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Supplemental Material

Short-Term Exposure to Wildfire Smoke and $PM_{2.5}$ and Cognitive Performance in a Brain-Training Game: A Longitudinal Study of U.S. Adults

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Table S5. Results for all sensitivity analyses of the associations between smoke density and attention score for western U.S. users. A *P*-value of 0.05 was used to determine statistical significance. Exposure metrics include the daily maximum smoke density the day of and day prior to gameplay (Lag 0 and Lag 1) and in the 1 week prior to gameplay (1-Week).

Figure S1. Screenshot showing the appearance of the *Lost in Migration* game. In this example, the center bird is flanked by four other birds oriented in a different direction.

Figure S2. Average learning curves (95% CI) across 20 plays of *Lost in Migration* for contiguous U.S. users by age group and device. Learning curves for other subgroup combinations in the western and contiguous U.S. can be viewed on the Dashboard (ehs-bccdc.shinyapps.io/PMSmoke_Attention_Dashboard/).

Figure S3. Distribution of the time of day played for all 20 plays of the contiguous U.S. study population.

Figure S4. Average learning curves (95% CI) across 20 plays of *Lost in Migration* for contiguous U.S. users by (A) age group, (B) gender, (C) habitual behavior, and (D) device. Learning curves for western U.S. user subgroups can be viewed on the Dashboard (ehs-bccdc.shinyapps.io/PMSmoke_Attention_Dashboard/).

Figure S5. Distribution of the attention scores for all 20 plays of the contiguous U.S. study population. Score distributions for the western U.S. study population, different user subgroups, and specific plays can be viewed on the Dashboard (ehs-bccdc.shinyapps.io/PMSmoke_Attention_Dashboard/).

Figure S6. Maps of the (A) spatial and (B) temporal variability of daily $PM_{2.5}$ across the contiguous U.S. Spatial variability was calculated as the average of the standard deviation of census tract-level daily average $PM_{2.5}$ concentrations across each ZIP3 between 2017-2018. Temporal variability was calculated as the standard deviation of the ZIP3-level population-weighted daily average $PM_{2.5}$ concentrations between 2017-2018.

Figure S7. Sensitivity of the observed associations between attention score and (A) $PM_{2.5}$ in the western U.S., (B) $PM_{2.5}$ in the contiguous U.S., and (C) smoke density in the western U.S. to the type of score used (raw vs. percentile score).

Figure S8. Sensitivity of the observed associations between attention score and $PM_{2.5}$ in the (A) western U.S. and (B) contiguous U.S. to the number of lags included in the distributed lag model (e.g., 1-6 lags instead of 7). The n-day cumulative association was calculated from all lags included in the model (e.g., if 5 lags were included, the value shown is the 5-day cumulative association).

Figure S9. Sensitivity of the observed associations between attention score and (A) $PM_{2.5}$ in the western U.S., (B) $PM_{2.5}$ in the contiguous U.S., and (C) smoke density in the western U.S. to the definition of habitual users. The alternative definitions of habitual users considered a different cutoff for the median time between plays (14 days instead of 7) or for the standard deviation for time-of-day played (3 or 4 hours instead of 2).

Figure S10. Sensitivity of the observed associations between attention score and (A) $PM_{2.5}$ in the western U.S., (B) $PM_{2.5}$ in the contiguous U.S., and (C) smoke density in the western U.S. to the covariate model specification. The 'No Covariates, No Interactions' model only included the exposure variable(s), the log(n) variable, and the third order autoregression. The 'Covariates, No Interactions' model included all covariates but no interactions between the log(n), age group, and device variables. The 'Covariates, Interactions' model is the model used in the primary analyses and included all covariate and interaction terms.

Figure S11. Nonlinear associations between daily $PM_{2.5}$ and attention score in the (A) western U.S. and (B) contiguous U.S.

Figure S12. Sensitivity of the observed associations between attention score and (A) $PM_{2.5}$ in the western U.S., (B) $PM_{2.5}$ in the contiguous U.S., and (C) smoke density in the western U.S. to the number of unique dates required in the user inclusion criteria (i.e., users who completed 20 plays across less than 20 unique dates). To allow for comparison, only a user's first play on any given date was included (e.g., if plays 4-6 occurred on one date, only play 4 is included).

Figure S13. Sensitivity of the observed associations between attention score and (A) $PM_{2.5}$ in the western U.S., (B) $PM_{2.5}$ in the contiguous U.S., and (C) smoke density in the western U.S. to the number of plays required in the user inclusion criteria (i.e., users who completed less than 20 plays). To allow for comparison, users still must have completed each play across unique dates (e.g., a user with 18 plays must have completed the plays across 18 unique dates).

References