

Adverse Mental Health Effects of the 2025 Los Angeles Wildfire Disaster: a Difference-in-Difference Analysis of the Understanding America Study

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Background

- Numerous studies have found adverse mental health effects of wildfire.
 - Increased Post-Traumatic Stress Disorder (PTSD), depression, and anxiety.
 - Multifactorial contributions: life-loss, financial loss, disruptions of normal life.
 - **Wildfire smoke (PM_{2.5})** is a main risk factor.
- However, previous studies investigated retrospective effects over a long time after the wildfire.
- Study participants are restricted to communities directly affected.
- Limited understanding of modifying effects of social-economic factors, such as SES and prior financial shocks.



Eaton Fire, Jan 8th, 2025.

Source: CNN



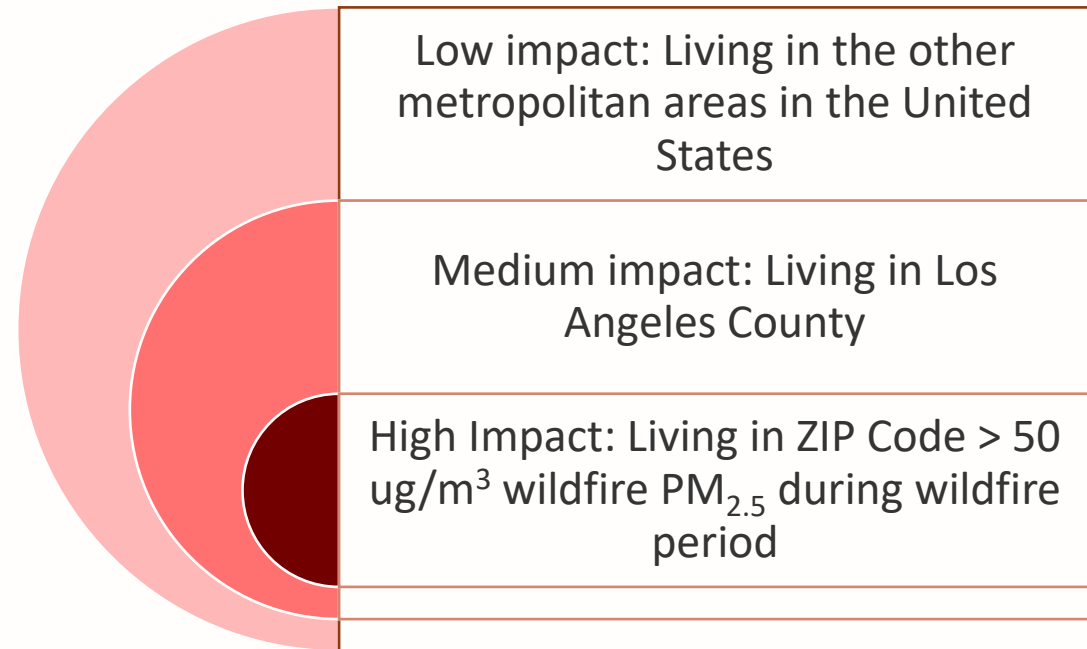
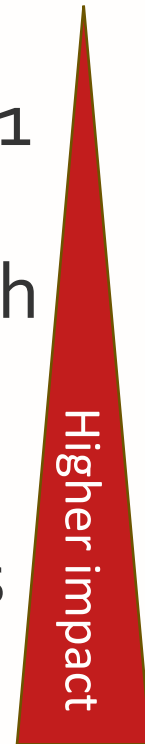
NASA Terra MODIS Image showing air smoke, Jan 8th, 2025.

To et al., 2021; <https://doi.org/10.3390/bs11090126>

Eisenman et al., 2022; <https://doi.org/10.1186/s12889-022-14662-z>

Objective

- **Objectives:** to investigate the short-to-mid term (1 month to 1 year) effects of wildfire and wildfire smoke on mental health prospectively.
- **Hypothesis:** exposure to wildfire smoke and living in Los Angeles County during the wildfire disaster have adverse effects on mental health
- Sub-hypothesis: Population with lower income and with prior negative financial shocks are more vulnerable



Methods

Study Population :

- Understanding American Study (UAS) participants.
- Only include UAS participants with addresses in Los Angeles (LA) County and other metropolitan county.¹
- Address (ZIP Code and County), demographic (age, sex, race and ethnicity), and socio-economic factors (income, marital status, occupation, and financial shocks) collected at baseline and monthly surveys

¹Based on National Center for Health Statistics (HCHS) Large central metro county

Understanding
AmericaStudy

USC Dornsife
Center for Economic
and Social Research

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This repository is under review for potential modification in compliance with Administration directives.

WELCOME TO THE

Understanding America Study

GETTING STARTED
GUIDE

WHAT'S NEW

INTERACTIVE
DATA EXPLORER

FOR
PARTICIPANTS

FOR CLIENTS

Come to CIPHER 2026 in D.C.! February 26-28, 2026. Free to attend, just RSVP. [Click here for details.](#)

Interested in collecting data for free? [Click here](#) to learn more. If you do not have a google account, please follow [these alternative instructions.](#)

Want to quickly learn more about the UAS? [Click here](#) to download our brochure or read the [UAS cohort profile.](#)

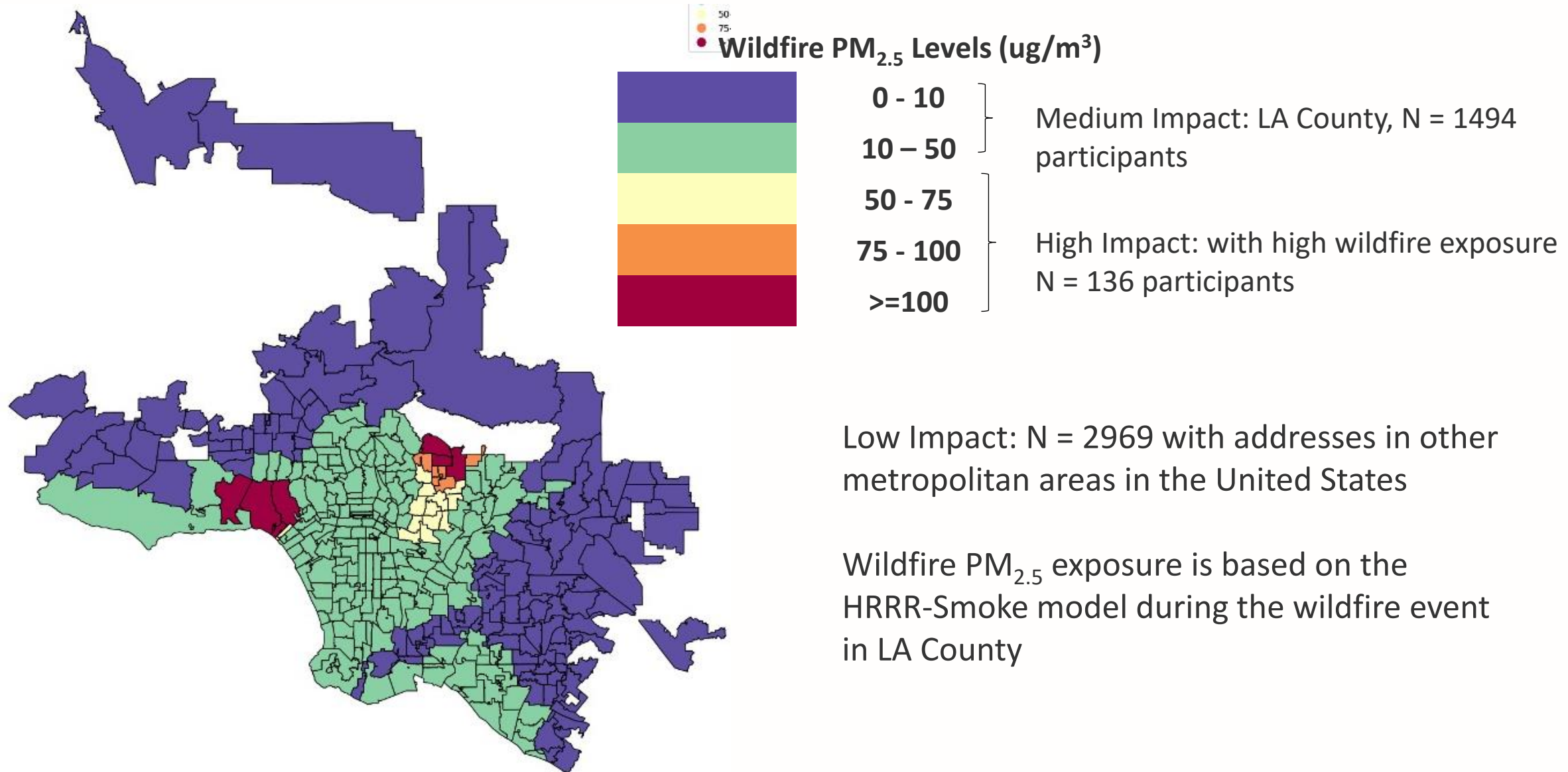
WELCOME

The Understanding America Study (UAS), housed at the University of Southern California, is a nationally representative, probability-based Internet panel of approximately 15,000 U.S. residents, including a 3,500-person California oversample. It serves as an open and flexible platform for data collection in the social and health sciences, integrating state-of-the-art survey practices for both longitudinal and cross-sectional research. The UAS collects rich, multifaceted data, including online surveys, genetic samples, wearable device data, administrative linkages, and real-time assessments, to examine a broad array of factors shaping individual and family experiences across the life course. By offering surveys in both English and Spanish and providing Internet-enabled devices when needed, the UAS supports broad participation and accessibility.

Methods - Outcome

- Self-reported mental health outcomes from the UAS Monthly Survey from Oct 2023 to Dec 2025.
- Anxiety and depression were assessed based on the Patient Health Questionnaire (PHQ-4) and perceived stress from Perceived Stress Scale 4 (PSS-4).
- The original scores and dichotomized outcomes were used as outcomes of anxiety, depression, and perceived stress.

Wildfire Smoke Exposure



Methods – Statistical Analysis

- Difference-in-difference analysis using the mixed-effects model for longitudinal outcomes.
- $$Y_{ij} = \beta_0 + \beta_1 FireExposure_{ij} + \beta_2 PostFire_{ij} + \beta_3 FireExposure_{ij} \times Postfire_{ij} + \beta_4 Covariates_i + nc(Wave) + e_i + e$$
- FireExposure indicates high/medium/low categories; PostFire indicates survey completes before or after Jan 7, 2025.
- Adjust for covariates including age, sex, race and ethnicity, education, household incomes, marital status, and a natural cubic spline for wave
- Random intercept for each individual i .
- Stratified and interaction of incomes (Household Income $\geq 100K$ versus lower) and previous experience of negative financial shock before fires.
- Sensitivity analysis of
 - Incorporating sampling weights
 - Exclude wave 16 during Jan 2025.

Results

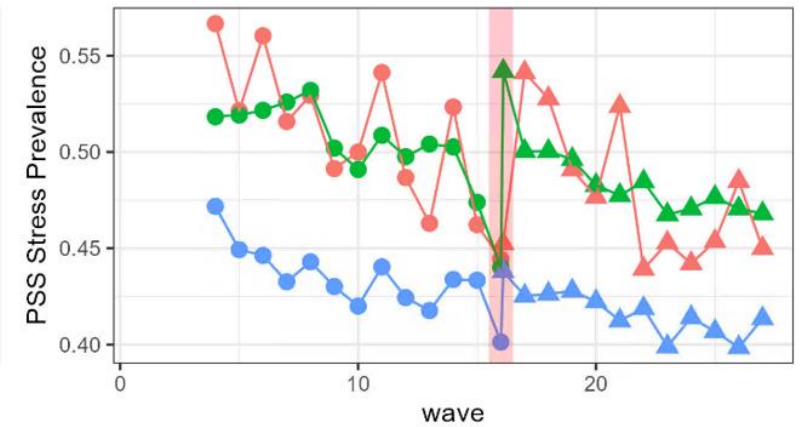
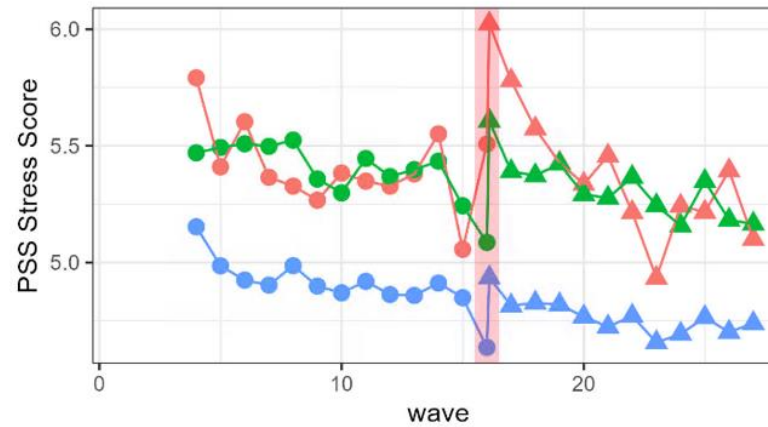
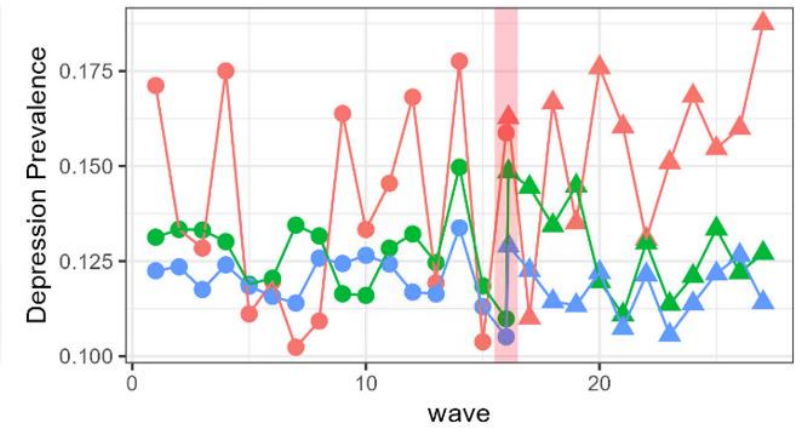
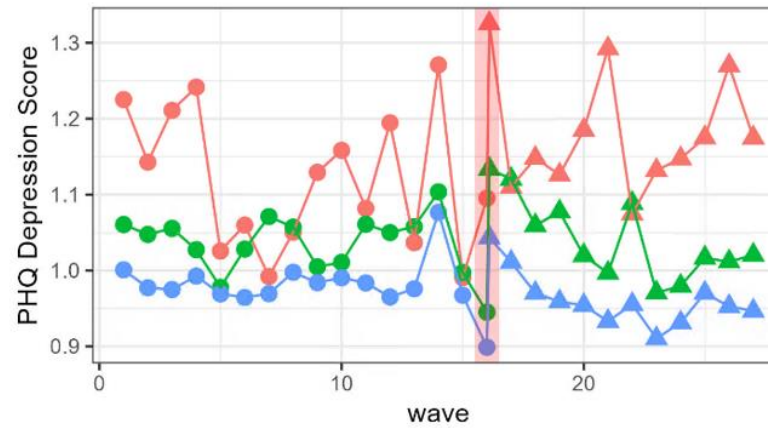
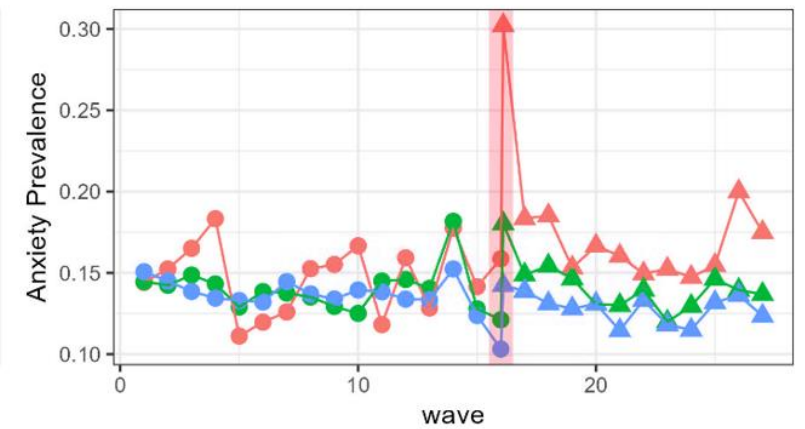
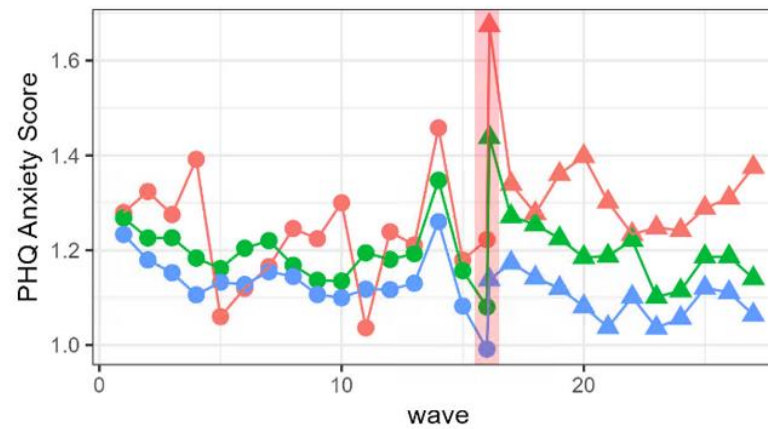
COVARIATES	ALL	HIGH IMPACT: CLOSE TO FIRE AND HIGH EXPOSURE TO WILDFIRE SMOKE	MEDIUM IMPACT: LA COUNTY	LOW IMPACT: OTHER METROPOLITAN AREAS
N	4599	136	1494	2969
Sex				
Female	2778 (60.6%)	90 (66.7%)	927 (62.0%)	1761 (59.6%)
Male	1807 (39.4%)	45 (33.3%)	568 (38.0%)	1194 (40.4%)
Age in years, mean(SD)	48.3 ± 16	48.2 ± 16.3	46.5 ± 15.1	49.2 ± 16.4
Race and ethnicity, N(%)				
Non-Hispanic White	2016 (44%)	34 (25.2%)	459 (30.7%)	1523 (51.5%)
Black	561 (12.2%)	<20 (<20%)	127 (8.5%)	433 (14.7%)
Asian	599 (13.1%)	30 (22.2%)	210 (14%)	359 (12.1%)
Hispanic	1180 (25.7%)	61 (6.7%)	639 (42.7%)	480 (16.2%)
Other	229 (5%)	<20 (<20%)	60 (4%)	160 (5.4%)
Education, N(%)				
Advanced Degree	1040 (22.7%)	39 (28.9%)	282 (18.9%)	719 (24.3%)
College Completed	1338 (29.2%)	42 (31.1%)	439 (29.4%)	857 (29%)
Some College	1423 (31%)	32 (23.7%)	498 (33.3%)	893 (30.2%)
High School	571 (12.5%)	<20 (<20%)	184 (12.3%)	371 (12.6%)
Less than High School	214 (4.6%)	<20 (<20%)	92 (6.2%)	115 (9.3%)
Household Income in USD, N(%)				
Above 150 K	932 (20.3%)	25 (18.5%)	288 (19.3%)	619 (20.9%)
100 K – 150K	758 (16.5%)	26 (19.3%)	243 (16.3%)	489 (16.5%)
75K – 100 K	540 (11.8%)	<20 (<20%)	166 (11.9%)	358 (12.1%)
35 K – 75 K	1158 (25.3%)	33 (24.4%)	387 (25.9%)	738 (25%)
10 K – 35 K	817 (17.8%)	22 (16.3%)	284 (19%)	511 (17.3%)
Less than 10 K	380 (8.3%)	<20 (<20%)	127 (8.5%)	240 (8.1%)
Marital Status				
Married	2166 (46.6%)	62 (45.5%)	689 (46.1%)	1415 (47.6%)
Never Married	1588 (34.5%)	60 (44.1%)	563 (37.7%)	965 (32.5%)
Separated or Divorced or Widowed or Other	845 (18.9%)	<20 (<20%)	241 (16.1%)	589 (19.8%)
Experience Financial Hardship during Oct 2023 – Dec 2024				
Yes	1213 (26.4%)	38 (27.9%)	431 (28.8%)	744 (25.1%)
No	3386 (73.6%)	98 (72.1%)	1063 (71.2%)	2225 (74.9%)

N = 4599 (mean age 48.3 years)

LA participants are younger, more racially and ethnically diverse, and have a lower socioeconomic status.

Results

- Plots of the anxiety, depression, and perceived stress scores and prevalence over time from Oct 2023 (wave 1) to Dec 2025 (wave 27)
- The wildfire event happened on Jan 7-12, during the wave 16.



Post LA Fire ● 0 ▲ 1 Exposed to LA Fire ● High Impacted ● Medium Impacted ● Low Impacted

Results

Outcome	High impacted vs. Low impacted		Medium impacted vs. Low impacted		High impacted vs. Medium impacted	
Anxiety prevalence	2.5% (0.4%, 4.5%)	P = 0.018	1.5% (0.5%, 2.6%)	P = 0.003	1.9% (-0.2%, 4%)	P = 0.073
Depression prevalence	1.2% (0.7%, 3.1%)	P = 0.23	1.1% (0.1%, 2%)	P = 0.03	0.8% (-1.1%, 2.8%)	P = 0.408
Perceived stress prevalence	-0.7% (-3.5%, 2.1%)	P = 0.606	0.4% (-1%, 1.7%)	P = 0.618	0.6% (-3.4%, 2.3%)	P = 0.686
Anxiety score	0.1 (0.027, 0.174)	P = 0.007	0.066 (0.029, 0.102)	P < 0.001	0.063 (0.011, 0.138)	P = 0.097
Depression score	0.043 (-0.026, 0.111)	P = 0.552	0.03 (-0.004, 0.065)	P = 0.082	0.021 (0.049, 0.092)	P = 0.552
Perceived stress score	0.15 (0.005, 0.304)	P = 0.058	0.088 (0.012, 0.164)	P = 0.024	0.082 (0.075, 0.24)	P = 0.306

Results – Stratified analysis of Household Income

Outcome	High impacted vs. Low impacted					Medium impacted vs. Low impacted				
	Household Income >= 100,000 USD		Household Income < 100,000 USD			Household Income >= 100,000 USD		Household Income < 100,000 USD		
	Estimates (95% CI)	P-value	Estimates (95% CI)	P-value	Int. P	Estimates (95% CI)	P-value	Estimates (95% CI)	P-value	Int. P
Anxiety prevalence	0.6% (-2.5%, 3.7%)	0.10	3.9% (1.5%, 6.4%)	0.002	0.10	0.8% (-1.4%, 2.9%)	0.49	1% (-0.4%, 2.4%)	0.152	0.84
Depression prevalence	-2.5% (-5.4%, 0.5%)	0.099	3.6% (1.3%, 5.9%)	0.003	0.001	-0.2% (-2.4%, 1.9%)	0.829	0.9% (-0.4%, 2.3%)	0.179	0.365
Perceived stress prevalence	-2.8% (-7.1%, 1.5%)	0.20	0.1% (-3.3%, 3.6%)	0.932	0.29	-1.7% (-4.7%, 1.2%)	0.25	0 (-1.9%, 1.9%)	0.99	0.33
Anxiety score	-0.03 (-0.14, 0.082)	0.597	0.186 (0.09, 0.275)	<0.001	0.003	0.019 (-0.059, 0.09)	0.63	0.033 (-0.017, 0.084)	0.194	0.77
Depression score	-0.1 (-0.206, 0.005)	0.062	0.137 (0.053, 0.22)	0.001	<0.001	0.028 (-0.047, 0.104)	0.463	0.038 (-0.011, 0.086)	0.128	0.839
Perceived stress score	0.08 (-0.156, 0.317)	0.506	0.145 (-0.045, 0.335)	0.135	0.67	-0.034 (-0.196, 0.128)	0.680	-0.001 (-0.105, 0.103)	0.98	0.73

Bold indicates P-value < 0.05, **red** indicate interaction p-value < 0.05

Results – Stratified analysis of Prior Financial Shock

Outcome	High impacted vs. Low impacted					Medium impacted vs. Low impacted				
	Without Financial Hardship		With financial hardship			Without Financial Hardship		With financial hardship		
	Estimates (95% CI)	P-value	Estimates (95% CI)	P-value	Int. P	Estimates (95% CI)	P-value	Estimates (95% CI)	P-value	Int. P
Anxiety prevalence	2.2% (-0.1%, 4.5%)	0.061	4.1% (0.5%, 7.8%)	0.028	0.37	0.3% (-1.1%, 1.7%)	0.679	0.27% (0.5%, 4.8%)	0.014	0.068
Depression prevalence	0.8% (-1.3%, 3%)	0.44	2.4% (-1.1%, 5.8%)	0.178	0.46	0% (-1.3%, 1.4%)	0.97	1.8% (-0.2%, 3.9%)	0.08	0.15
Perceived stress prevalence	-2.2% (-5.4%, 0.9%)	0.16	2.6% (-2.4%, 7.7%)	0.31	0.11	-1.8% (-3.7%, 0.1%)	0.06	2.7% (-0.1%, 5.6%)	0.06	0.009
Anxiety score	0.06 (-0.02, 0.145)	0.133	0.21 (0.08, 0.34)	0.002	0.06	0 (-0.05, 0.051)	0.99	0.11 (0.03, 0.183)	0.006	0.02
Depression score	0.049 (-0.029, 0.126)	0.218	0.04 (-0.084, 0.16)	0.525	0.91	0.019 (-0.03, 0.068)	0.457	0.073 (-0.001, 0.146)	0.053	0.23
Perceived stress score	0.08 (-0.094, 0.255)	0.366	0.238 (-0.043, 0.52)	0.097	0.35	-0.086 (-0.191, 0.02)	0.109	0.188 (0.031, 0.346)	0.019	0.004

Bold indicates P-value < 0.05, **red** indicate interaction p-value < 0.05

Discussion and Conclusion

- Key findings:
 - The 2025 Los Angeles wildfire disaster had prolonged effects on mental health.
 - Effects are not restricted by communities directly affected by wildfire, but also entire Los Angeles County and those who are exposed to wildfire smoke.
 - Lower SES (lower income) and prior negative financial experience increase vulnerability to adverse mental health outcomes from fire, with potentially different mechanistic pathways.
- Strengths:
 - Prospective study design in a large population
 - Monthly mental health outcome collections (~1 year before and after wildfire)
 - National population in metropolitan areas as controls
 - Difference-in-difference analysis

Thank you for your attention

For any questions, please contact me (Jiawen Liao, PhD., Research Associate)
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