

# Same Brain, Different Scanners – Bridging Clinical & Research MRI Through Harmonisation

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When routine clinical MRI has sufficient resolution and contrast, harmonised processing pipelines can produce robust research-grade measures from routine scans, increasing their value for research and clinical translation.

## BACKGROUND & AIM

- Routine clinical MRI is acquired for diagnosis and is less standardised across sites.
- Because these scans already exist at scale, image-derived metrics from them support clinical research and translation.
- Using paired research-quality and routine clinical brain MRI scans from the same participants, we assessed T1-weighted (T1w) volumetric agreement and the extent to which harmonisation reduced clinical scan variability.

- Fifty-eight NHS patients from the Oxford Cognitive Neurology Clinic had paired research and clinical T1w MRI (mixed diagnoses).
- Research scans used the UK Biobank protocol on the same 3T scanner; Clinical scans were heterogeneous across 1.5T/3T scanners, with either high resolution (High-res) (N=28) or low resolution (Low-res) (N=30).
- The UK Biobank pipeline was applied to research scans, and adapted variants to high and low-res clinical scans [Figure 1].
- We compared seven volumetric measures between research and clinical scans with and without harmonisation using correlation [Figure 2], % difference [Figure 3], and correlation with age [Figure 4].

## METHODS

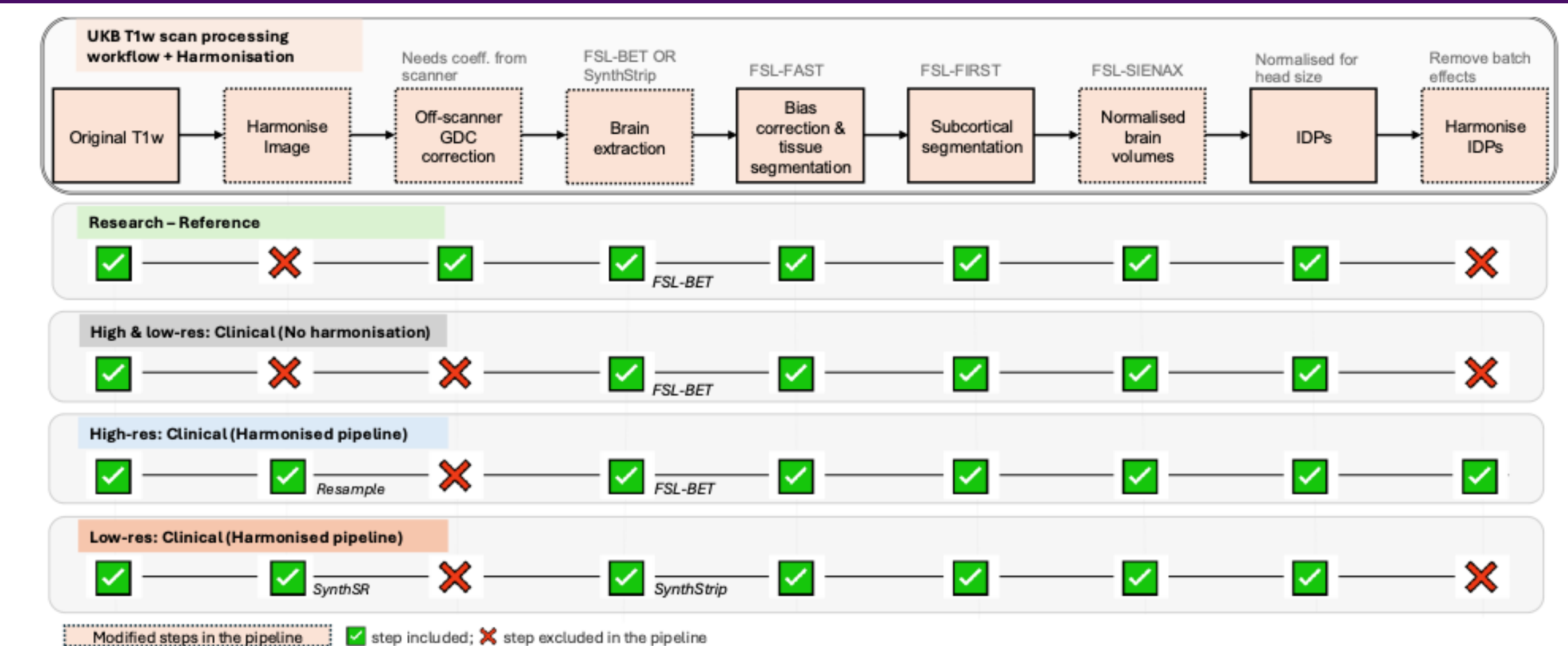


Figure 1. Image processing pipelines for research and clinical T1w MRI brain scans

## RESULTS

Figure 2. Spearman rank correlation of volumes between research and clinical scans

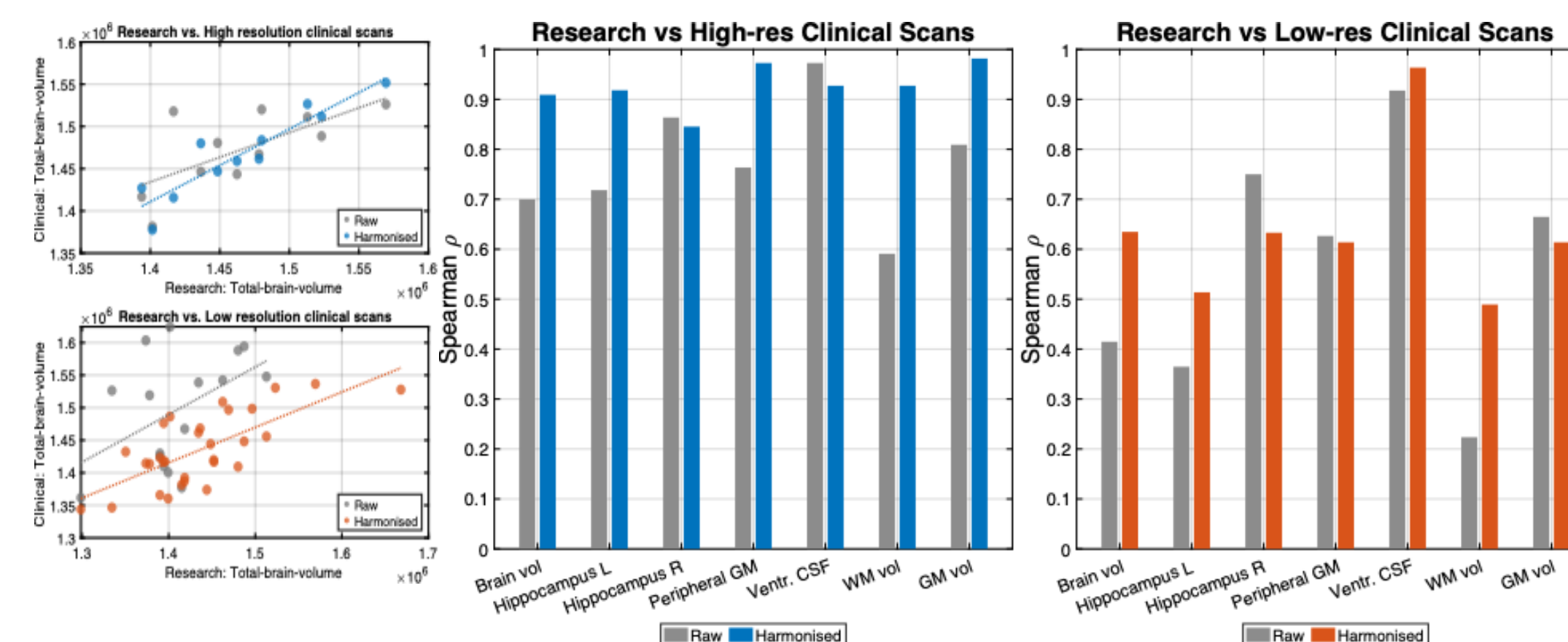


Figure 3. % difference in volumes between research and clinical scans

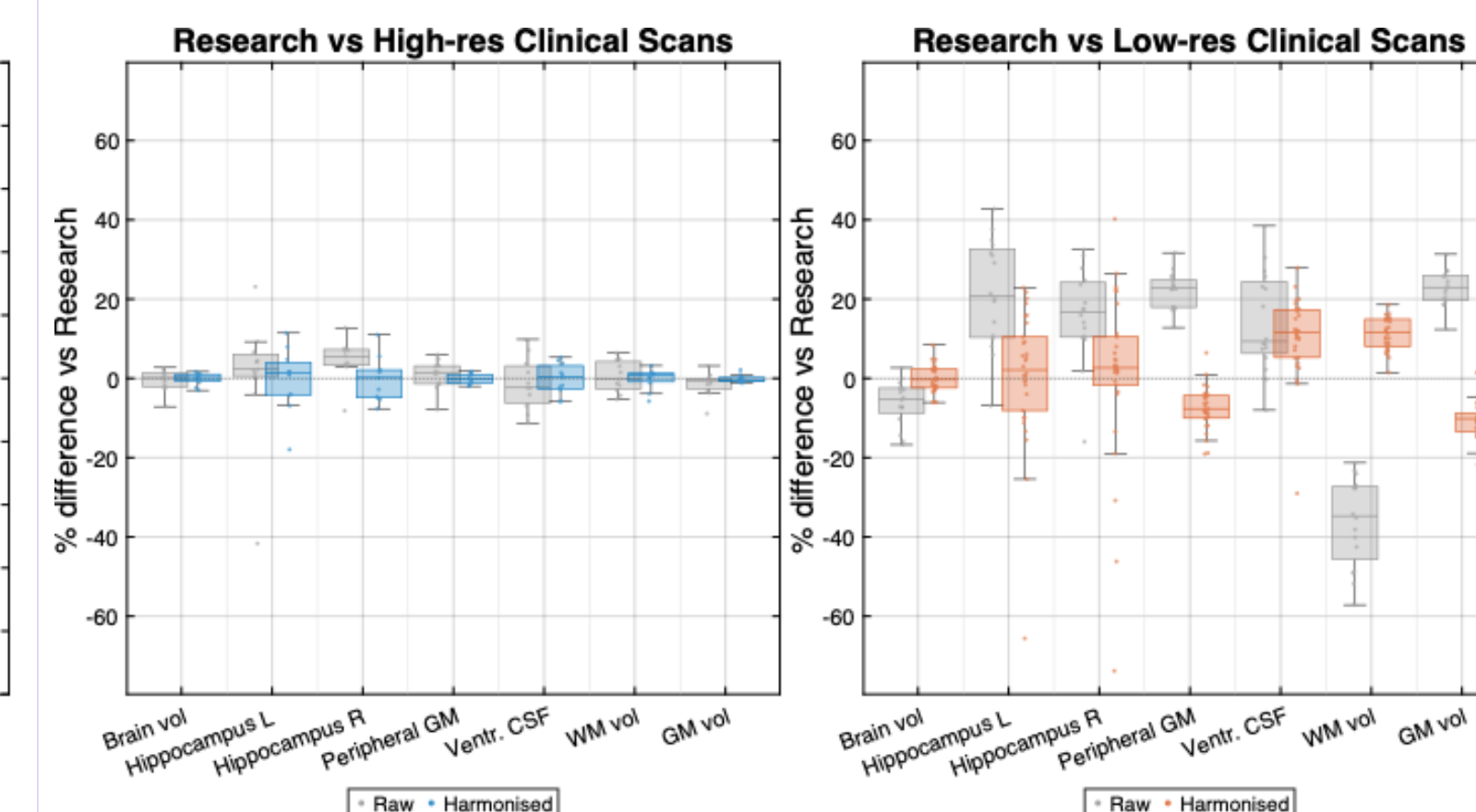
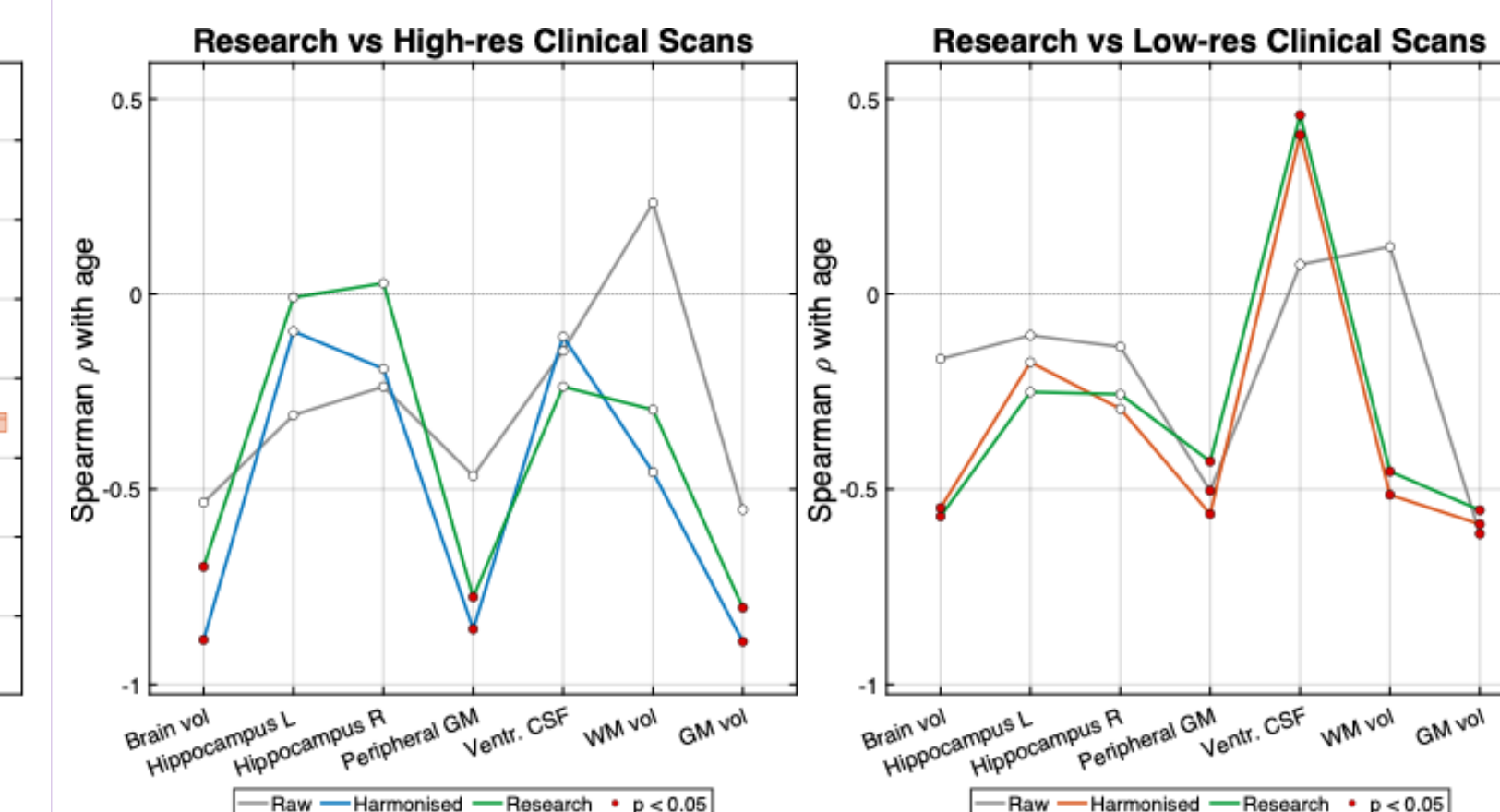


Figure 4. Age-volume correlation trends in research and clinical scans



## CONCLUSIONS

- Harmonised pipelines reduced protocol- and scanner-related variability, but it could not fully compensate for low resolution.
- Reliability of measurements depended on spatial resolution of the clinical scans.
- When scan resolution is adequate, routine clinical scans can support robust quantitative analysis with clinical translation potential.

- High-res clinical scans showed strong agreement with research scans across most measures ( $\rho$  ranging from  $\sim 0.6$  –  $\sim 1.0$ ), with further improvement after harmonisation ( $\rho > \sim 0.8$ ).
- Low-res clinical scans showed low-to-high agreement ( $\rho$  ranging from  $\sim 0.2$  –  $\sim 0.9$ ), with harmonisation improving some measures but not all ( $\rho$  ranging from  $\sim 0.5$  –  $\sim 0.9$ ).

- High-res clinical scans showed low bias compared with research scans, and harmonisation further reduced it toward zero.
- Low-res clinical scans showed greater bias, and harmonisation reduced it, though not to the same extent as in high-res scans.

- Before harmonisation, the age-volume trends were less consistent between clinical and research scans.
- After harmonisation, both high-res and low-res clinical scans broadly followed the age-volume trends seen in research scans.

## REFERENCES:

- PMID: 29079522, PMID: 39969115
- <https://doi.org/10.5281/zenodo.11389726>
- <https://doi.org/10.64898/2026.04.21.26351106>

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