

Official Title: Acute Effects of Cold Exposure on Cognitive Function

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Statistical Analytical Plan

1. Health outcomes related to cognitive function

1.1 Linear mixed-effects model A linear mixed-effects (LME) model would be utilized explore the effects of high temperature on cognitive function. To control for the influence of baseline cognitive function, the changes in measures from pre-exposure to post-exposure periods would be firstly calculated, and the differences of changes in measures between the intervention and control groups would be assessed using LME model. To account for potential confounding effects, several confounders would be included in the LME model, including gender (male, female), age (years), and body mass index (BMI, kg/m²). Additionally, random intercepts for each participant would be included to account for the repeated measurements. Similarly, LME model would be applied to assess the effects of low temperature on biomarkers (e.g., brain-derived neurotrophic factor). Finally, LME model would be used to examine the effects of low temperature on fMRI metrics, based on post-exposure metrics comparing the intervention and control groups.

1.2 Analytical tools MRI metrics were estimated using SPM12 (Statistical Parametric Mapping). All statistical analyses are carried out in R software version 4.1.1. Statistical tests are two-sided, and $p < 0.05$ or $FDR < 0.1$ are considered statistically significant.

2. Transcriptomics analysis

Transcriptomics analysis is performed in strict accordance with the manufacturer's guidelines. Transcriptomics data was log-transformed before formal analysis. We mainly apply the linear mixed-effects model to analyze the percent changes of detected omics features associated with heat exposure. Differential analytes are further conducted based on the p values obtained from the LME models. For the identified differential features from the LME model, pathway enrichment is performed at the ingenuity pathway analysis platform (IPA, QIANGEN, Germany). The pathways with p values of less than 0.05 are considered statistically significant.