

Supplementary Figure 1. Protein expression of hormonal receptors in human female skeletal muscle stratified by age group and menopausal status. **A:** Protein expression of ER α , ER β , ER α :ER β ratio, GPER1, and AR across age groups. Age-related differences were assessed using one-way ANOVA. **B:** Protein expression of ER α , ER β , ER α :ER β ratio, GPER1, and AR across time-since-menopause groups (pre, <5, 5–<10, 10–<15, and $\geq$ 15 years since menopause). Menopausal status-related differences were assessed using ANCOVA adjusted for chronological age. $P < 0.05$ and $P < 0.01$ denote significant post hoc pairwise differences between groups. Individual data points represent single participants. Sample size varies between analyses due to differences in available lysate and technical exclusions related to limited protein availability.

Supplementary Figure 2. Protein expression of redox- and vascular-related proteins in human female skeletal muscle stratified by age group and menopausal status. **A:** Protein expression of eNOS, SOD2, GPX1, gp91phox (NOX2), and ER α across age groups. Age-related differences were assessed using one-way ANOVA. **B:** Protein expression of eNOS, SOD2, GPX1, gp91phox (NOX2), and ER α across time-since-menopause groups (pre, <5, 5–<10, 10–<15, and $\geq$ 15 years since menopause). Menopausal status-related differences were assessed using ANCOVA adjusted for chronological age. $P < 0.05$ and $P < 0.01$ denote significant post hoc pairwise differences between groups. Individual data points represent single participants. Sample size varies between analyses due to differences in available lysate and technical exclusions related to limited protein availability.

Supplementary Figure 3. Pairwise post hoc comparisons of hormonal receptor protein expression across age groups and menopausal status groups. **A–B:** ER α ; **C–D:** ER β ; **E–F:** log ER α :ER β ratio; **G–H:** GPER1; **I–J:** AR. Panels A, C, E, G, and I show pairwise comparisons between age groups following one-way ANOVA. Panels B, D, F, H, and J show pairwise comparisons between time-since-menopause groups (pre, <5, 5–<10, 10–<15, and $\geq$ 15 years since menopause) following ANCOVA adjusted for chronological age. Heatmaps display unadjusted post hoc p-values for all pairwise comparisons, with warmer colors indicating lower p-values and cooler colors indicating higher p-values. Numerical values within each cell represent the corresponding p-value.

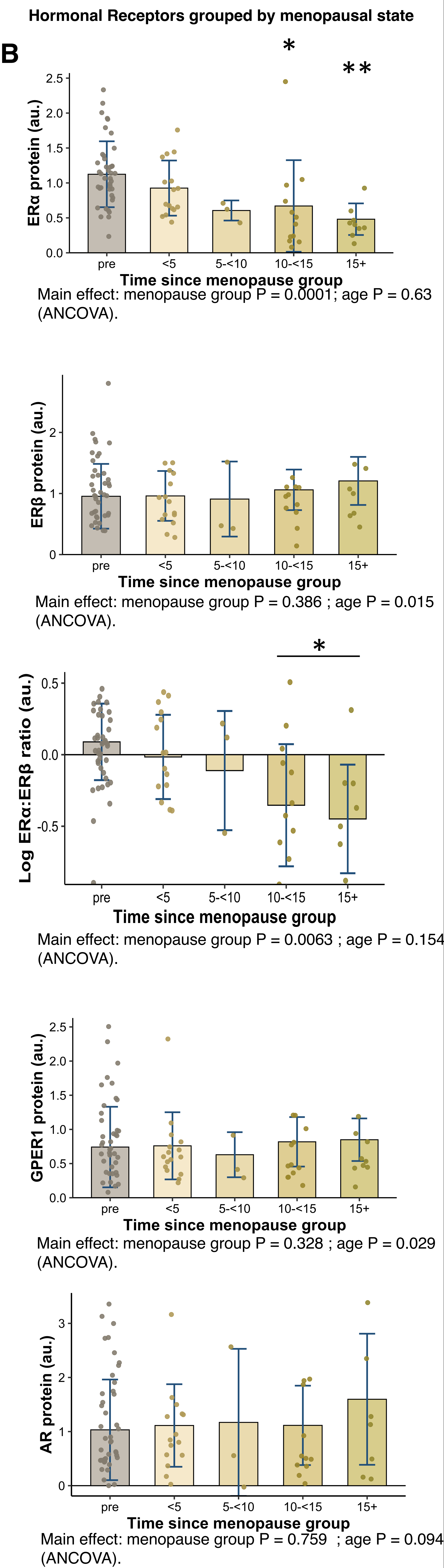
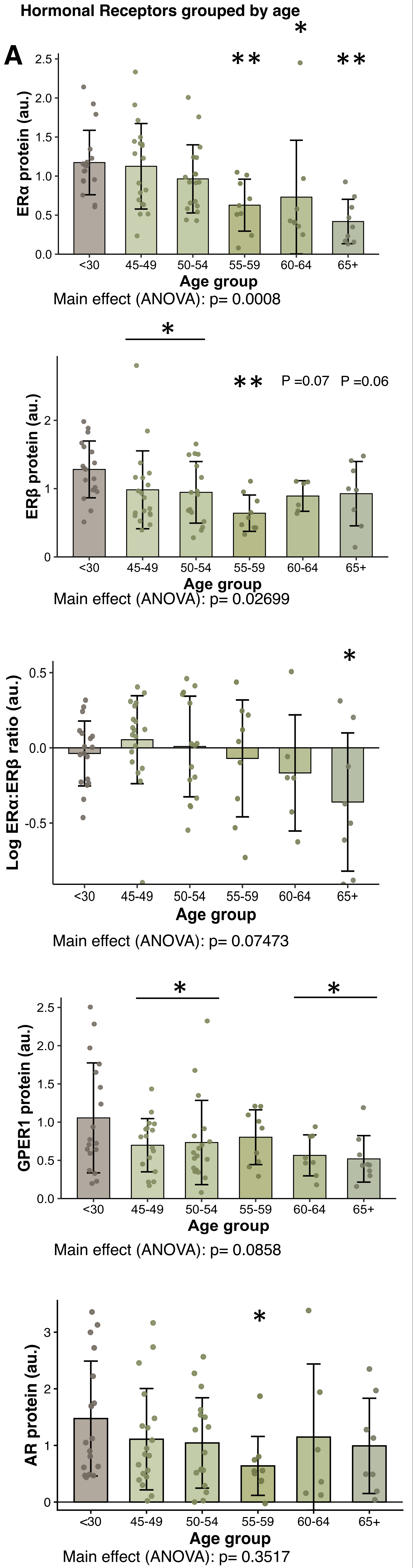
Supplementary Figure 4. Pairwise post hoc comparisons of redox- and vascular-related protein expression across age groups and menopausal status groups. **A–B:** eNOS; **C–D:** SOD2; **E–F:** GPX1; **G–H:** gp91phox (NOX2); **I–J:** ER α . Panels A, C, E, G, and I show pairwise comparisons between age groups following one-way ANOVA. Panels B, D, F, H, and J show pairwise comparisons between time-since-menopause groups (pre, <5, 5–<10, 10–<15, and $\geq$ 15 years since menopause) following ANCOVA adjusted for chronological age. Heatmaps display unadjusted post hoc p-values for all pairwise comparisons, with warmer colors indicating lower p-values and cooler colors indicating higher p-values. Numerical values within each cell represent the corresponding p-value.

Supplementary Figure 5. Associations between hormonal receptors and selected redox- and vascular-related proteins in human female skeletal muscle. **A:** AR and ER α ; **B:** AR and GPER1; **C:** AR and ER α ; **D:** ER α and ER β ; **E:** ER α and ER β ; **F:** SOD2 and AR; **G:** GPX1 and AR; **H:** eNOS and AR; **I:** gp91phox (NOX2) and ER α ; **J:** GPX1 and ER β ; **K:** SOD2 and ER β . Associations were assessed using Spearman rank correlations. Individual data points represent single participants and are color- and shape-coded according to age group. Correlation coefficients (ρ), corresponding p-values, and sample sizes (n) are shown in each plot. The solid line represents the fitted linear regression with 95% confidence intervals for visualization purposes. Sample size varies between analyses due to differences in available lysate and technical exclusions related to limited protein availability.

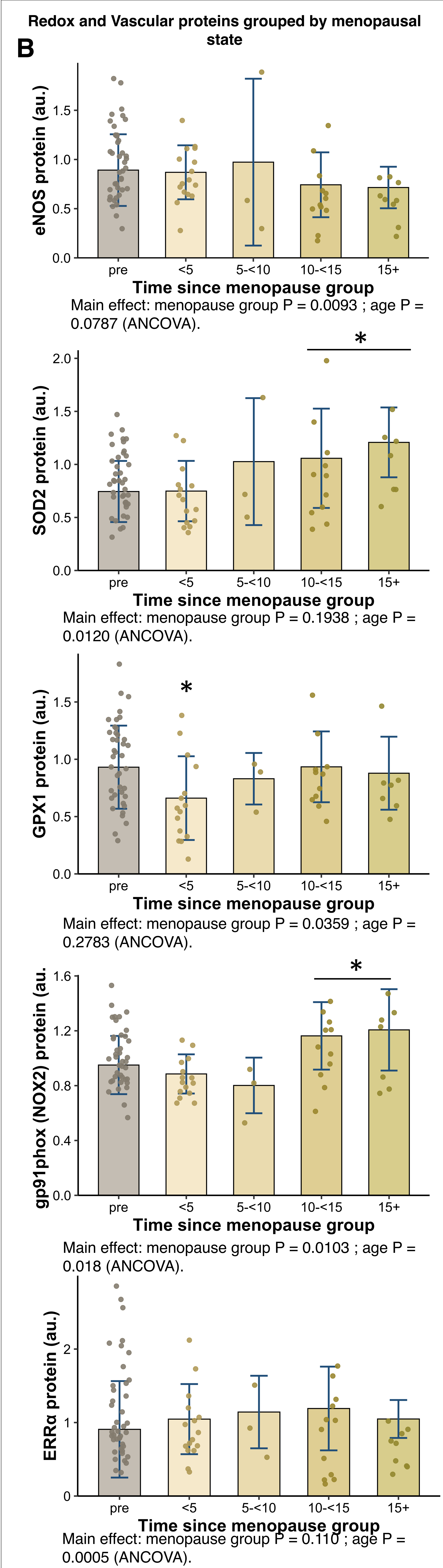
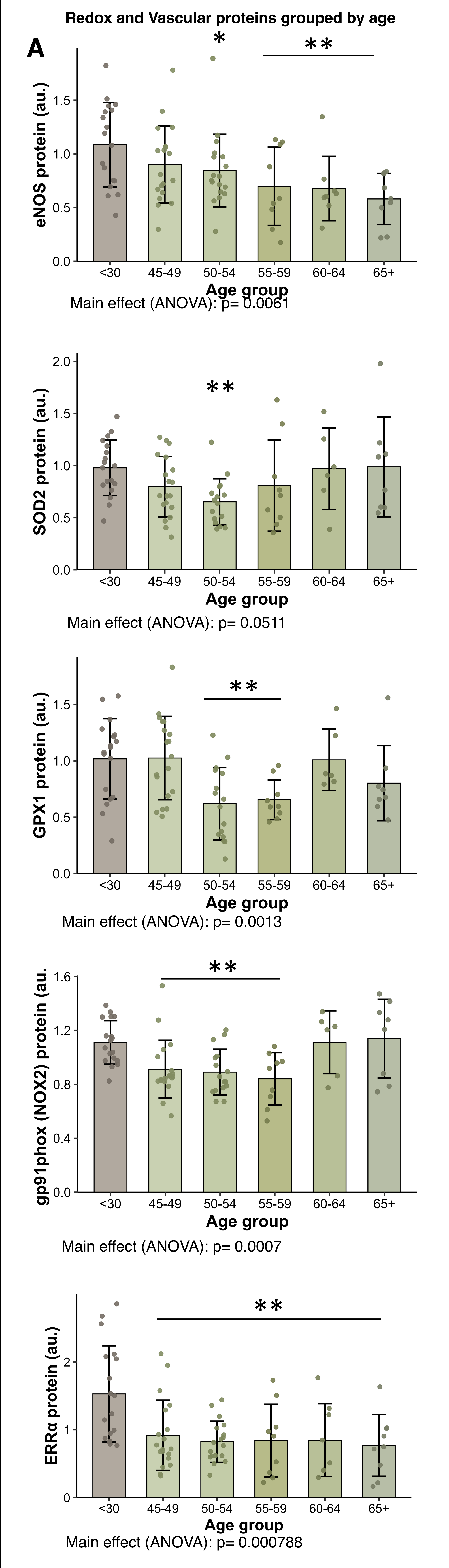
Supplementary Figure 6. Correlations between mean protein expression values across age groups and menopausal status groups. **A:** ER α and eNOS. **B:** ER β and eNOS. **C:** ER β and gp91phox (NOX2). **D:** GPER1 and NOX4. Green symbols and regression lines represent age-group means (<30, 45–49, 50–54, 55–59, 60–64, and $\geq$ 65 years), whereas yellow symbols and regression lines represent time-since-menopause group means (pre, <5, 5–<10, 10–<15, and $\geq$ 15 years since menopause). Associations were assessed using Pearson correlations. Correlation coefficients (R) and corresponding p-values are shown for each grouping approach.

Supplementary Figure 7. Representative immunoblots of hormonal receptor, vascular, and redox-related proteins in human skeletal muscle. **A:** AR, GPER1, ER β , and ER α . **B:** eNOS, SOD2, gp91phox (NOX2), and GPX1. Corresponding stain-free gel images are shown to document uniform protein loading across samples. Molecular weights (kDa) are indicated for each target protein. Age and time since menopause for representative samples are shown below each blot. A study-specific pooled muscle lysate, generated by combining aliquots from all study participants, was included across membranes to facilitate normalization between gels. Representative immunoblots contain molecular weight-specific membrane sections derived from the same gel and are presented for visualization purposes.

Supplementary figure 1



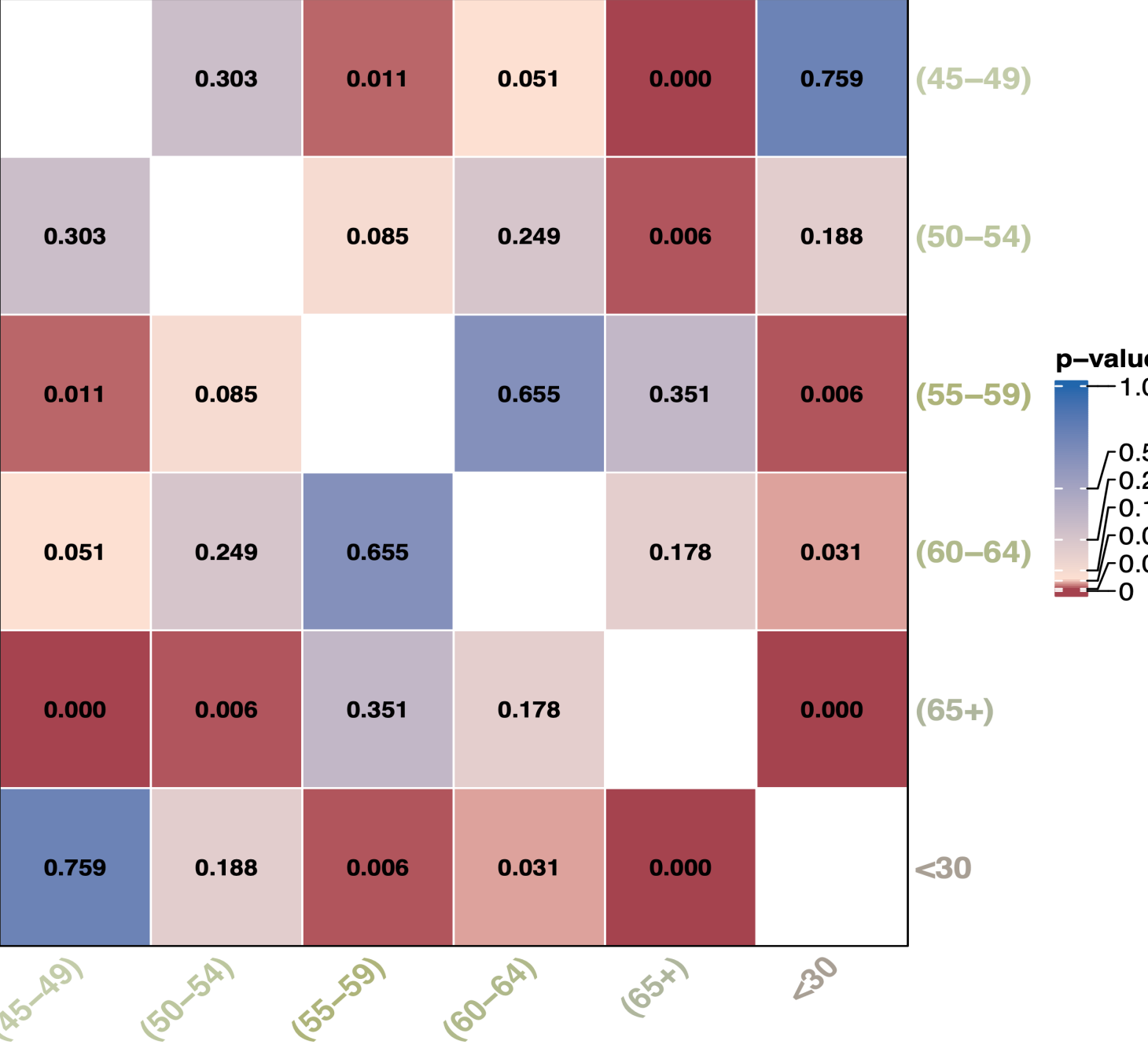
Supplementary figure 2



Supplementary figure 3

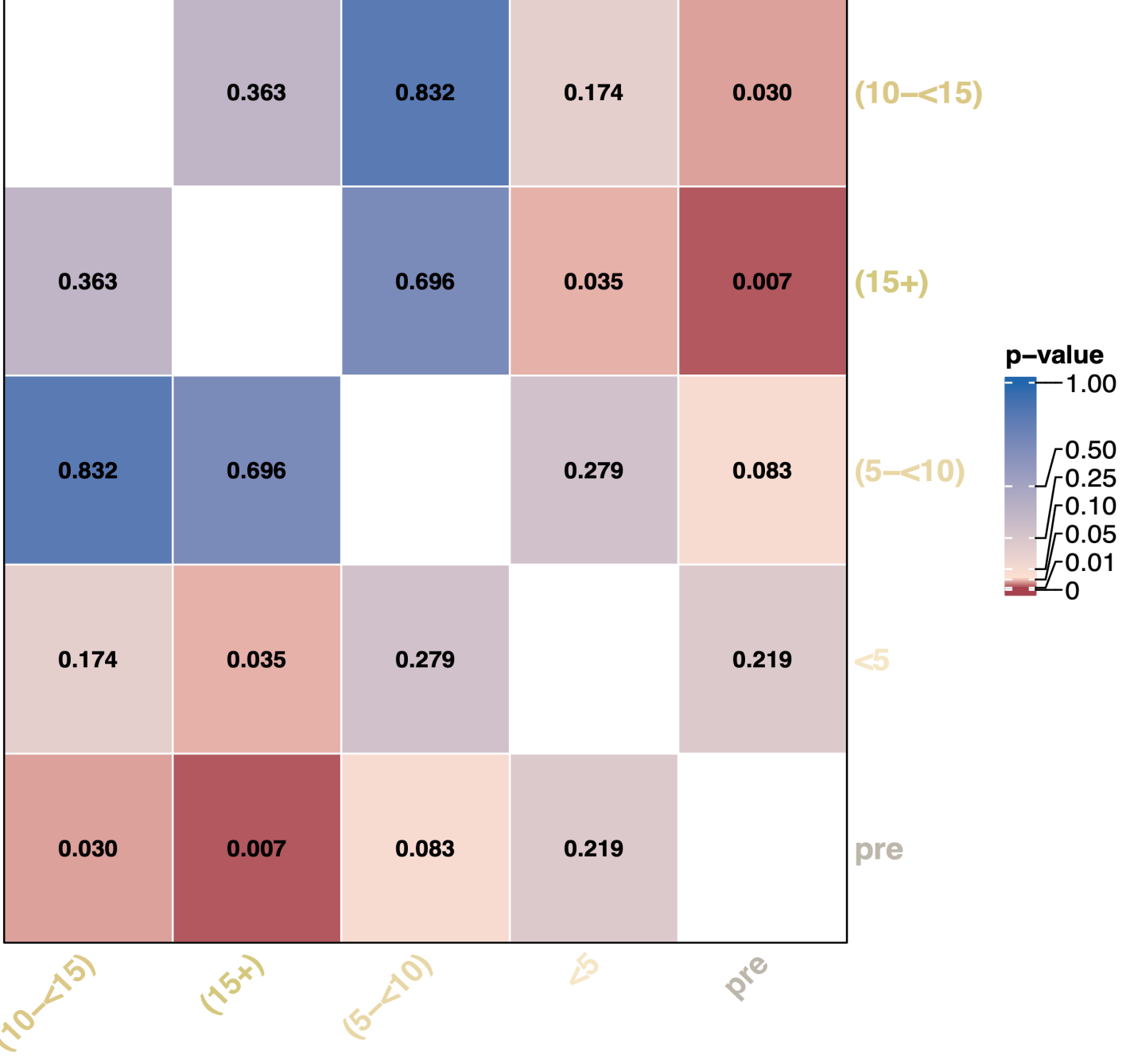
A ERα protein expression (a.u)

Pairwise comparisons between age groups



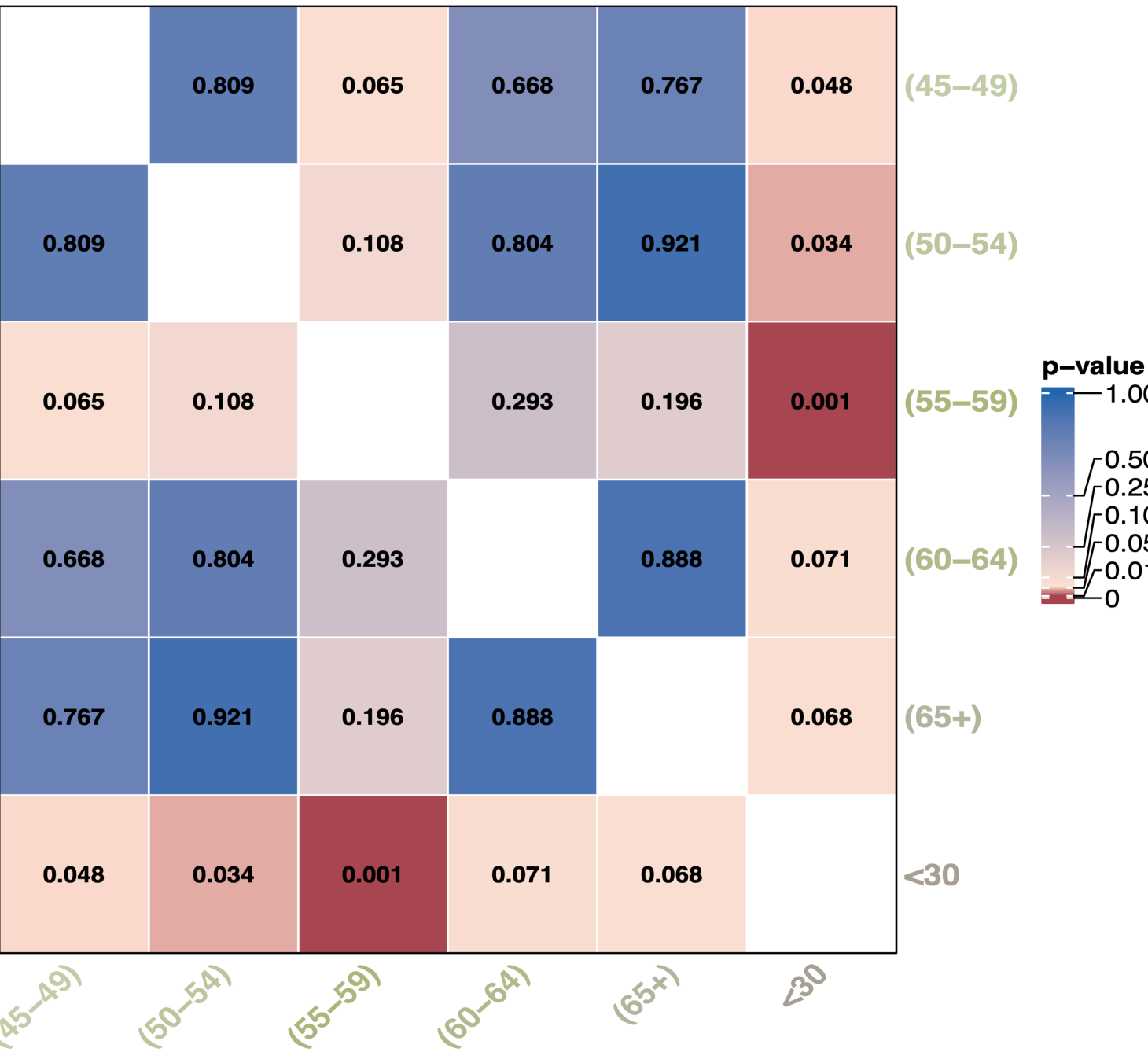
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Pairwise comparisons between menopausal groups



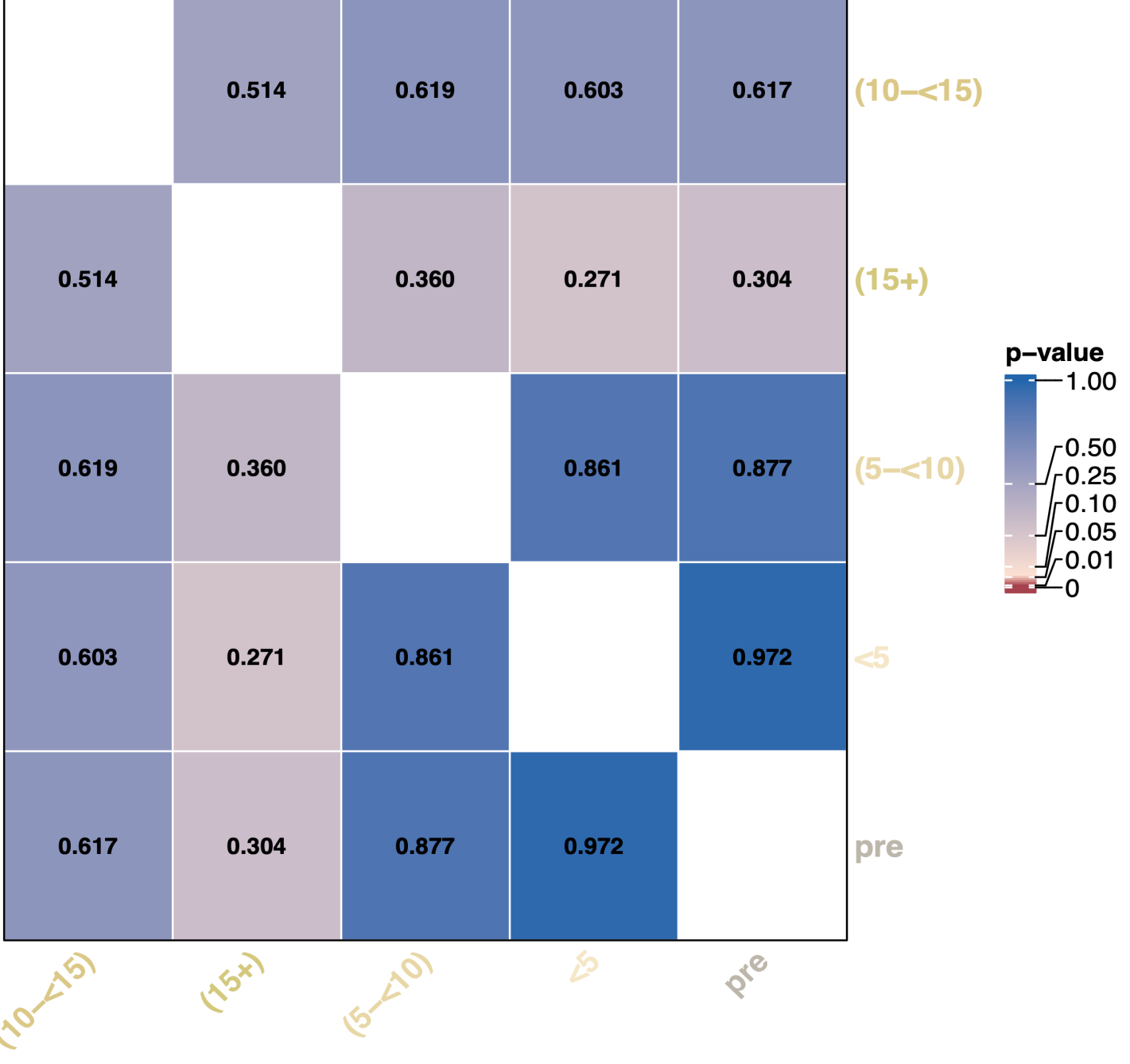
C ERβ protein expression (a.u)

Pairwise comparisons between age groups



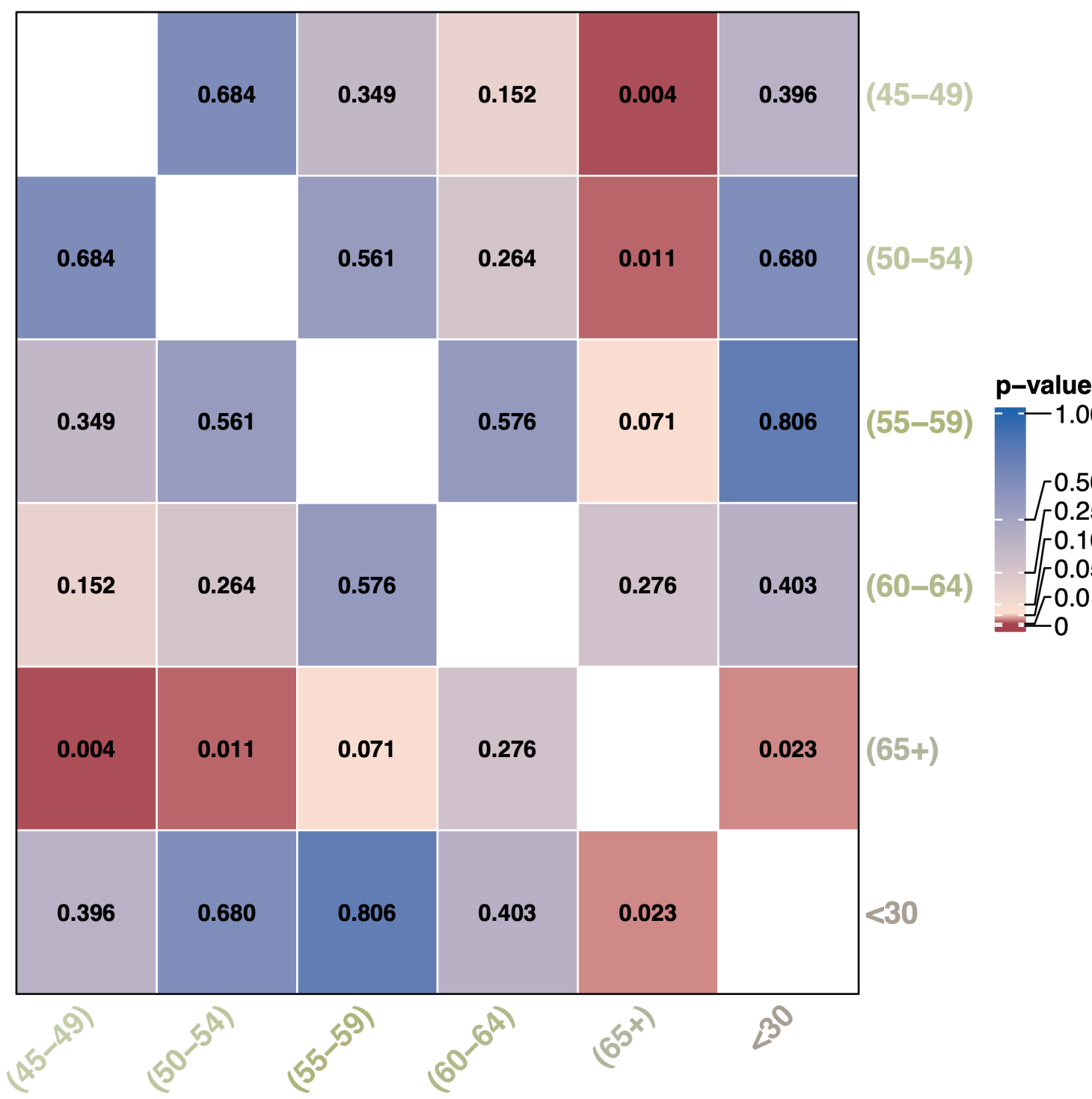
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Pairwise comparisons between menopausal groups



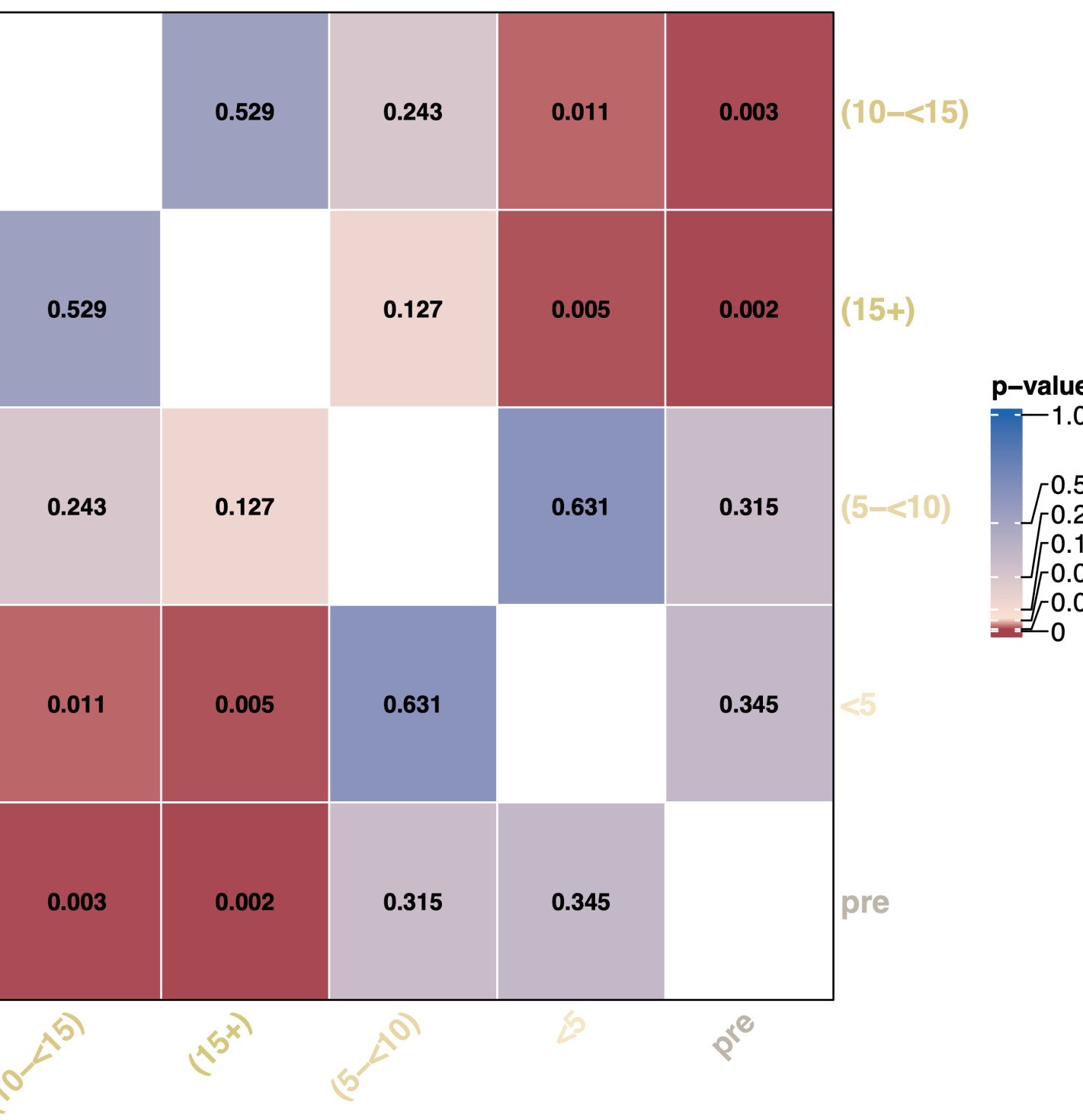
E Log ERα:ERβ ratio protein expression (a.u)

Pairwise comparisons between age groups



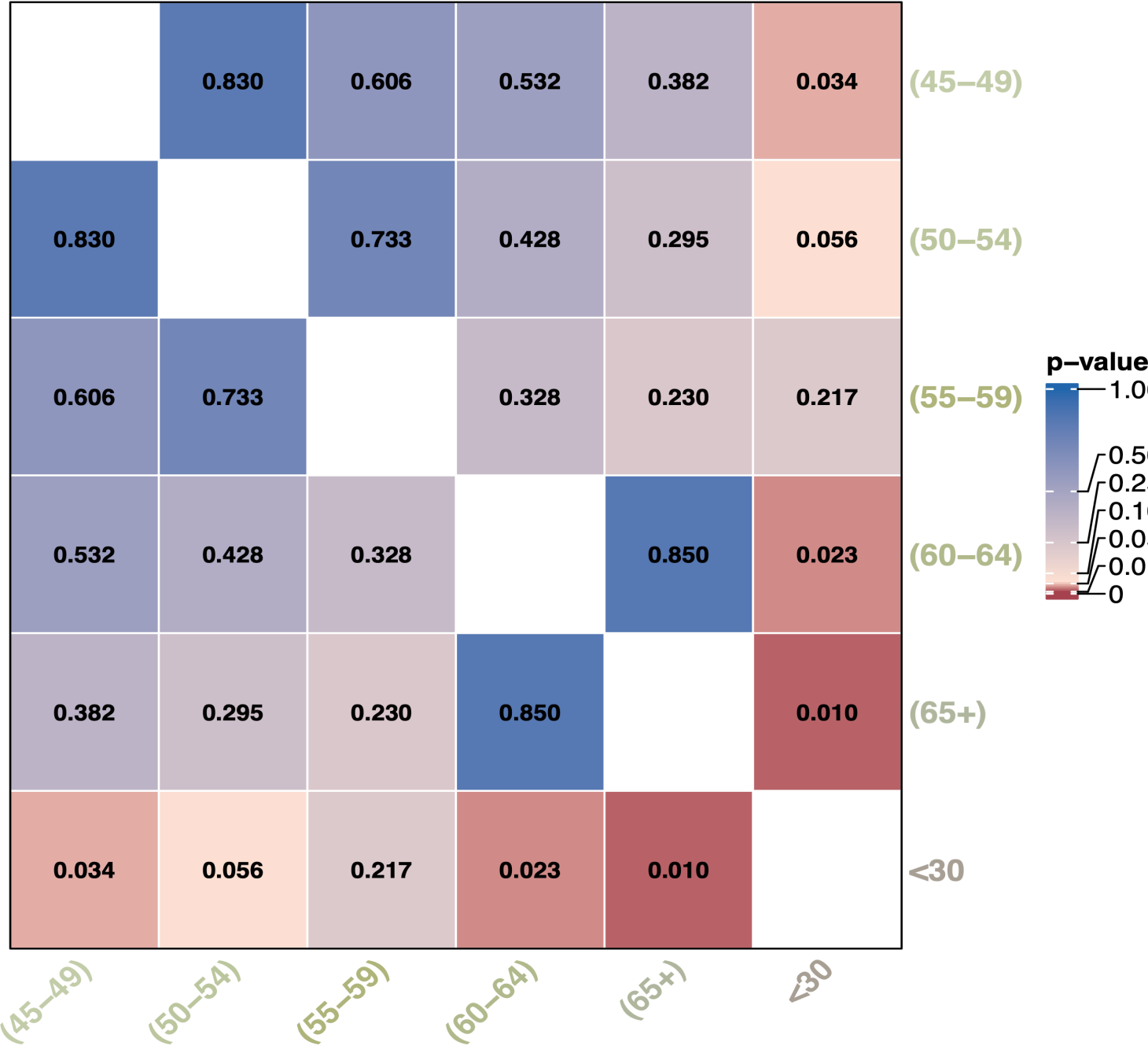
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Pairwise comparisons between menopausal groups



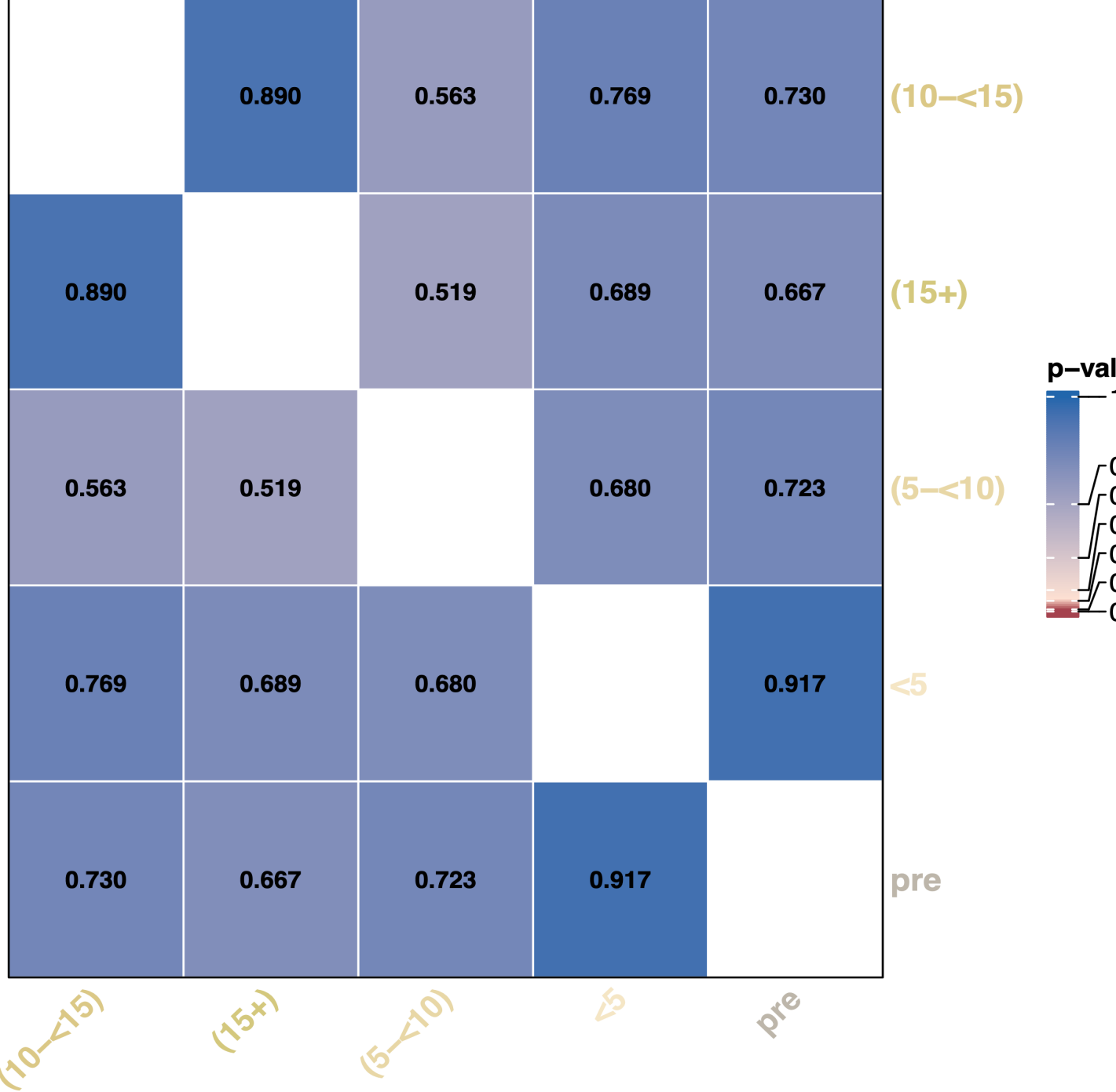
G GPER1 protein expression (a.u)

Pairwise comparisons between age groups



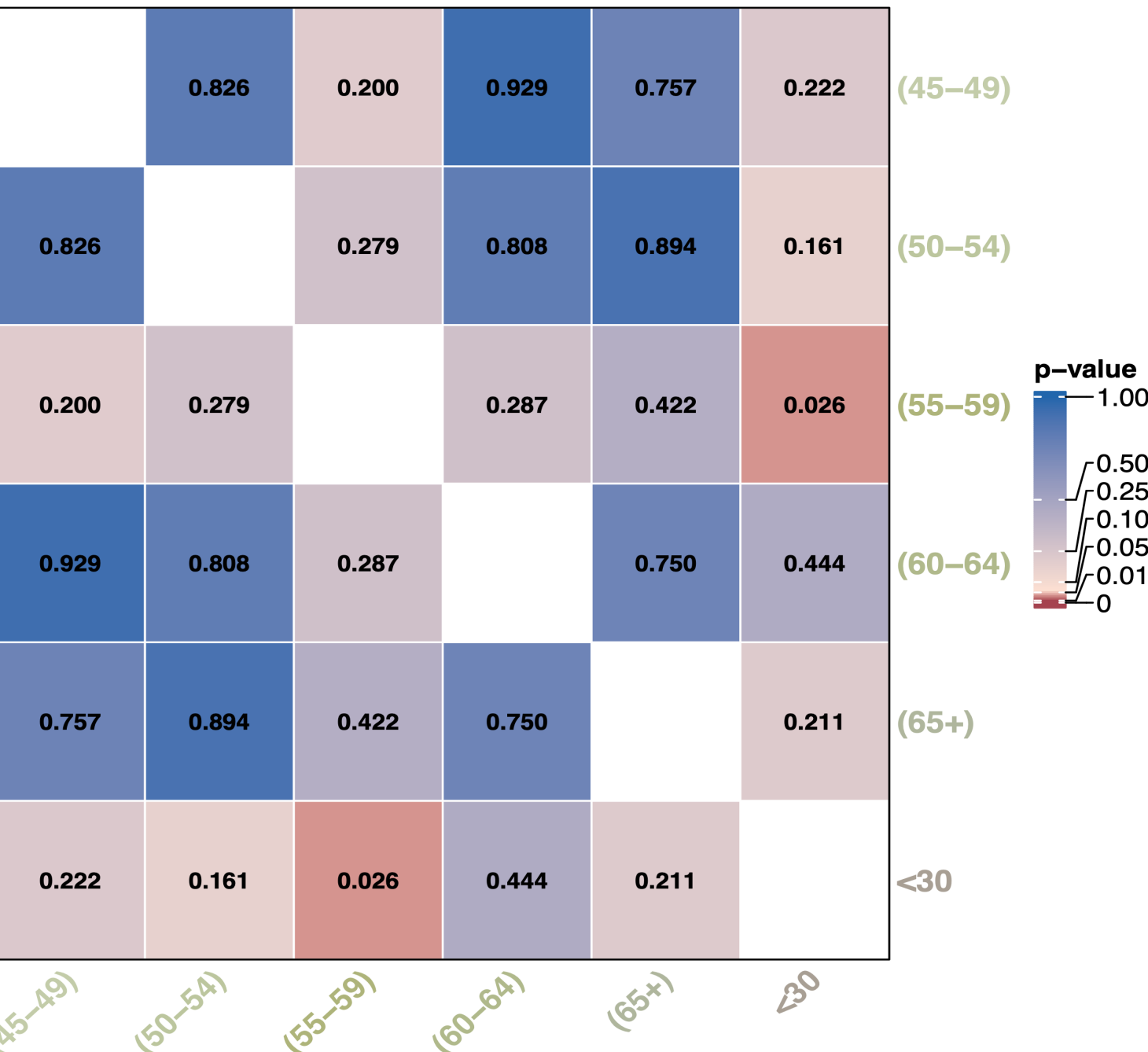
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Pairwise comparisons between menopausal groups



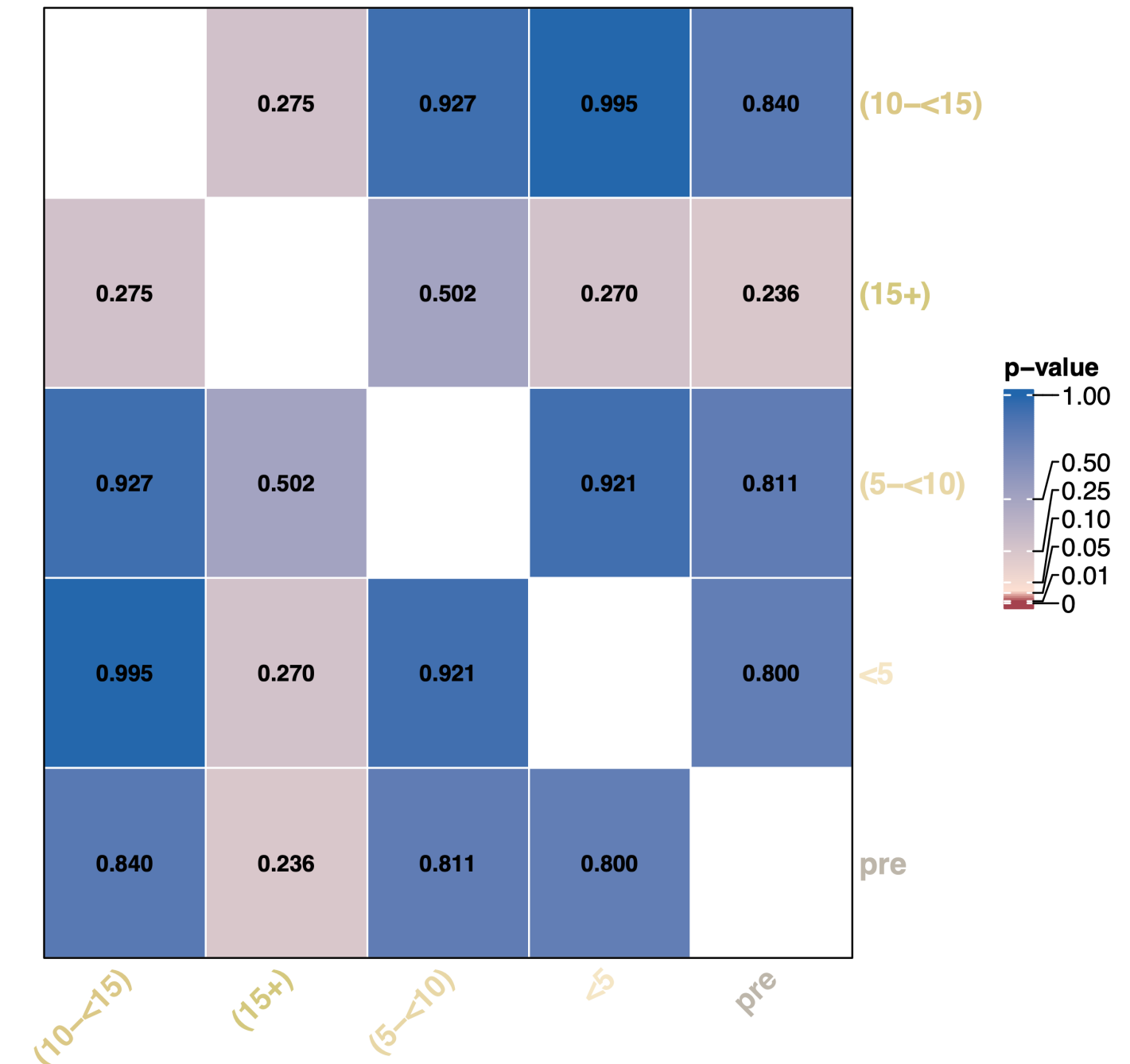
I AR protein expression (a.u)

Pairwise comparisons between age groups



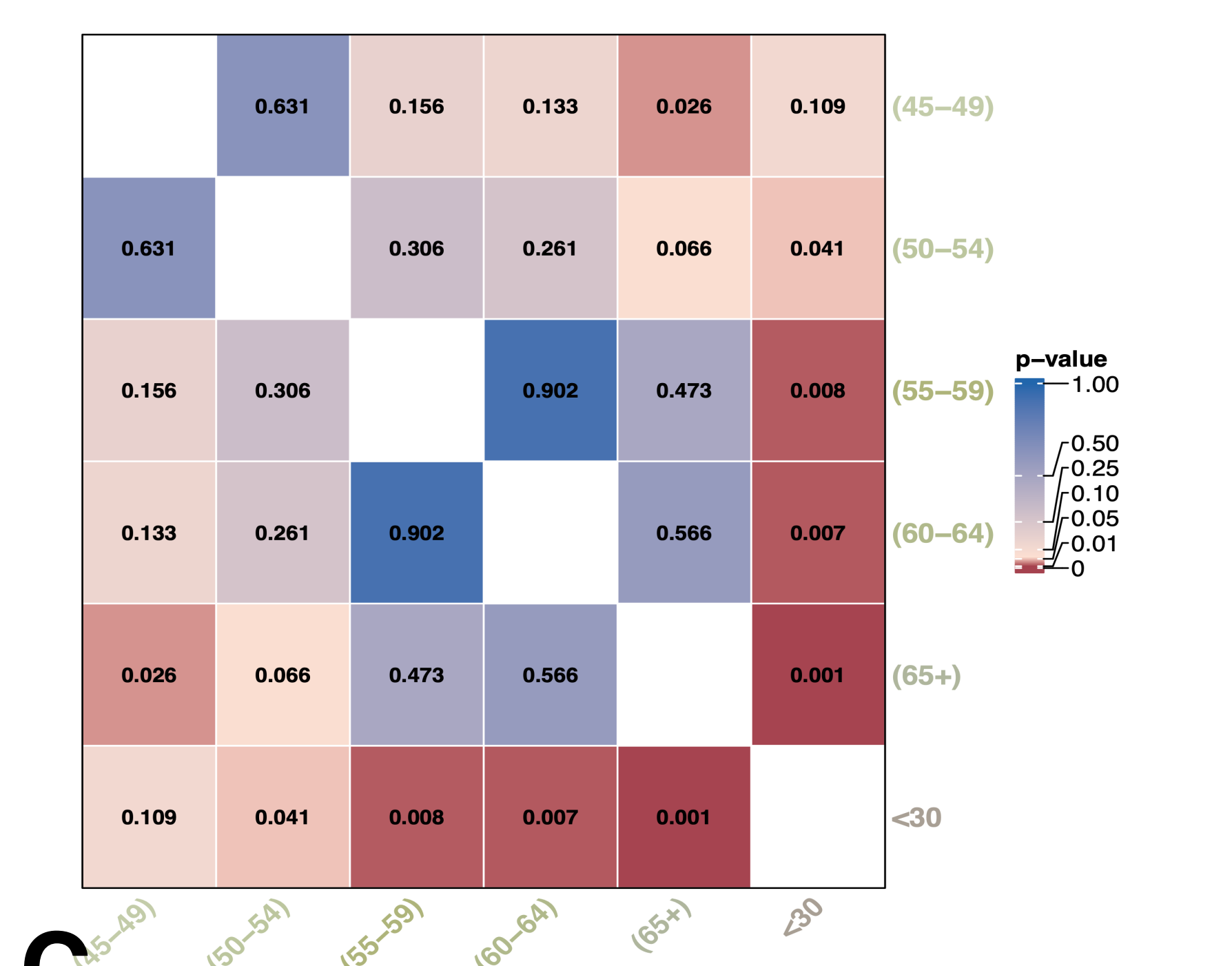
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Pairwise comparisons between menopausal groups

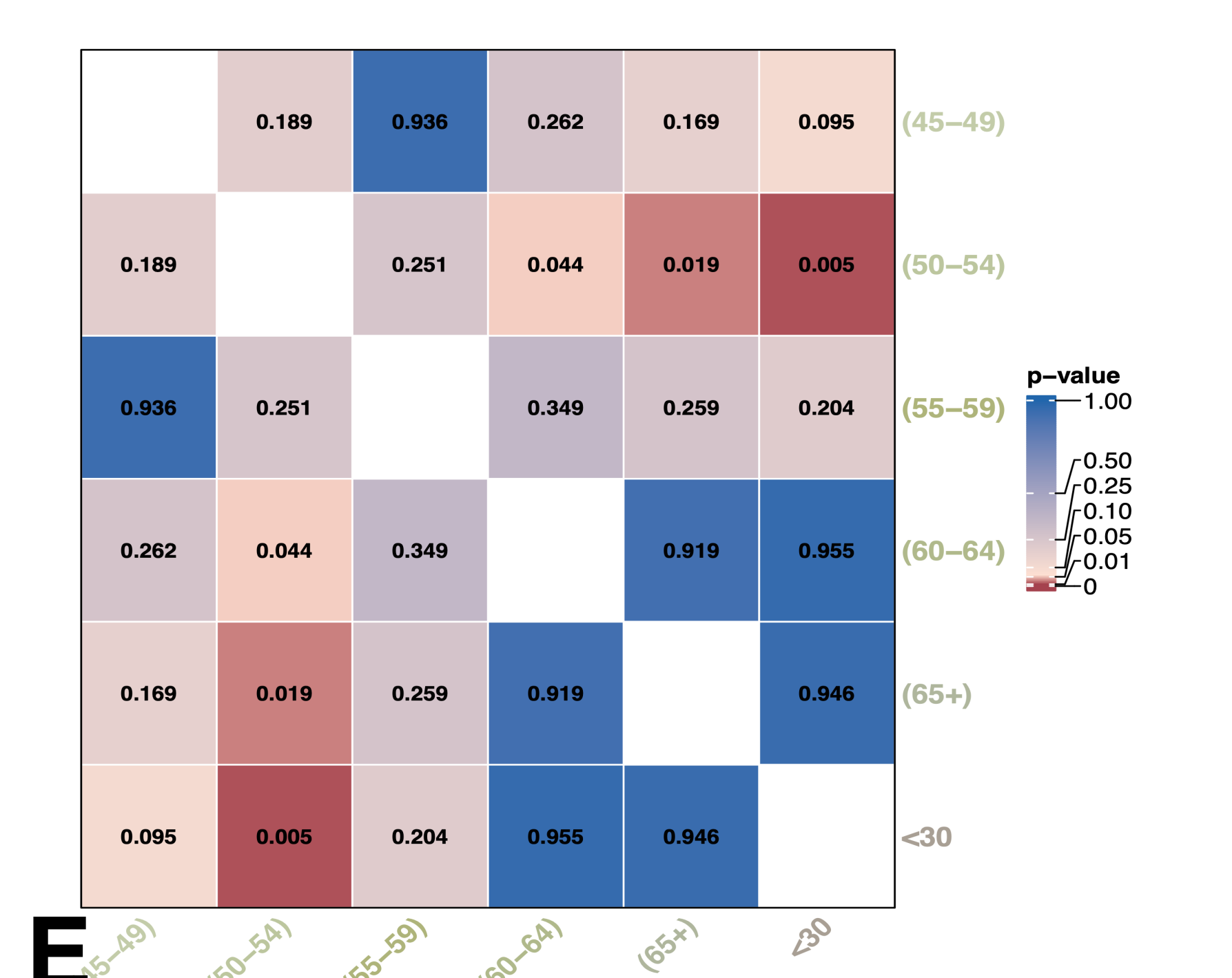


Supplementary figure 4

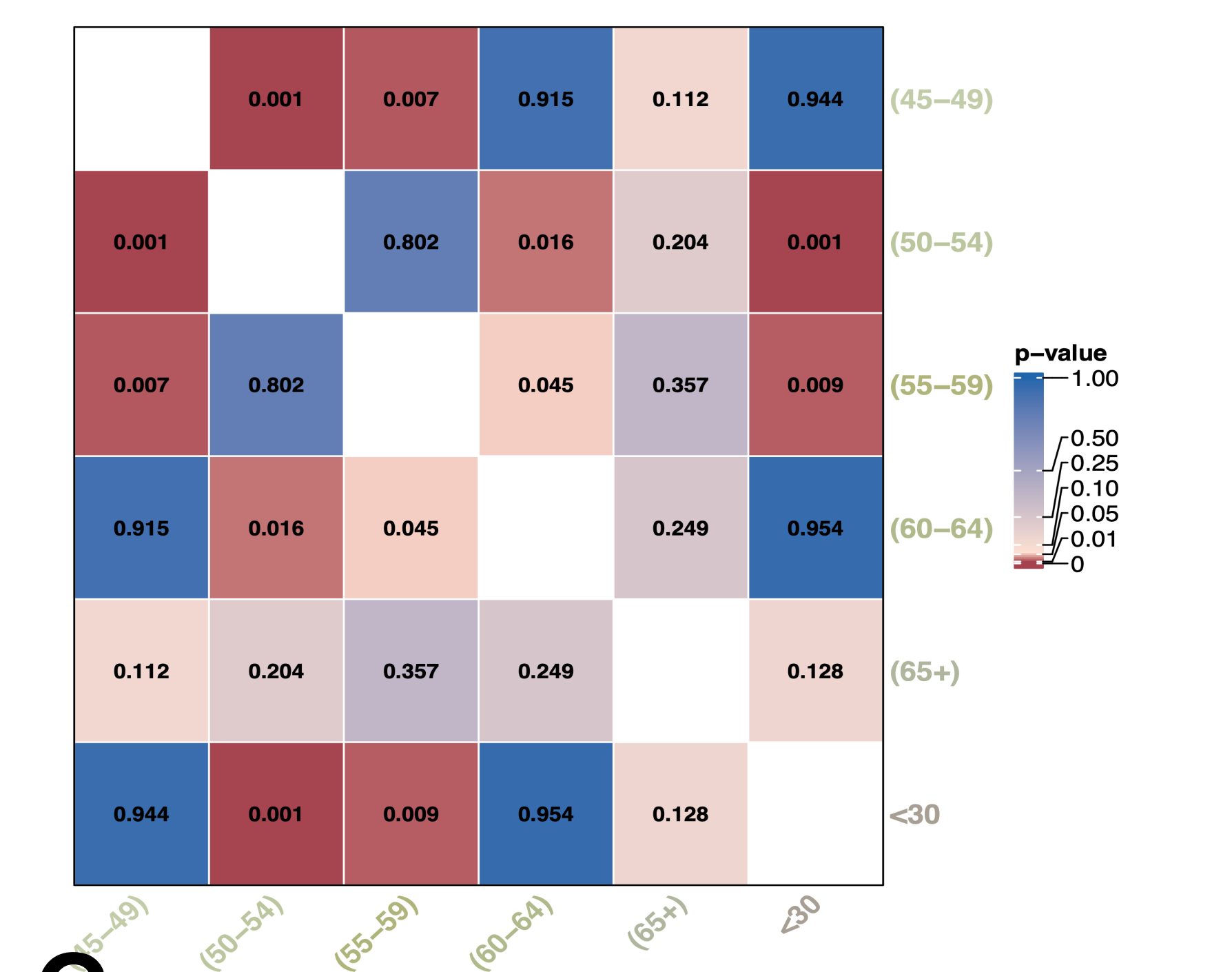
A eNOS protein expression (a.u)
Pairwise comparisons between age groups



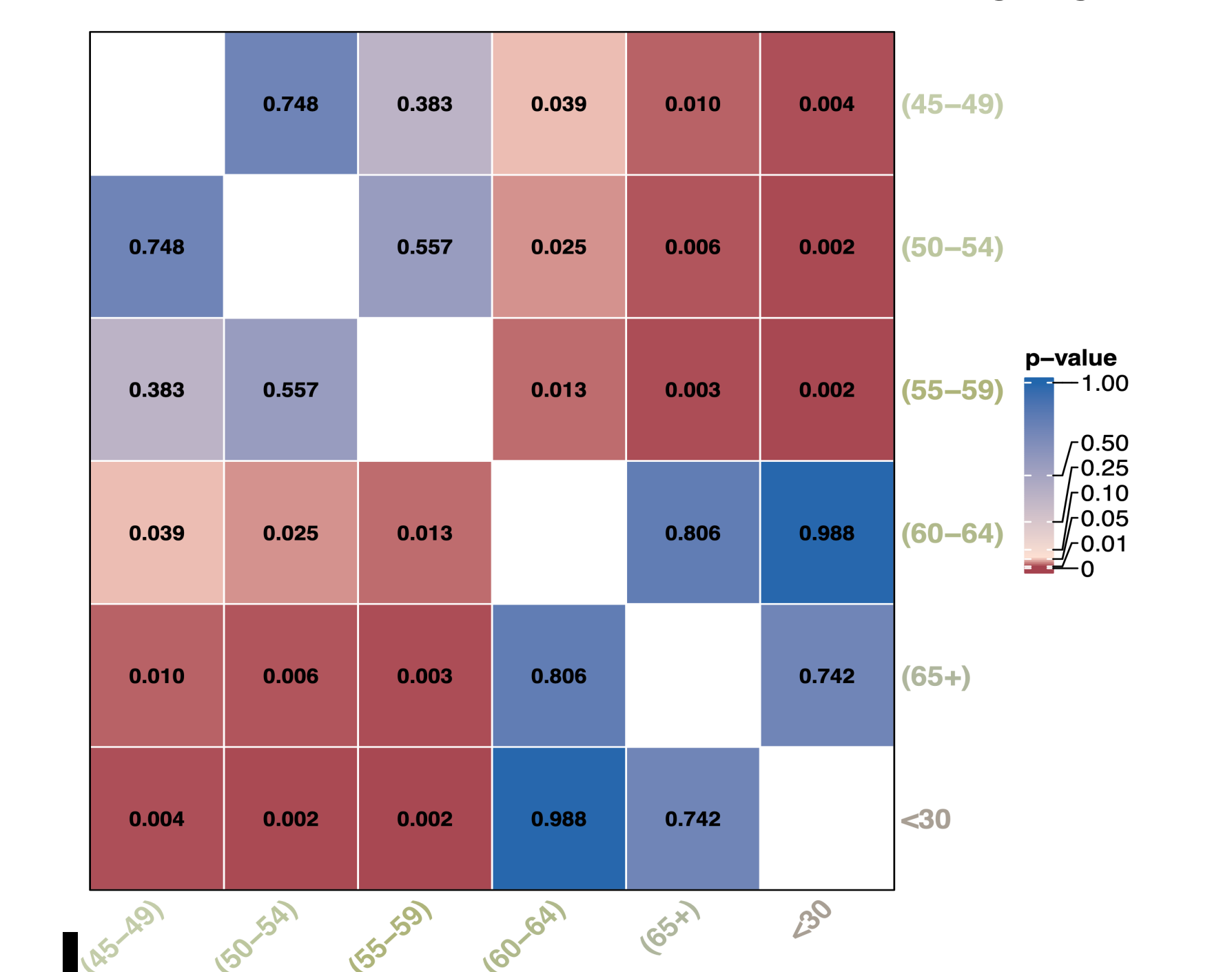
C SOD2 protein expression (a.u)
Pairwise comparisons between age groups



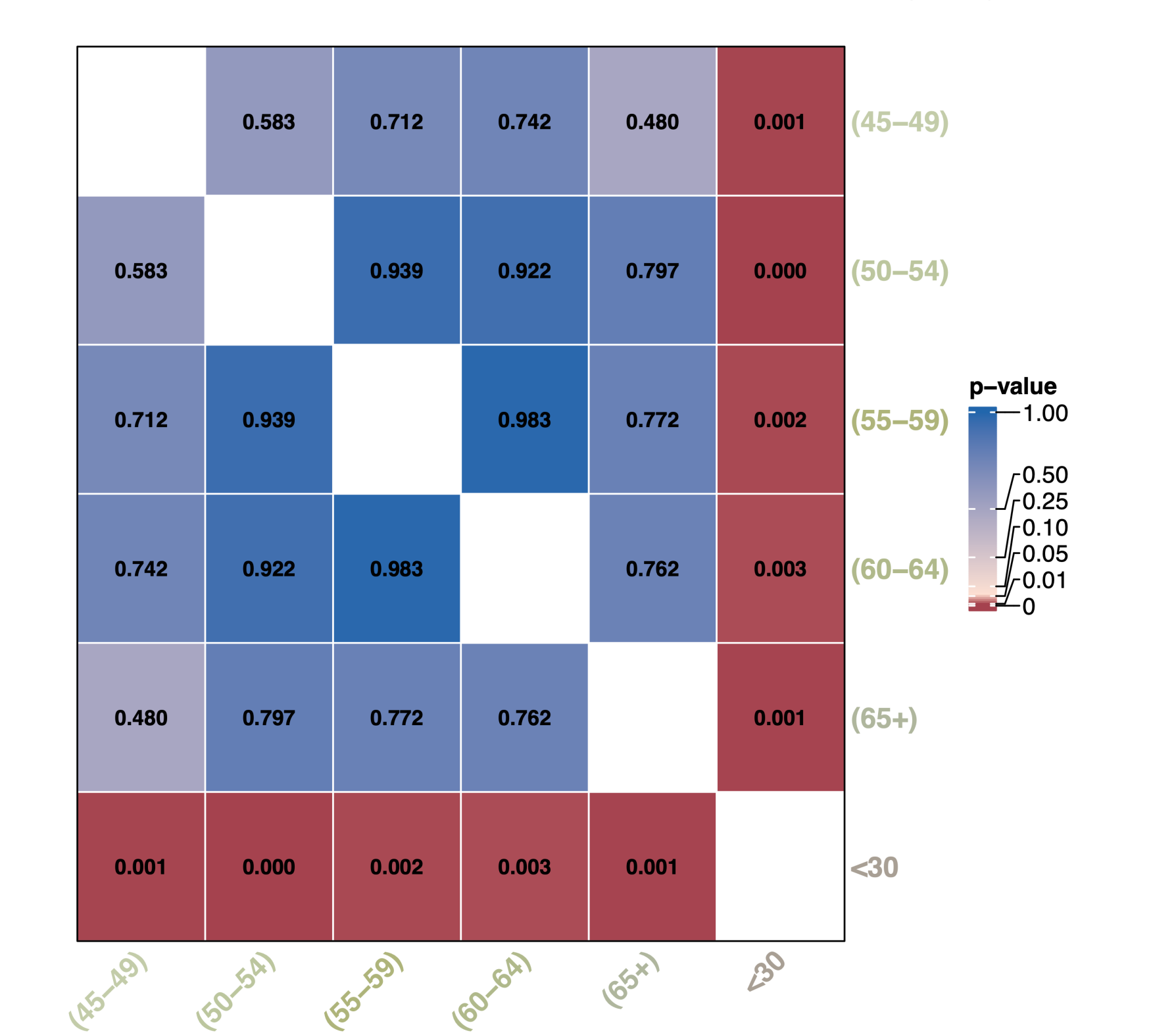
E GPX1 protein expression (a.u)
Pairwise comparisons between age groups



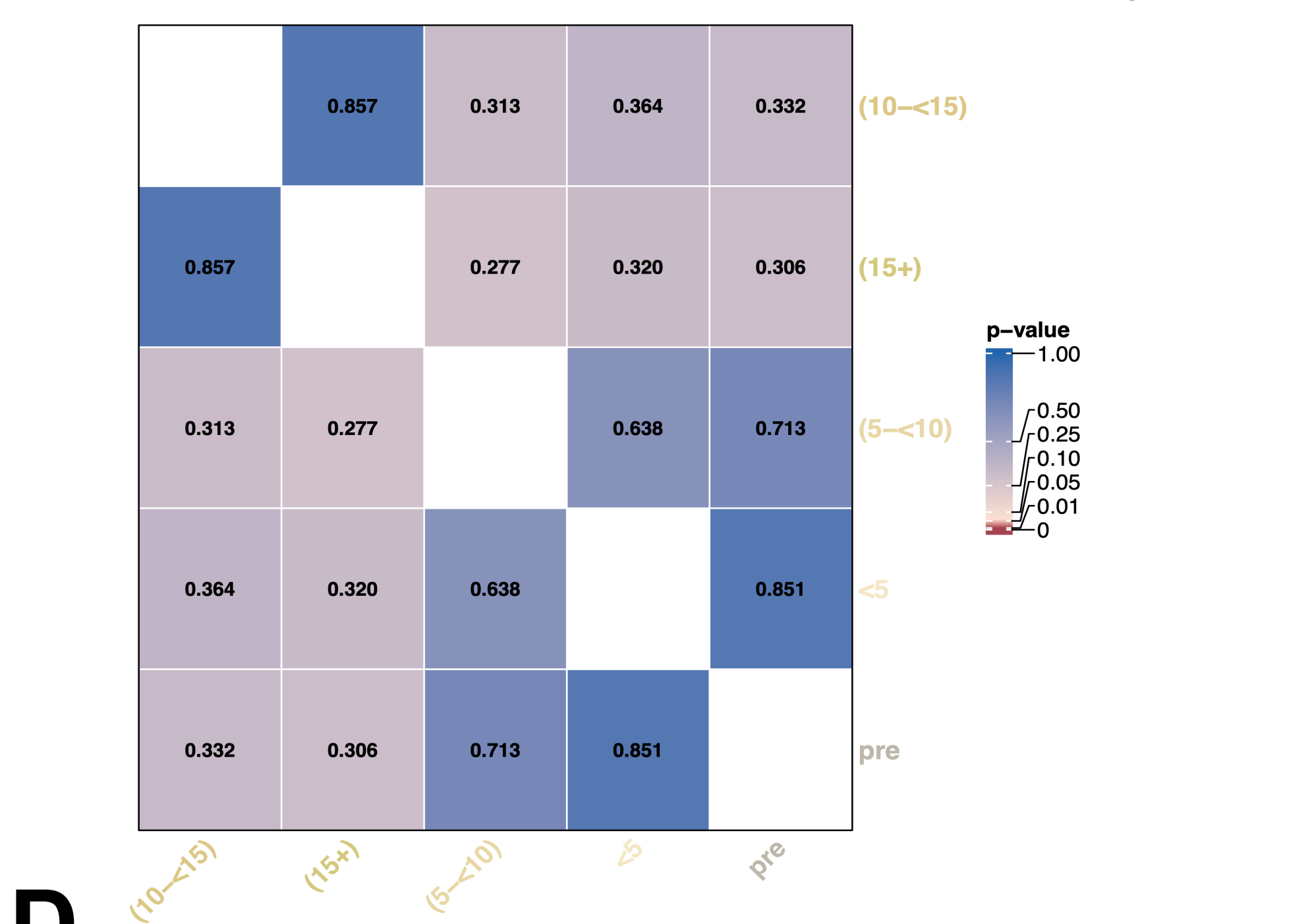
G Gp91phox protein expression (a.u)
Pairwise comparisons between age groups



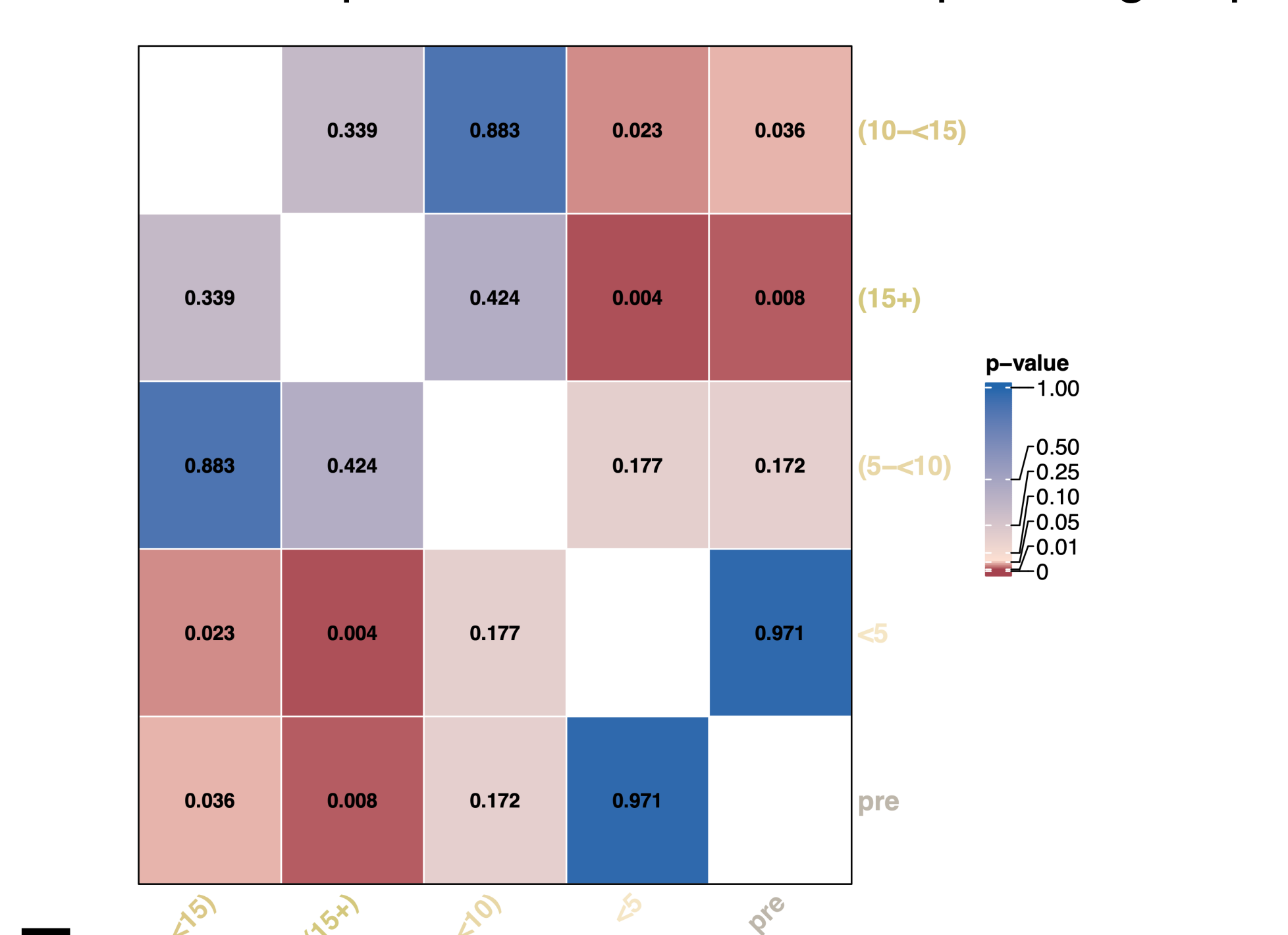
I ERRA protein expression (a.u)
Pairwise comparisons between age groups



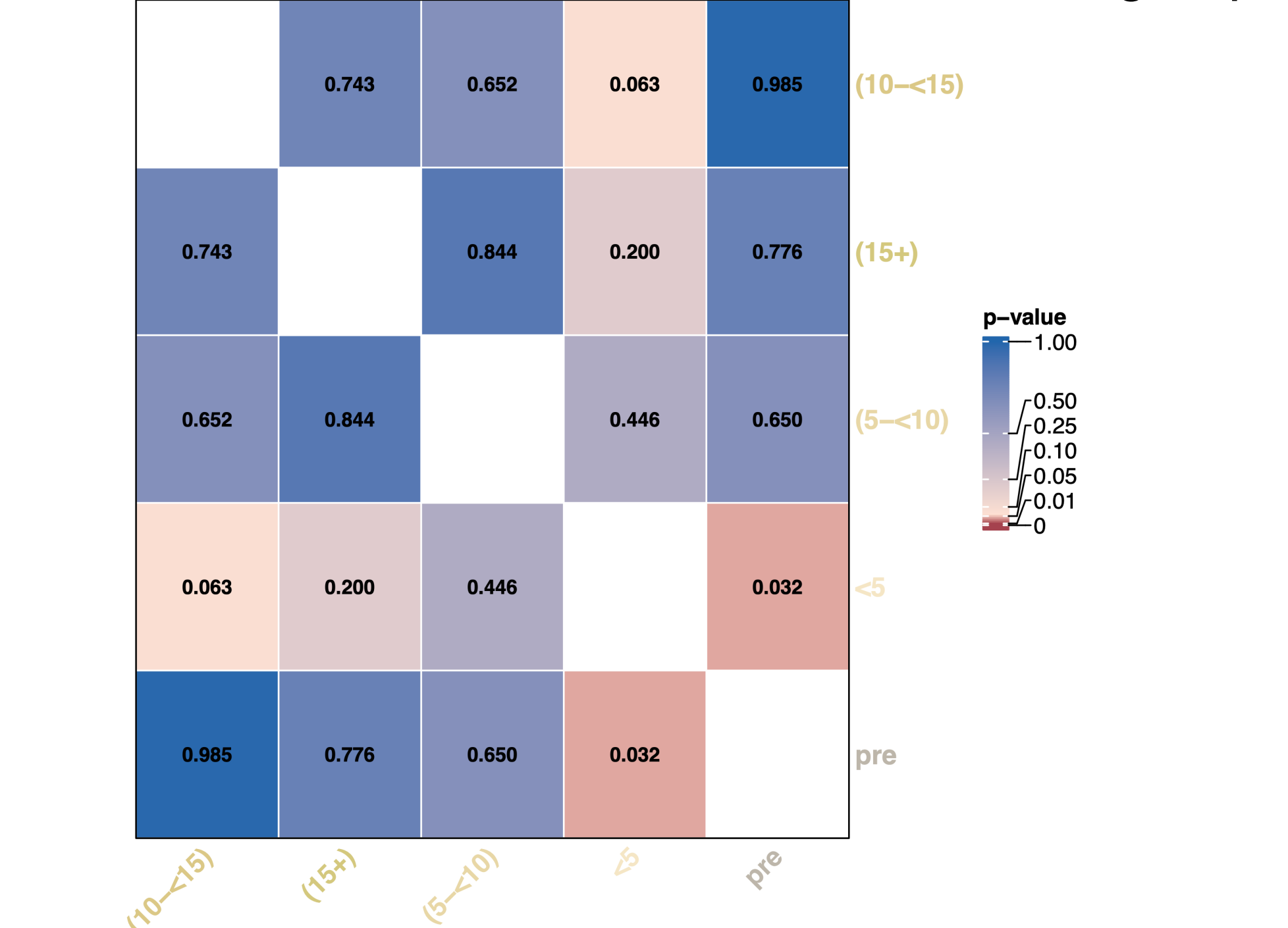
B Pairwise comparisons between menopausal groups



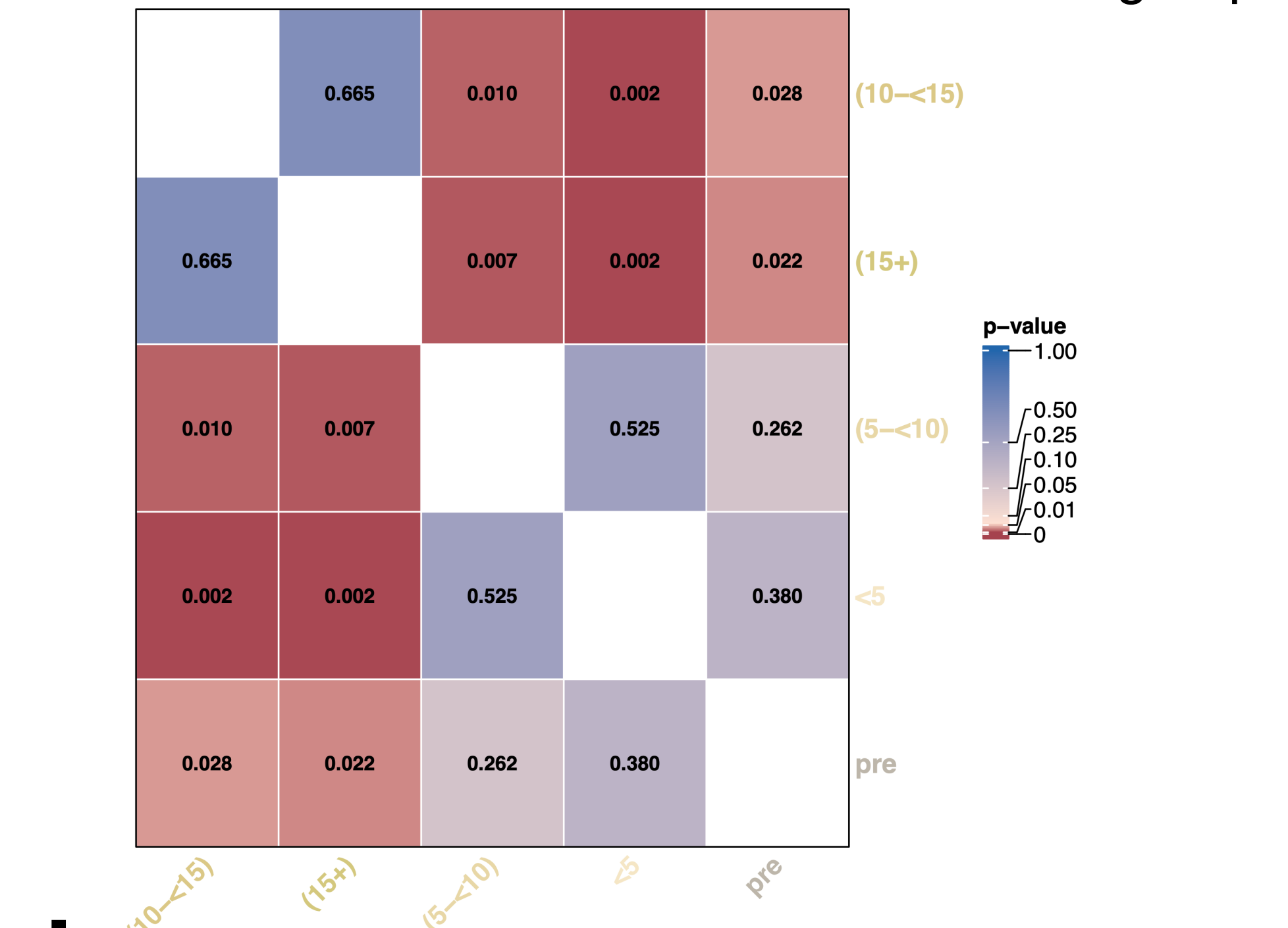
D Pairwise comparisons between menopausal groups



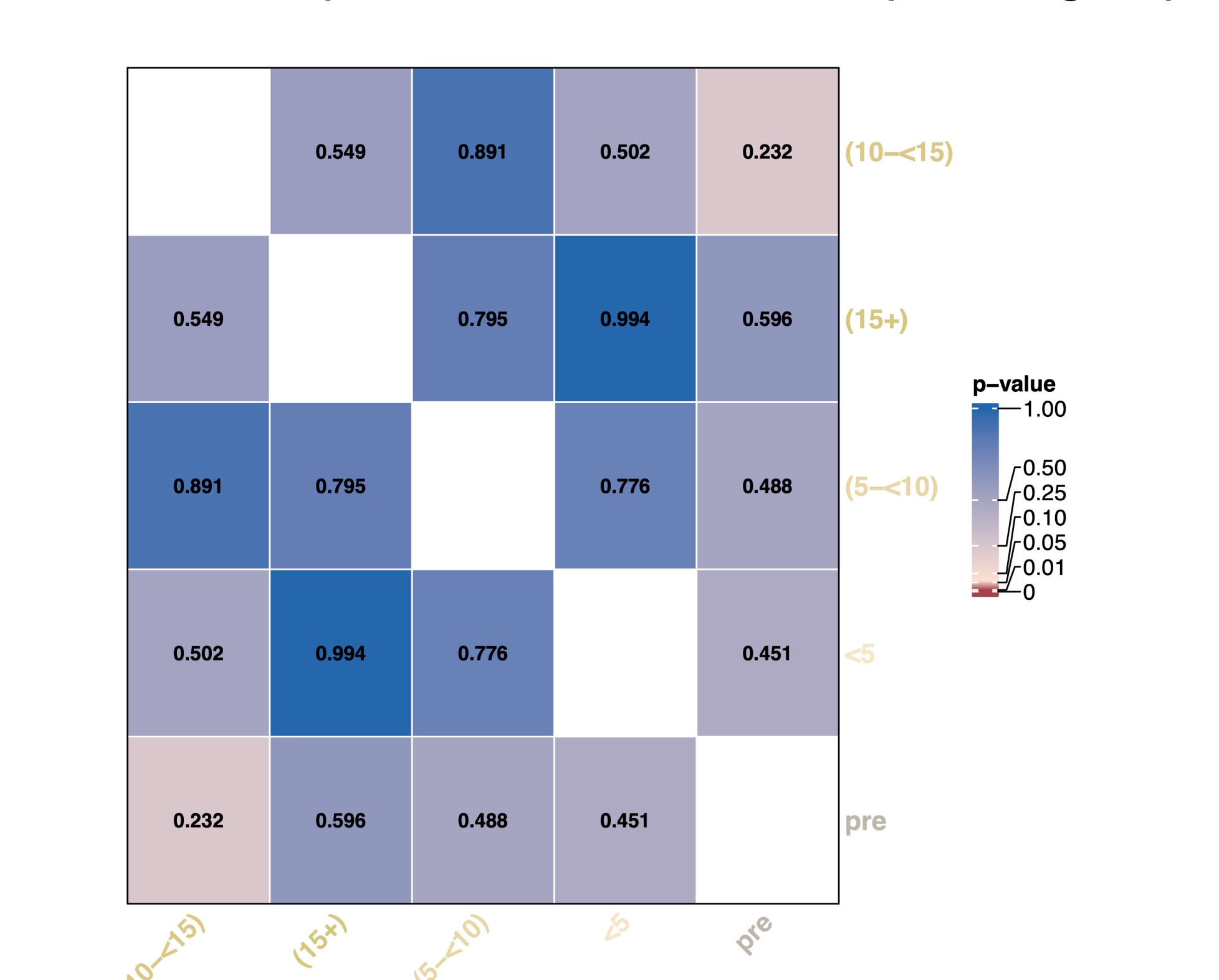
F Pairwise comparisons between menopausal groups



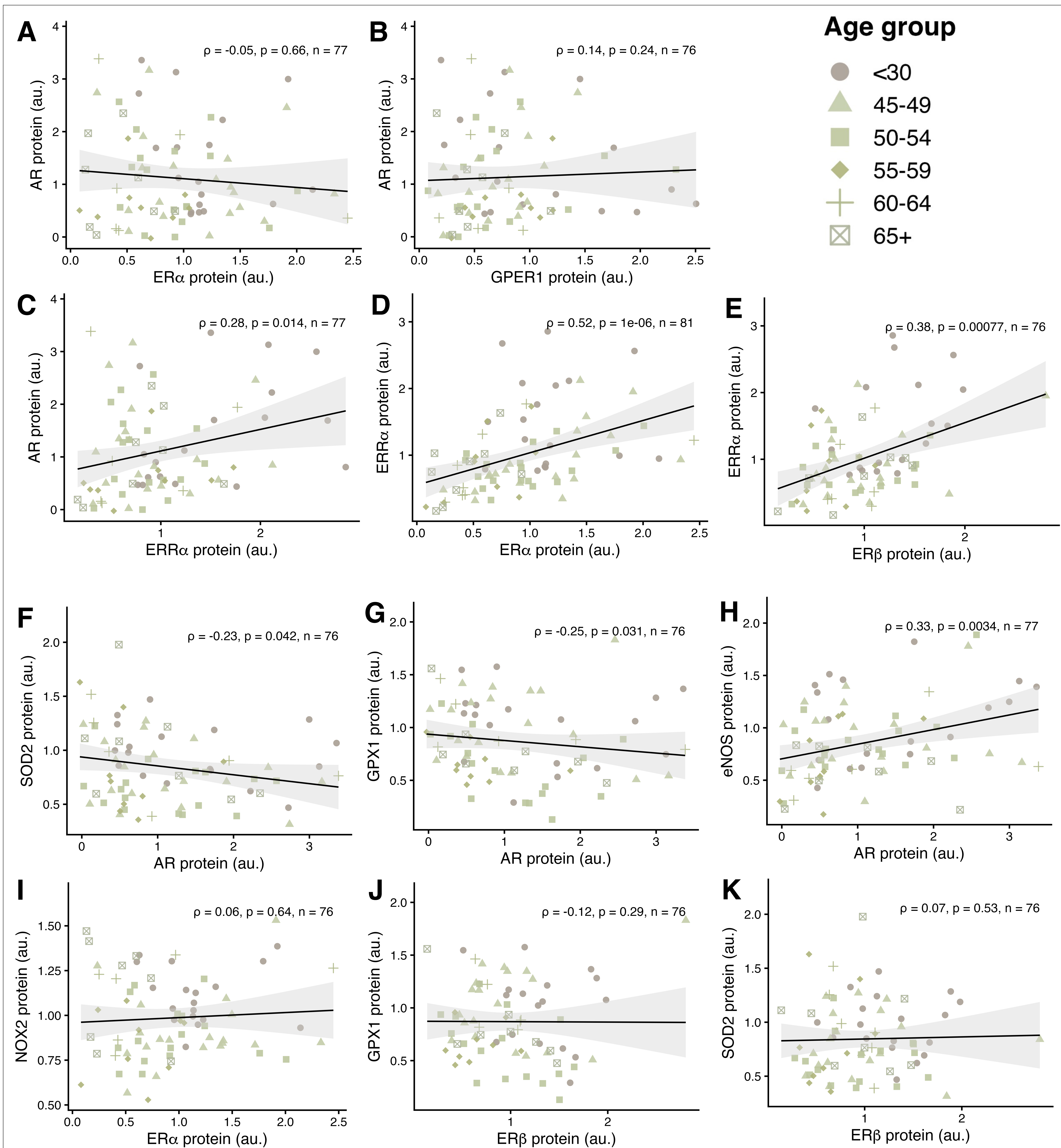
H Pairwise comparisons between menopausal groups



J Pairwise comparisons between menopausal groups

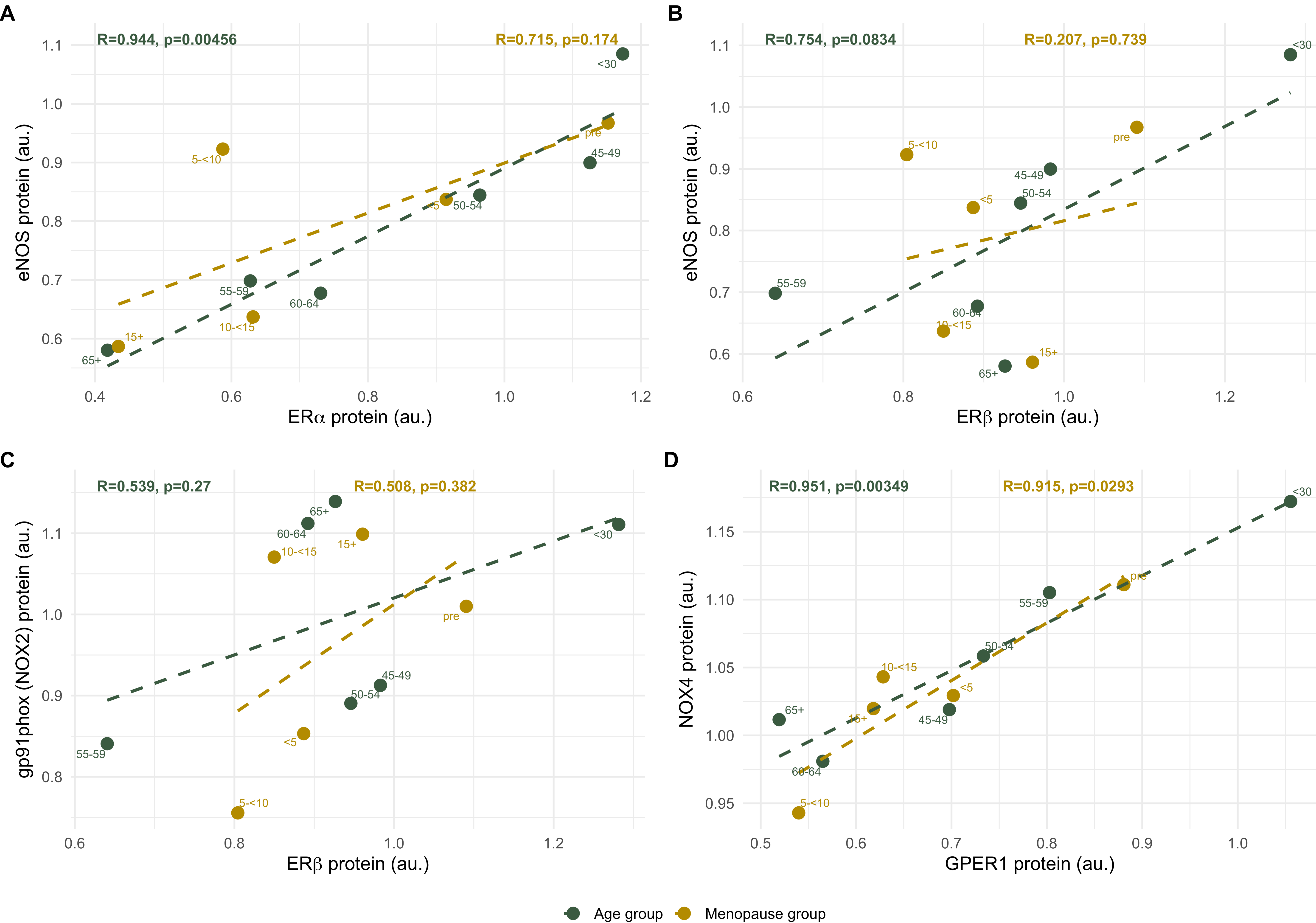


Supplementary figure 5



Supplementary figure 6

Correlations of group means



Supplementary figure 7

