MRI-Scans / 2024-09-16 MRI T1 Subject: "Bibi"

**Navigator**

- MRI-scans
- Reports
- Individuals

**Brian Age** 80 +11.01%

**Dementia index** 7/10 -0.03%

**Microhemorrhages** 5

**Total volume change (ml)** -5,1 -0.5%

**Subject data**

Age	75
Sex	M
CDR	1
MMSE	24
...	...
...	...

**AI model observation**

**Visual rating scores**

MTA		
CGA		
Fazekas		
PSMD		0.5
CAA		

**Probable pathologies**

Vascular dementia	
Lewy body dementia	
Alzheimer	

**Volumes (ml)**

Cerebral matter G&W	980 ml
Cerebral cortex	520 ml
Brain tissue WMH	9.5 ml
Hippocampus (L/R)	2.4/2.2 ml
Lateral ventricle (L/R)	32.4/33.2 ml

**Image history**

- MRI scan (T1, T2, PD) today, 11:59 AM
- MRI scan (T1, T2, PD) Sep 4, 2024
- MRI scan (T1, T2, PD) Feb 2, 2024
- PET scan Feb 2, 2024

baba.vision

# Treatment response prediction and monitoring of patients on anti-amyloid therapies

---

# Treatment response and monitoring

 EUROPEAN MEDICINES AGENCY  
SCIENCE MEDICINES HEALTH

Medicines ▾ Human regulatory ▾ Veterinary regulatory ▾ Committees ▾ News & events ▾ Partners & networks ▾ About us ▾

Home > News > Leqembi recommended for treatment of early Alzheimer's disease



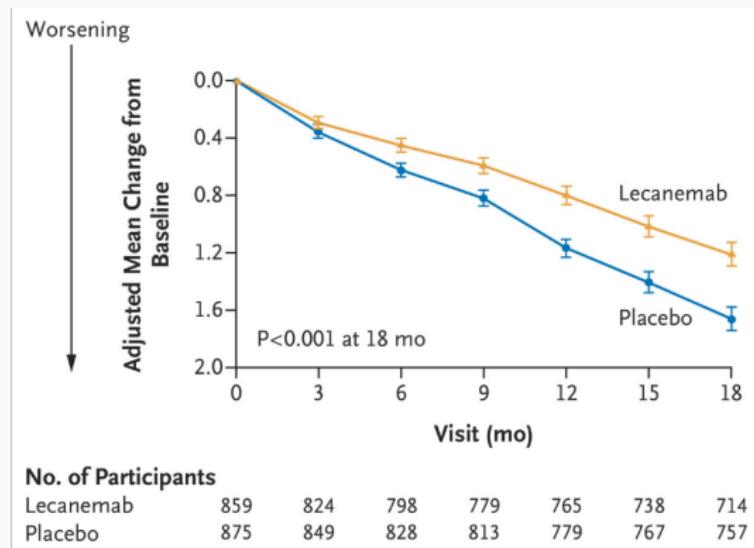
## Leqembi recommended for treatment of early Alzheimer's disease

14 November 2024

Re-examination concludes that benefits outweigh risks in a restricted patient population

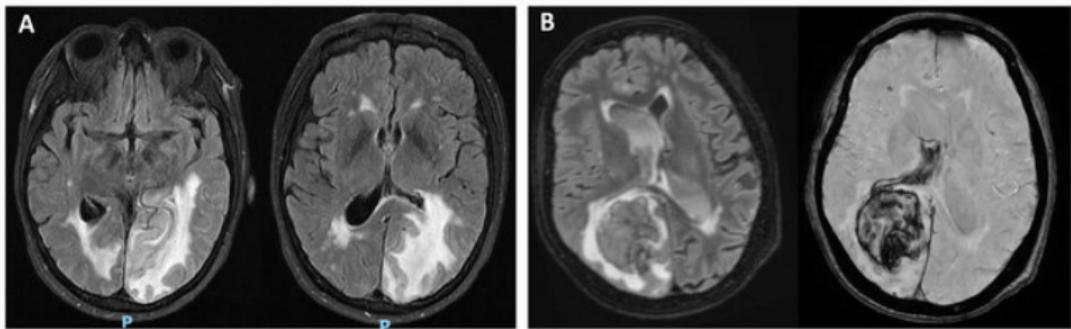
News Human Medicines

# Treatment response and monitoring



Van Dyck, C. H., Swanson, C. J., Aisen, P., Bateman, R. J., Chen, C., Gee, M., ... & Iwatsubo, T. (2023). Lecanemab in early Alzheimer's disease. *New England Journal of Medicine*, 388(1), 9-21.

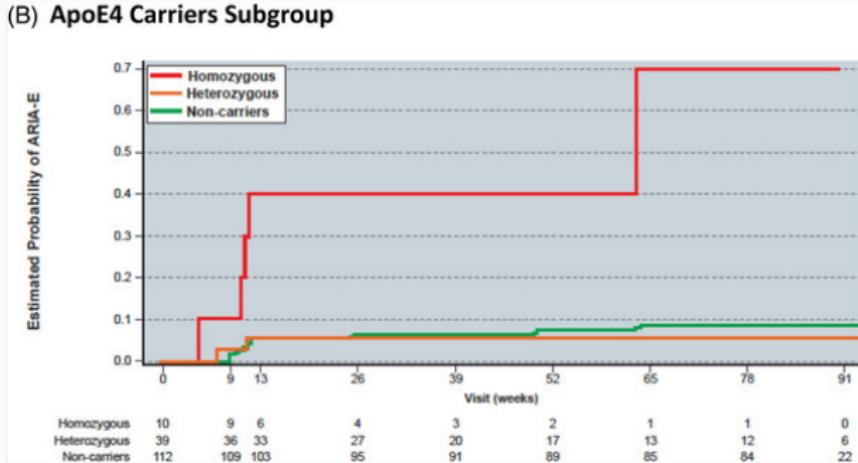
# Treatment response and monitoring



Villain, N., Planche, V., & Levy, R. (2022). High-clearance anti-amyloid immunotherapies in Alzheimer's disease. Part 1: Meta-analysis and review of efficacy and safety data, and medico-economical aspects. *Revue neurologique*, 178(10), 1011-1030.

# Treatment response and monitoring

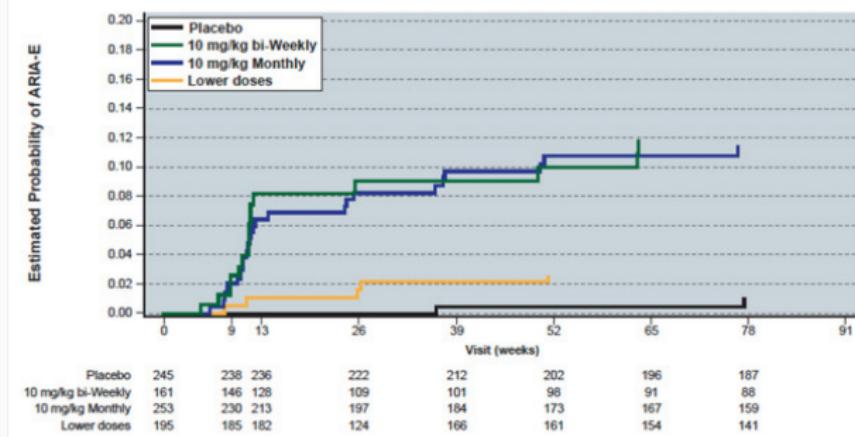
(B) ApoE4 Carriers Subgroup



Honig, L. S., Barakos, J., Dhadda, S., Kanekiyo, M., Reyderman, L., Irizarry, M., ... & Sabbagh, M. (2023). ARIA in patients treated with lecanemab (BAN2401) in a phase 2 study in early Alzheimer's disease. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 9(1), e12377.

# Treatment response and monitoring

## (A) Overall Population

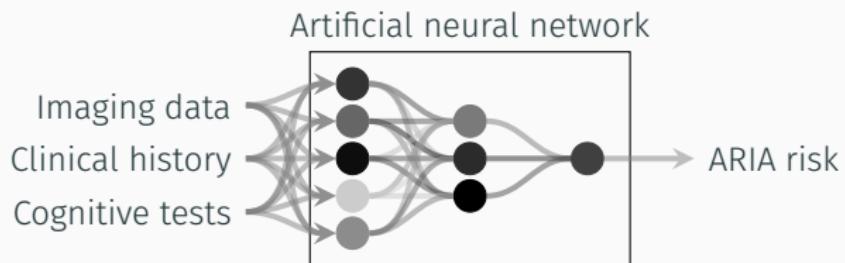


Honig, L. S., Barakos, J., Dhadda, S., Kanekiyo, M., Reyderman, L., Irizarry, M., ... & Sabbagh, M. (2023). ARIA in patients treated with lecanemab (BAN2401) in a phase 2 study in early Alzheimer's disease. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 9(1), e12377.

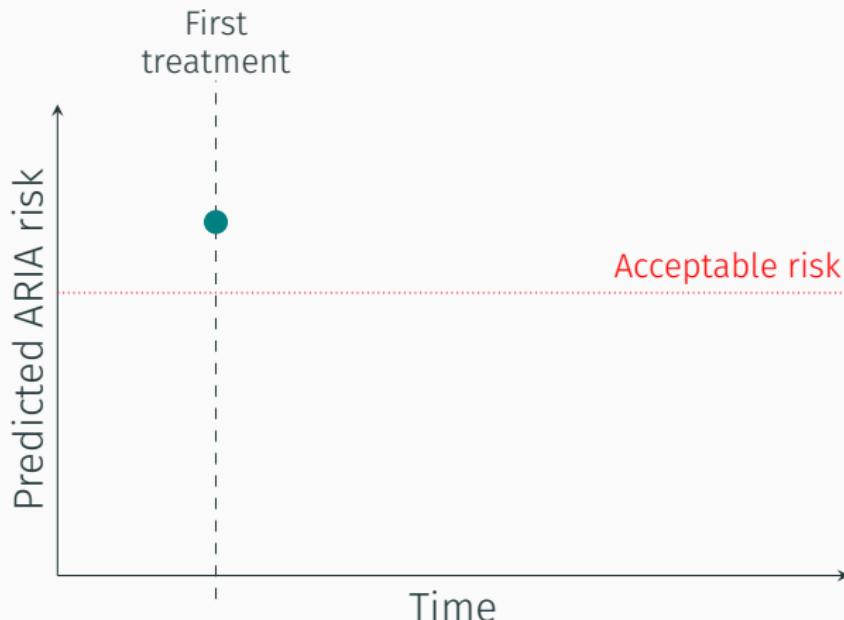
# Treatment response and monitoring

"MRI-based exclusion criteria of the lecanemab phase 3 (CLARITY AD) study included a history of any CNS macrohemorrhage >10 mm in diameter, more than 4 microhemorrhages (<10 mm in diameter), evidence of superficial siderosis, evidence of brain vasogenic edema, significant white matter hyperintensities, multiple lacunar strokes, or any cerebral strokes involving a major vascular territory. Evidence of cerebral contusion, encephalomalacia, brain aneurysms or other vascular malformations, central nervous system (CNS) infection, and brain tumors other than meningioma or arachnoid cysts excluded patients from phase 3 trial participation. **These same restrictions should apply when considering patients for treatment with lecanemab.** MRI evidence of underlying CAA-ri/ABRA or other conditions placing patients at risk for ARIA as well as more serious forms of ARIA should exclude patients as treatment candidates."

# Treatment response and monitoring



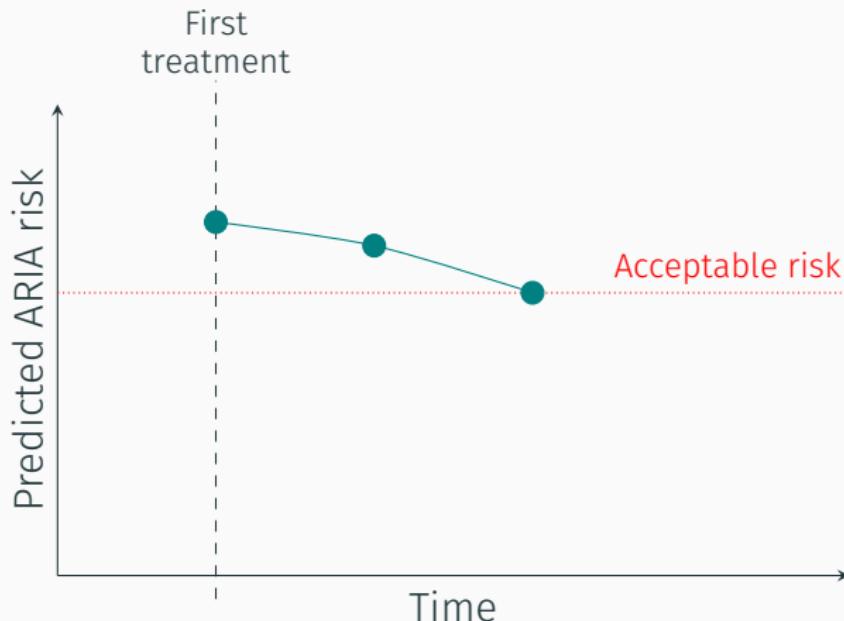
# Treatment response and monitoring



## Treatment response and monitoring

"We recommend obtaining MRIs after the **5th, 7th, and 14th infusions** as outlined in the PI. We recommend an additional week 52 (i.e., before the 26th infusion) MRI scan, especially for APOE4 carriers and those with evidence of ARIA on earlier MRIs."

# Treatment response and monitoring



# Treatment response and monitoring

**SAMPLE**  
**ARIA-H Report**

icobrain aria  
by comatrix

NAME: icobrain aria DATE OF BIRTH: 1952-01-01 STUDY DATES: 2018-02-06 - 2018-11-21 ID: IOC ID:

STATUS: Intermediate REMARKS: Not for clinical use.

2018-02-06 2018-11-21 2018-11-21

**Microhemorrhages**

NEW COUNT	EVALUATED SEVERITY
6	Moderate

Frontal Lobe	Left (count)	Right (count)
0	0	0
Parietal Lobe	0	0
Occipital Lobe	0	0
Temporal Lobe	0 + 6	0

Total (count)
0

Cerebellum	0
Other	0

Whole Brain	0 + 6
-------------	-------

**Superficial Siderosis**

NEW COUNT	EVALUATED SEVERITY
0	None

Frontal Lobe	Left (count)	Right (count)
0	0	0
Parietal Lobe	0	0
Occipital Lobe	0	0
Temporal Lobe	0	0

Total (count)
0

Cerebellum	0
Other	0

Whole Brain	0
-------------	---

**Severity**

- No new incidents
- Less than 5 new incidents
- 5 to 9 new incidents
- 10 or more new incidents
- New incidents

**Note:** In benchmark mode, automated measurements for patients with estimated MILD or SEVERE Microhemorrhages. Severity test, an average, the following scores were used: 0 = No new microhemorrhages, and 5.5 = New positive new microhemorrhages.

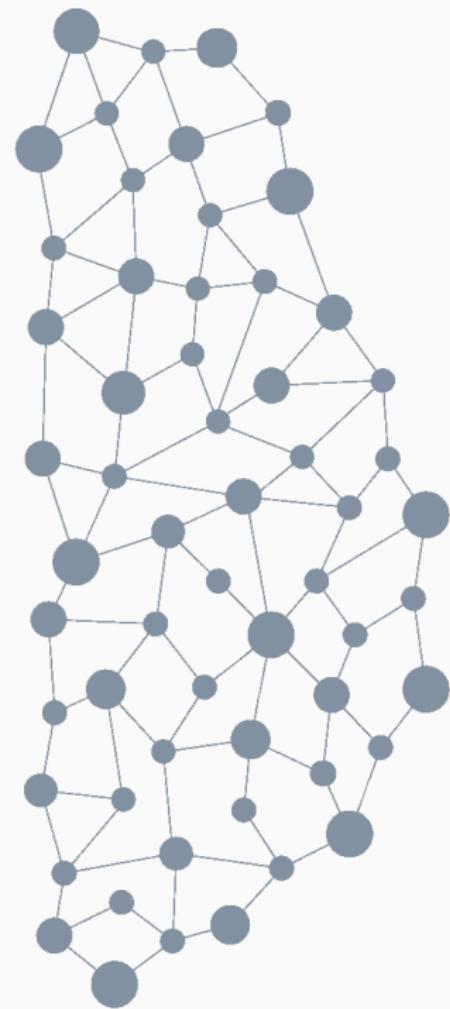
**Severity**

- No new areas
- 1 new area
- 2 new areas
- More than 2 new areas
- New incidents

**Note:** In benchmark mode, automated measurements for patients with estimated ICONE Superficial Siderosis Severity test, an average, the following scores were used: 0 = No new superficial siderosis sites, and 5.5 = New superficial siderosis sites.

To be used only with a radiological report. Please consult the HCP manual for additional guidance.  
Please visit [www.aria-h.com](http://www.aria-h.com), call the USA toll-free [1-888-222-2222](tel:18882222222) or contact [support@aria-h.com](mailto:support@aria-h.com) for more information. Pending regulatory approval.

© 2023 icobrain aria. All rights reserved. [www.aria-h.com](http://www.aria-h.com) Version 1.0.1 | 2/2



Thank you for your attention!  
[esten@baba-vision.com](mailto:esten@baba-vision.com)