27 Clinical Symptoms, Cognitive Functioning, and Brain Health in Agricultural Workers

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Objective: Agricultural workers are immersed in environments associated with increased risk for adverse psychiatric and neurological outcomes. Agricultural work-related risks to brain health include exposure to pesticides, heavy metals, and organic dust. Despite this, there is a gap in our understanding of the underlying brain systems impacted by these risks. This study explores clinical and cognitive domains, and functional brain activity in agricultural workers. We hypothesized that a history of agricultural work-related risks would be associated with poorer clinical and cognitive outcomes as well as changes in functional brain activity within cortico-striatal regions.
Participants and Methods: The sample comprised 17 agricultural workers and a comparison group of 45 non-agricultural workers recruited in the Northern Colorado area. All participants identified as White and non-Hispanic. The mean age of participants was 51.7 years (SD = 21.4, range 18-77), 60% identified as female, and 37% identified as male. Participants completed the National Institute of Health Toolbox (NIH Toolbox) and Montreal Cognitive Assessment (MoCA) on their first visit. During the second visit, they completed NIH Patient-Reported Outcomes Measurement Information System (PROMIS) measures and underwent functional magnetic resonance imaging (fMRI; N = 15 agriculture and N = 35 non-agriculture) while completing a working memory task (Sternberg). Blood oxygen-level dependent (BOLD) response was compared between participants. Given the small sample size, the whole brain voxel-wise group comparison threshold was set at alpha = .05, but not otherwise corrected for multiple comparisons. Cohen's d effect sizes were estimated for all voxels.
Results: Analyses of cognitive scores showed significant deficits in episodic memory for the agricultural work group. Additionally, the agricultural work group scored higher on measures of self-reported anger, cognitive concerns, and social participation. Analyses of fMRI data showed increased BOLD activity around the orbitofrontal cortex (medium to large effects) and bilaterally in the entorhinal cortex (large effects) for the agricultural work group. The agricultural work group also showed decreased BOLD activity in the cerebellum and basal ganglia (medium to large effects).
Conclusions: To our knowledge, this study provides the first-ever evidence showing differences in brain activity associated with a history of working in agriculture. These findings of poorer memory, concerns about cognitive functioning, and increased anger suggest clinical relevance. Social participation associated with agricultural work should be explored as a potential protective factor for cognition and brain health. Brain imaging data analyses showed increased activation in areas associated with motor functioning, cognitive control, and emotion. These findings are limited by small sample size, lack of diversity in our sample, and coarsely defined risk. Despite these limitations, the results are consistent with an overall concern that risks associated with agricultural work can lead to cognitive and psychiatric harm via changes in brain health. Replications and future studies with larger sample sizes, more diverse participants, and more accurately defined risks (e.g., pesticide exposure) are needed.

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28 A Graph Theoretical Approach to Understanding Associations between Structural Connectivity and Improvements in Behavior of Children Born Very Preterm Following a Positive Parenting Intervention

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