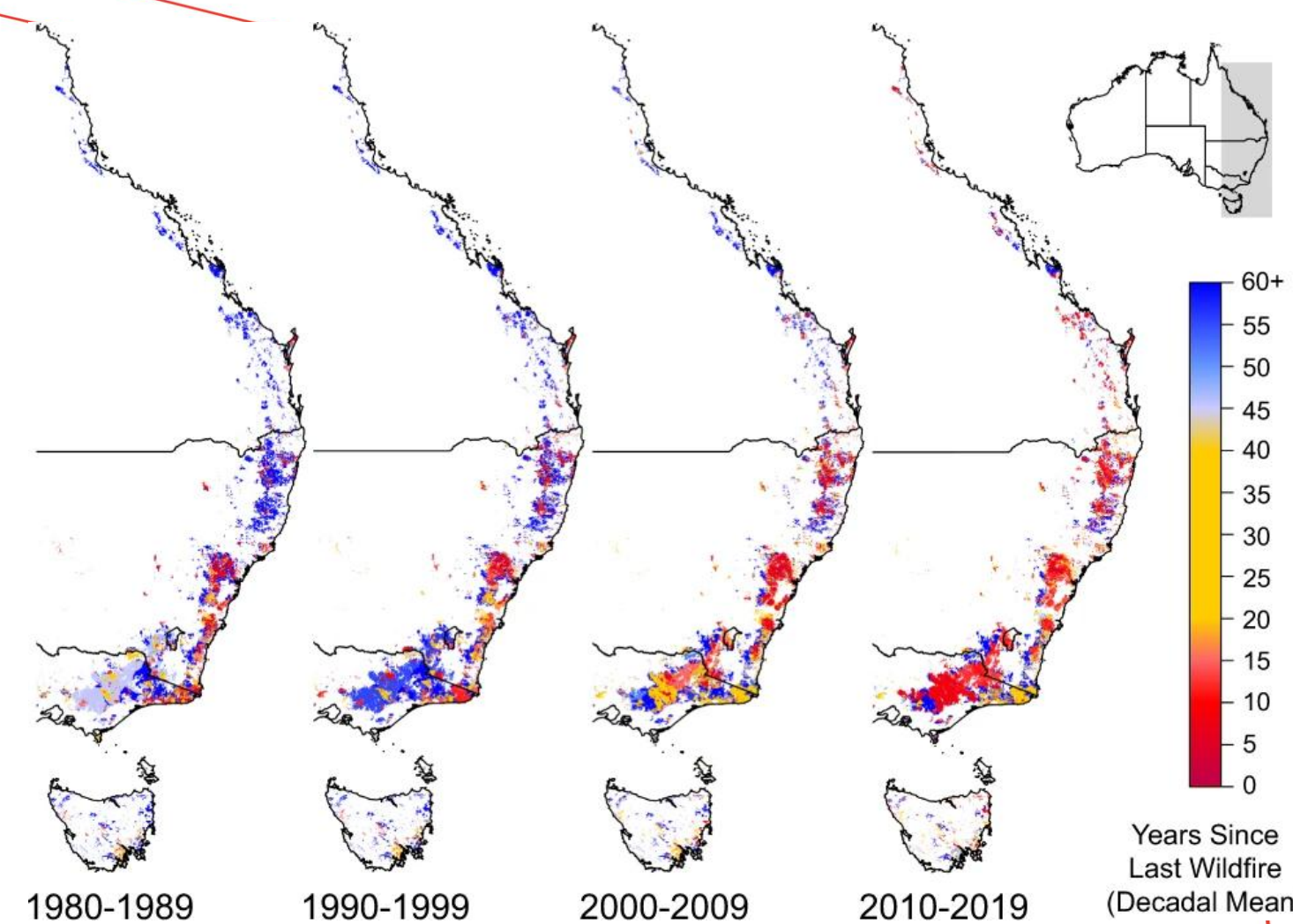


R-FIRE (Rural Firefighter Investigation of Risk & Exposure): Brain Health



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Number of years since the last wildfire (decadal mean) for forested areas from Australian State and Territory fire histories. (Canadell et al. 2021)

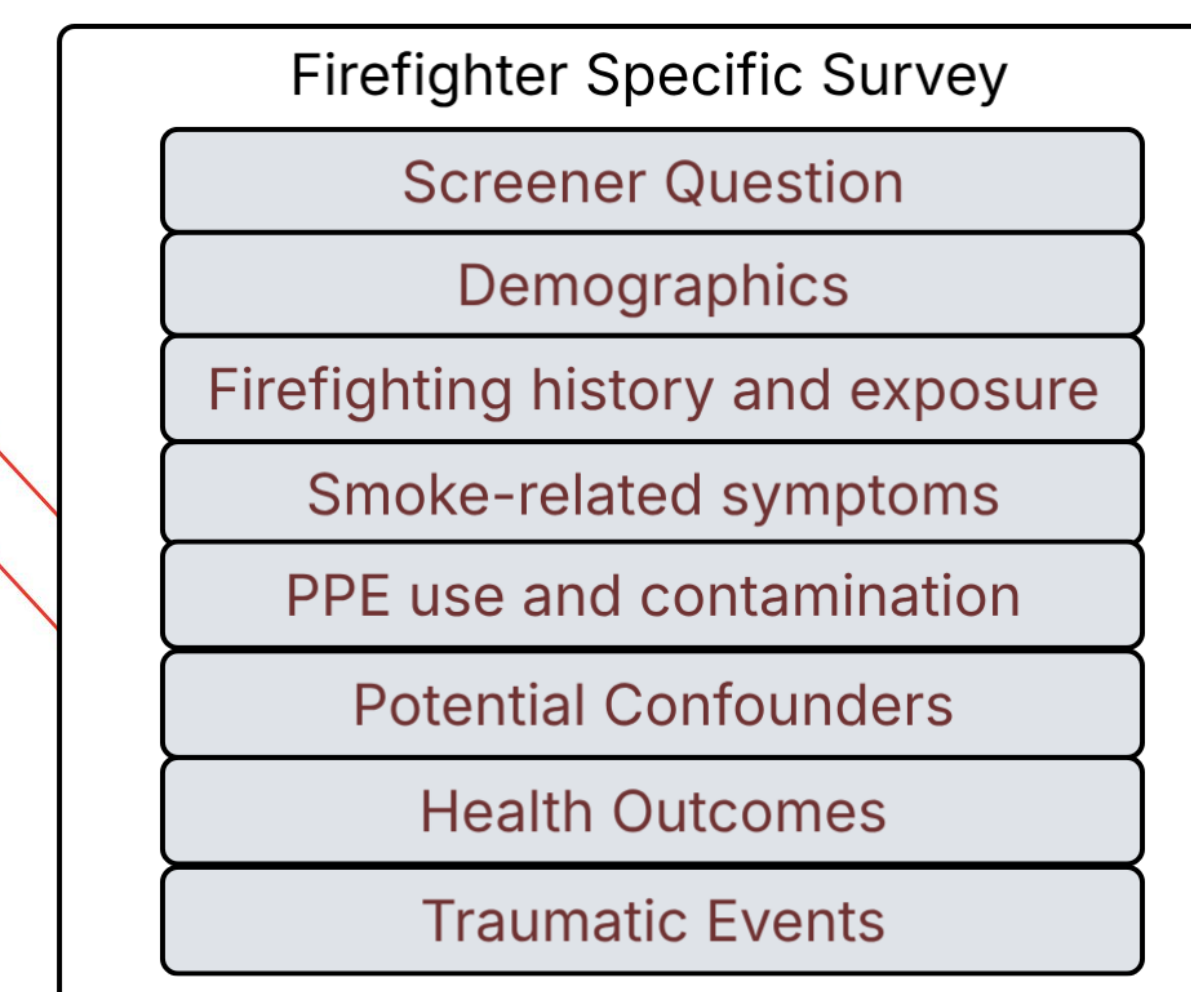
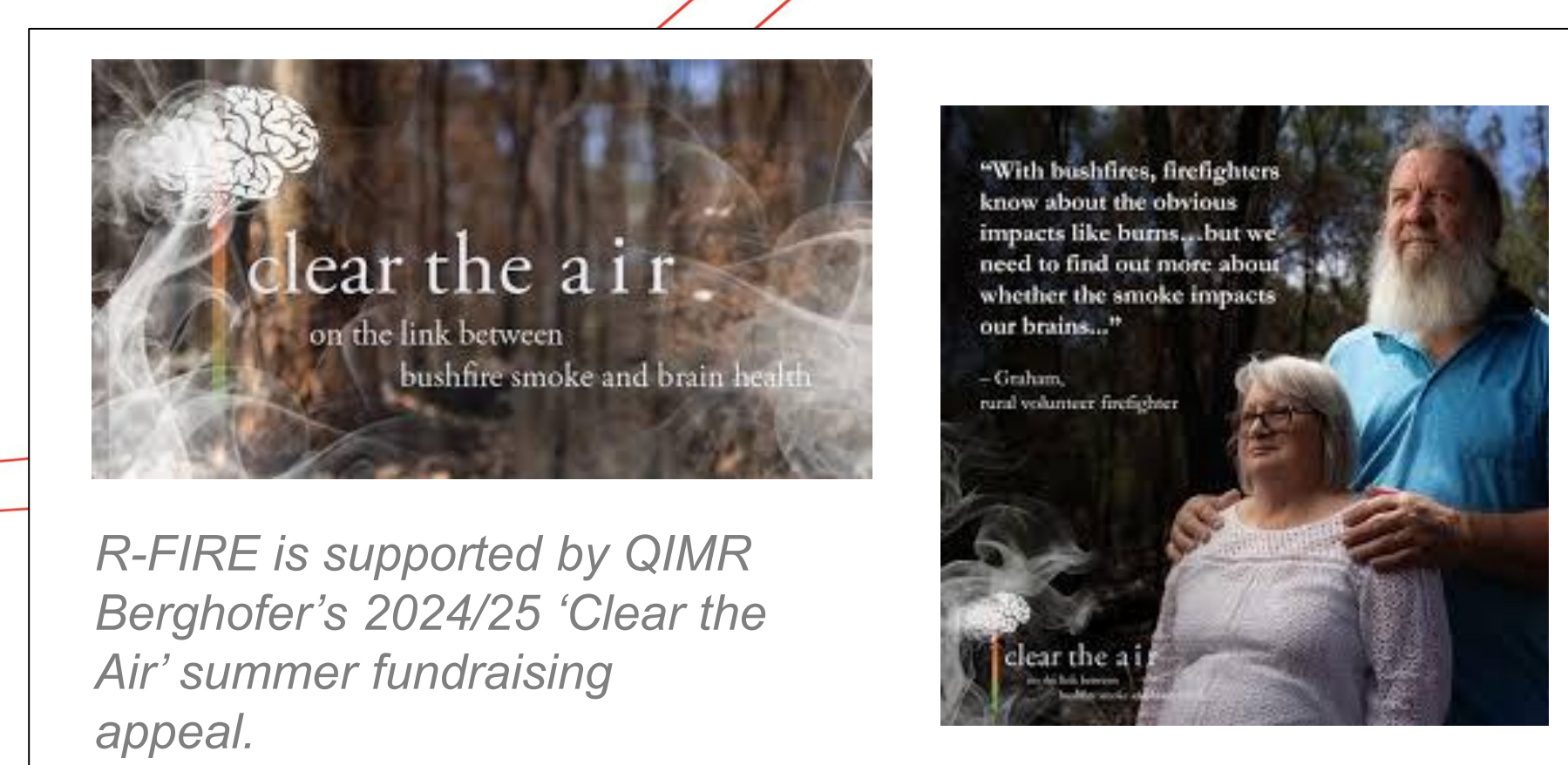
Participants will complete online surveys, with paper versions available on request. A firefighter specific survey will collect data on bushfire smoke exposure (Table 1). This has been developed in conjunction with consumer representatives (Figure 2).

Participants will be co-enrolled in our established Prospective Imaging Study of Ageing (PISA) (Lupton et al.) and will complete the PISA survey, which collects detailed health information, including demographics, memory and cognition, medical history, mental and physical health, linkage to medical records, personal wellbeing, lifestyle, and home address data. Online cognitive testing will be carried out in a home environment (Cogstate and Creyos platforms).

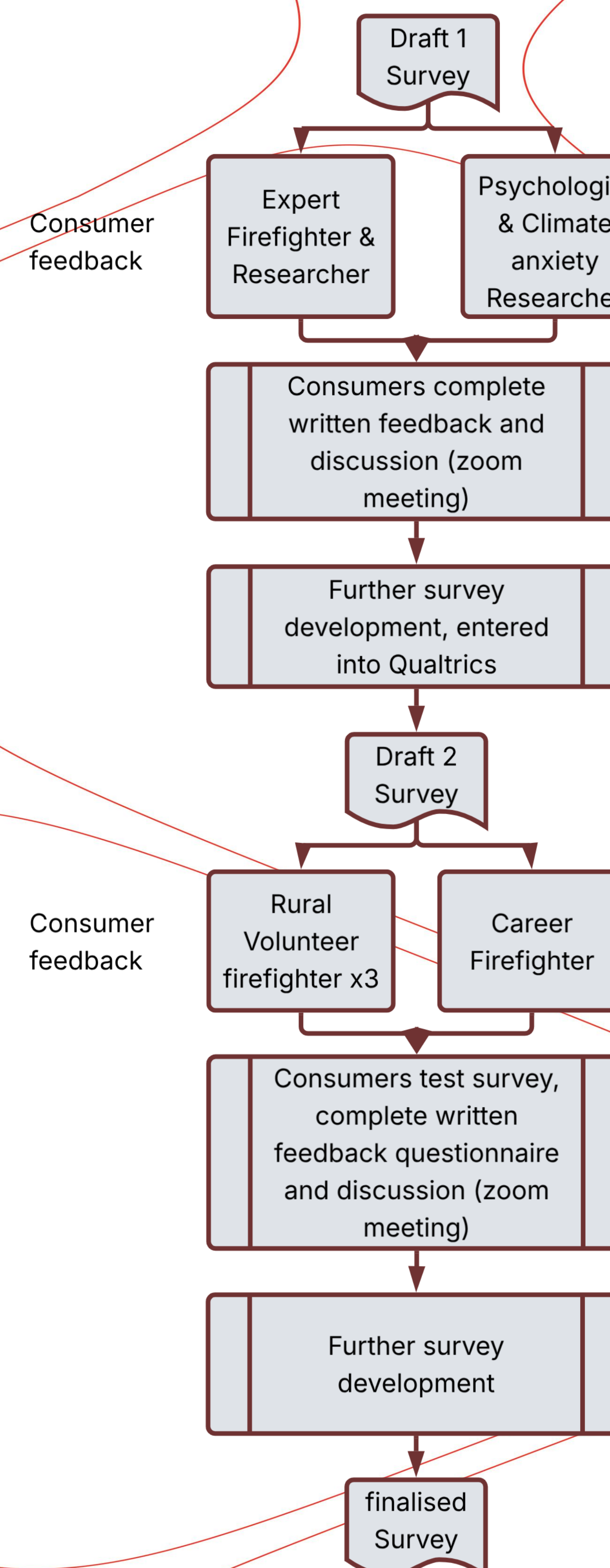


Exposure to background air pollution will be extrapolated for bushfire PM2.5 and non-bushfire PM2.5 at current and former residences using measured air pollution data with land use and remotely sensed (satellite) data (Borchers-Arrigada et al).

We will collect blood samples from a subset of 50 participants, selected based on extremes of bushfire smoke exposure and matched on key demographics. Participants will receive blood collection kits for use at their local pathology clinic. Plasma will be assayed using NULISA (Alamar Bioscience) CNS panel of 120 neuro-specific and inflammatory proteins. Stored samples will form a valuable biobank for future studies investigating multi-omics biomarkers and genetic risk.



Consumer Involvement timeline



We will investigate clinical and biological markers of bushfire smoke-associated neurological impacts. We will test for an association between long term PM2.5 exposure and general health outcome measures, as well as comprehensive brain health and cognitive measures. We will test for an association between PM2.5 levels and blood-based biomarkers of inflammation, neuronal injury, and dementia. PISA will serve as a control dataset for comparing the effect of PM2.5 in the general population (background exposure) with that experienced by volunteer firefighters.

Future extensions include: 1) an increase in sample size and power to detect bushfire smoke exposure effects, 2) longitudinal data collection through follow-up time points to understand the effects of short and long term bushfire smoke exposure.

Through the identification of indicators of elevated dementia risk and other brain health impacts related to bushfire smoke exposure, this research will facilitate early detection and intervention strategies. By developing a predictive medicine approach, the study aims to enable targeted screening and intervention efforts to mitigate the neurological consequences of smoke exposure, thereby improving health outcomes for affected individuals.



The R-FIRE webpage will go live, and recruitment will begin in August 2026

References: Lupton et al. A prospective cohort study of prodromal Alzheimer's disease: Prospective Imaging Study of Ageing: Genes, Brain and Behaviour. *NeuroImage. Clinical* 29, 102527 (2021). Borchers-Arrigada et al. Daily PM2.5 and Seasonal-Trend Decomposition to Identify Extreme Air Pollution Events from 2001 to 2020 for Continental Australia Using a Random Forest Model. *Atmosphere* 15, 1341 (2024)