Statistical analysis plan

Effects of high ventilation breathwork with retention on mental health and wellbeing: A randomised placebo-controlled trial (NCT06064474)

Guy William Fincham, Elissa Epel, Alessandro Colasanti, Clara Strauss, Kate Cavanagh

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Outcome scale measures (quantitative): Stress, anxiety, depression, mental wellbeing, sleep-related impairment, positive & negative affect, credibility & expectancy of breathwork

Primary outcome of stress at post-intervention (primary timepoint) will be calculated from Depression Anxiety Stress Scale—21 items (DASS-21) stress subscale. Secondary outcomes of stress (at follow-up), anxiety and depression will be calculated from respective DASS-21 subscales. Scores on DASS-21 subscales will be multiped by two to convert them to scores equivalent to longer form DASS-42 score in line with DASS scoring recommendations. Secondary outcomes of mental wellbeing and sleep-related impairment will be measured by Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS) and PROMIS Item Bank v. 1.0 - Sleep-Related Impairment - Short Form 4a (PROMIS-4a), respectively. Total raw scores on SWEMWBS will be transformed into metric scores using the SWEMWBS conversion table. PROMIS-4a will be scored using a T-score transformation according to the PROMIS Sleep scoring manual. Pre-intervention, post-intervention (after 21 days) and follow-up (after a further three weeks) scale score differences between groups will be analysed through mixed analysis of variance.

Secondary outcomes of positive and negative affect will be calculated from respective subscales on Positive and Negative Affect Schedule (PANAS-20). Pre-intervention, after first breathwork session, and post-intervention scale score differences between groups will be analysed through mixed analysis of variance. Self-reported credibility and expectancy of the breathwork protocol will be measured via the Credibility/Expectancy Questionnaire (CEQ-6). Descriptive statistics for all measures for all participants in each condition will be reported. Missing items within scales will be replaced using the mean for other items in the scale/subscale in cases where =<30% of data are missing from a scale/subscale or where whole scales/subscales are missing. Multiple imputation will be used where >30% of data are missing from a scale/subscale or where whole scales/subscales are missing. Cronbach's alphas will be used to assess internal consistency of each scale at baseline. The DASS-21, SWEMWBS, PROMIS-4a and PANAS-20 all have one attention-check question in them to ensure participants are completing the surveys properly.

Primary analysis

Intention-to-treat; post-intervention is the primary timepoint for primary outcome stress. For both the primary outcome and secondary scale outcomes, group x time effects at the $p<.05$ level will be determined using mixed ANOVAs. Group x time effects at the $p<.05$ level will be followed up with simple contrasts (with pre-intervention as the comparator) and between-group t-tests. Baseline data will be controlled for depending on the outcome being tested (i.e., DASS-21 Stress at baseline will be entered as a covariate when testing effects on DASS-21 Stress). Data analysis will be performed in R and SPSS.

Secondary analysis

Per-protocol analysis (participants reporting at least 10 sessions of the breathwork) will be conducted as secondary analysis.

Sensitivity checks

If sizeable missing data are present at the primary timepoint of post-intervention (6% or above), they will be replaced using multiple imputation using 30 imputed datasets and entering any study variable that predict missingness or outcomes into

the imputation model, and used for sensitivity analysis. Analysis without baseline covariates will be included as sensitivity analysis. If a participant answers more than one of the attention-items incorrectly at each timepoint their data will be excluded from the main analyses but included in a sensitivity analysis.

Exploratory analysis of secondary measures

Adherence to breathwork protocol

Post-intervention, participants will answer how many times they completed the guided breathwork out of the assigned 21 days. This will be compared between groups via unpaired t-test, and correlated with outcome scale scores on DASS-21, SWEMWBS, PROMIS-4a and PANAS-20 within each condition to see whether there are any associations between adherence and changes in these scale scores. Adherence will be looked at as a moderator.

Credibility & expectancy of breathwork protocol

CEQ-6 scores will be compared between groups via unpaired t-tests. If there are significant differences between groups on credibility/expectancy, primary tests will be run again with this used in covariance analysis. Similar to adherence, CEQ-6 scores will be correlated with the outcome scale scores above, to see whether there are relationships between CEQ-6 and changes in these scale scores within each condition.

Negative side effects due to protocol

Whether participants experienced: 1) Unpleasant/unwanted short-term effects and/or 2) Lasting bad effects from the breathwork. Analysis will be content analysis.

Other outcomes (qualitative)

Below outcomes will be explored to offer complementary findings to main quantitative analyses above.

Overall Experience

Participants' perspectives and overall experience of the breathwork protocol and study-period (i.e., positive, negative, neutral, general notes, etc.) post-intervention and follow-up. At post-intervention, analysis will be sentiment analysis, based on whether a participant reported their overall experience of the breathwork as strongly positive, positive, neutral, negative, or strongly negative.

Hypothesis Guessing

Whether participants can correctly guess which condition they were allocated to, at end of follow-up questionnaire, to tentatively infer if blinding was successful.