Purpose: Group studies have demonstrated thinning of the brain cortex over decades as we age, but thickness is generally considered constant over shorter periods of time. This study evaluates the constancy and measurable variations in cortical thickness over time periods of minutes, weeks, months and years in individuals.

Methods: Eight healthy adults (2 female, 6 male, 24-60 yrs) received back-to-back scans on 8 to 12 occasions. Each data acquisition consisted of 160 high resolution IR-SPGR MRI images yielding a 1x1x1mm resolution. Freesurfer software (http://surfer.nmr.mgh.harvard.edu) was used to analyze this data, producing tens of thousands of thickness measurements and providing automatic segmentation of the cortical regions. Differences in back-to-back scans were used as an estimate of measurement error. Each scan was considered a valid measure, and all combinations of scans were compared and evaluated as time periods of weeks, months and years. Confidence intervals at the 95% level were established based on the estimated error.

Results:Within each individual there were regions demonstrating 95% of the measured differences to be within the confidence interval, demonstrating anatomical stability and consistency in measurements. Other areas in each individual, however, showed significantly increased variation with greater than 15% of the measured differences outside of the confidence interval. These variations were specific to individuals, with different profiles of areas and intervals of stability and of variance.

Conclusions: This work expands on prior group analysis to the longitudinal measurement of cortical changes within normal individuals without intervention. Understanding the dynamics of cortical thickness measures is critical if such measurements are to be used as biomarkers of physiologically significant cortical changes. Cortical areas reconsolidate in individually specific and reversible ways during week, month, and longer periods of life.