Supplementary Table S3

Primary study traceability matrix for wildfire effects in later life

The traceability matrix summarises primary investigations supporting the social, economic and psychological synthesis. For each study it records population and age definitions, study setting, territorial and hazard relevance, principal observations and interpretive limitations. The matrix is purposive and does not represent an exhaustive systematic-review extraction or formal risk-of-bias assessment.

Seventeen primary investigations were selected for direct relevance to later-life wildfire experiences and the three thematic domains. The two studies of Sandy Lake First Nation address the same wildfire evacuation and are not interpreted as independent replications. Reviews and contextual reports are presented separately.

Study	Setting and design	Sample age and timing	Domain and directness	Contribution	Principal limitation
Belleville et al. (2021)	Fort McMurray, Canada; wildfire evacuation Population telephone survey	1,510 adults 18+; mean 44.11 years (SD 12.69) One year after the 2016 wildfire; May–July 2017	Psychological Wildfire specific; mixed age; rural relevance indirect	Self-reported post-traumatic stress, depressive, anxiety and sleep symptoms were assessed after evacuation.	No pre-fire baseline; 40.2% response; symptom thresholds are not clinical diagnoses; no older rural cohort.
Humphreys et al. (2022)	Methow Valley, Washington, USA; rural wildfire smoke Three resident focus groups and professional interviews	13 residents; 16 professionals Residents 18+; mean 46.6 years November 2019–January 2020	Social; Economic; Psychological Rural and wildfire specific; mixed age	Accounts describe disrupted activities, financial pressures, distress and both social withdrawal and mutual support during smoke episodes.	Small selected sample; residents predominantly White and relatively advantaged; no older-specific prevalence or financial effect estimate.
Silveira et al.	California, USA;	725 adults	Psychological	Exposure was associated	Convenience recruitment

(2021)	Camp Fire exposure groups Cross-sectional online survey	18–84; mean 27.01 years (SD 13.59) Approximately six months after the 2018 Camp Fire	Wildfire specific; predominantly younger sample	with adverse mental-health symptoms; age associations did not justify assuming uniformly greater distress at older ages.	and self-report; no pre-fire measures; neither an older-only nor a rural-only sample.
Pacella et al. (2024)	Victoria, Australia; 2009 Black Saturday bushfires Three-wave cohort	802 at 3–4 years; 596 at 5 years; 436 at 10 years; 369 at all waves Mixed-age adults; mean 52.6 years at disaster 3–4, 5 and 10 years after the disaster	Psychological Wildfire specific; mixed age	Adjustment difficulties followed heterogeneous long-term courses.	Attrition; no pre-disaster mental-health baseline; trajectories cannot be treated as inevitable older-adult decline.
Drolet and Choudhury (2024)	Alberta, Canada; recovery after the 2016 wildfire Interviews and small focus groups with professionals	51 professionals: 40 interviewees and 11 focus-group participants Professionals discussing older adults; no older-resident sample Post-fire recovery in the COVID-19 context	Social Older-adult topic; professional proxy accounts	Professionals described relationships and older adults' participation as important to recovery.	Does not provide direct interviews with 51 older residents or an intervention effect estimate.
Zheng (2023)	United States; BRFSS/FIRESTAT; repeated cross-	Adults 65+; BRFSS 2000–2010; 105,263 model observations for Table 8	Psychological; older-adult wildfire-specific, nationally	Table 8 alternative-estimator ATT = 2.073 additional poor-mental-	Observations are model-level, not unique participants; no rural-

	sections; differences-in-differences	mental-health outcome	aggregated	health days in past 30 days; SE 0.645; p < .01	stratified outcome; self-report, not diagnosis
Cherry et al. (2021)	Louisiana, USA; 2016 flood Post-disaster observational study	223 adults 18–88; mean 49.6 years (SD 17.7) After the 2016 flood	Psychological Cross-hazard contextual evidence; mixed age	Examines relationships between disaster stressors and psychological well-being.	Flood evidence cannot establish wildfire-specific effects; mixed ages despite the title; detailed methods not fully audited here.
Zhou and Kwan (2024)	Rural China; multiple natural hazards China Family Panel Studies, 2010–2018	11,633 adults Under 45; 45–59; 60+ Cumulative hazard exposure across survey waves	Psychological Rural and age comparative; not wildfire specific	Age differences varied; middle-aged adults showed greater adverse effects than older adults in the reported comparison.	Multi-hazard exposure; institutional and geographic transferability limited; does not establish that older adults are always most affected.
Thompson et al. (2024)	South-eastern New South Wales, Australia; interviews	19 community-dwelling adults aged 65+; bushfires, floods and COVID-19	Social; older-adult-specific, successive hazards	Disruption of routines, social links, treatment and self-care	Cannot isolate wildfire-specific contribution
Halcomb et al. (2023)	South-eastern NSW, Australia; cross-sectional survey	155 adults older than 65; after 2019–2020 bushfires	Social/psychological; older-adult wildfire-related	86.2% reported worry; 57.2% perceived negative mental-health impacts	Non-probability survey; not diagnostic prevalence
Howard et al. (2017)	Regional Australia; 17 focus groups	Older people and other at-risk community groups	Social; older-adult role in regional disasters	Older residents contribute local knowledge and reciprocal support	Not a wildfire-only intervention study

Asfaw et al. (2019)	Remote Sandy Lake First Nation, Northern Ontario; qualitative community study	56 interviews and focus-group discussion; 2011 wildfire evacuation	Social/preparedness; remote Indigenous community, mixed ages	Delays and communication challenges during wildfire evacuation	Same 2011 disaster as Asfaw et al. (2020); not age-specific
Asfaw et al. (2020)	Remote Sandy Lake First Nation, Northern Ontario; community-based qualitative	Indigenous Elders; in-depth interviews and focus group; 2011 wildfire	Social; direct older-adult remote wildfire evacuation	Challenges in healthcare, language, accommodation and traditional food; important community support	Context-specific; overlaps 2011 event studied by Asfaw et al. (2019)
Haynes et al. (2010)	Australia; historical fatality analysis	552 civilian fatalities, 1900–2008	Wildfire mortality and response context	Age and temporal patterns of civilian fatalities	No social, economic or psychological recovery outcome
Mockrin et al. (2015)	Fourmile Canyon, Colorado; reconstruction outcomes assessed at 34 months after fire; later homeowner follow-up	Property/homeowner follow-up >3.5 years after 2010 fire	Economic; wildfire housing outcome	Approximately 30% of destroyed homes rebuilt	Approximately 30% of destroyed homes rebuilt and occupied at 34 months; underinsurance and settlement delays slowed recovery
Alexandre et al. (2015)	Contiguous United States; housing development spatial study	Destroyed homes, five-year rebuilding window	Economic; property-level reconstruction	Approximately 25% rebuilt by five years	No age-specific financial outcomes

Oliveira et al. (2020)	Portugal; mixed-age questionnaire study	282 respondents in affected and other localities	Social/preparedness; European mixed-age context	Risk perception and wildfire preparedness knowledge	Not longitudinal older-survivor recovery

Contextual reports and synthesis sources

Source	Evidence type and scope	Use and interpretation
Melton et al. (2023)	Scoping review Wildfires and older adults	Used to map impacts, risks and interventions; its 75 included publications are not the number included in the present narrative review.
Kwan and Walsh (2017)	Scoping review Older adults and disasters	Resilience is considered at individual, community and structural levels; this review is not an independent intervention trial.
Parker et al. (2016)	Systematic review and meta-analysis Older adults after natural disasters	Cross-hazard mental-health synthesis; not a wildfire-only effect estimate.
Lambrou et al. (2023)	Literature review Social drivers of wildfire vulnerability	Context for social and institutional inequality; no older-rural causal effect implied.
To et al. (2021)	Scoping review Wildfires and mental health	Context for psychological outcomes across age groups; not independent primary evidence.
Winkler and Mockrin (2025)	Primary demographic report United States Census blocks and wildfire risk	Older adults defined as 60+. The 87% statistic concerns growth of the population in moderate-to-high-risk locations, not the proportion of all residents at risk.
Lian (2023)	PATH Through Life project; research report on approximately ages 59–65	Longitudinal psychological context; not a journal primary study or an exclusively 65+ low-density sample

Kim (2023)	PATH Through Life project; qualitative report on 2019–2020 bushfire experiences among cohorts aged 59–65 and 78–87 years	Complementary older-adult qualitative evidence including participants in their eighties; does not provide an independent longitudinal recovery estimate for adults aged 85+ in low-density territories.

Boundaries for the synthesis

The core matrix includes direct research with Indigenous Elders during remote wildfire evacuation (Asfaw et al., 2020) and a separate, broader community-level preparedness investigation concerning the same Sandy Lake First Nation event (Asfaw et al., 2019). The latter study does not constitute another age-defined sample of Indigenous Elders or an independent replication. Other included sources address older-adult wildfire experiences, mixed-age outcomes, professional proxies, property-level rebuilding and cross-hazard context. Age-specific findings on psychological symptoms and self-reported mental-health outcomes are distinguished from social evidence of evacuation, healthcare disruption, reciprocal support and agency. Economic investigations describe housing reconstruction but do not establish older-rural financial effects.

Melton et al. (2023) identified 75 publications addressing a broad set of wildfire-related subjects, including biomedical outcomes, disaster management and Indigenous knowledge. The present 17-study matrix centres on social, economic and psychological experiences and related recovery processes. Its scope is therefore narrower than that review's literature corpus. European longitudinal research jointly measuring social, economic and psychological recovery in age-defined low-density survivor populations remains limited.

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