# HEAL 2024 Conference Abstract Book

## Contents

# Aboriginal And Torres Strait Islander Health and Knowledge Translation For Building Resilience To Environmental Change

# Remembering, Enlivening and Transcending Ancient Western and Indigenous Ways of Being-Knowing-Doing –  A Valuable Pathway for Healing with Country?

Dr Petra Buergelt[1]
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We are experiencing a cultural transition as our Western culture has become increasingly dysfunctional, creating suffering rather than harmony and health. This cultural transition holds the potential to be both apocalyptic and life giving. Worldwide, multiple growing existential crises are challenging us in all areas of life. They are not only threatening our existence but the existence of all life. These crises increasingly diminish our individual and collective capabilities and capacities to adapt, respond and recover, creating a down-ward spiral. Yet, these existential crises present opportunities to transform ways of being-knowing-doing that have become dysfunctional into more functional ones as they create disorienting dilemmas necessary for transformative learning. Essentially, the crises create the spaces for us to transmute and transcend our fundamental philosophical worldviews in ways that has us realise that a) the source of the crises is spiritual and the consequence of millennia long domestication and colonization by the Western culture, and b) that the solutions lie within us and in the ancient sacred nature wisdom and Laws of our Western and Indigenous ancestors. To move forward we need to go within and back. I will take you on a transformative journey that starts with exploring the nature and importance of philosophical worldviews and how the Western worldview is the source of our existential crises. Next, we will inquire into the ancient Western and Indigenous worldviews, knowledges and practices, and how they can lead us out of our existential crises and create cultures and societies that are live giving. It will become clear that building upon and ascending the metaphysical, nature-based, unified and egalitarian ancient worldviews create diverse cultures and societies that cultivate capabilities and capacities capable of resolving our existential crises, reclaiming our freedom and power, and fulfilling our custodial role of keeping all life creating and healthy.

## Eden's Worldview

Associate Professor Payi Linda Ford[1], Mrs Chloe Harkins-Ford[4], Miss Eden Harkins-Ford[4], Miss Emily Ford[4], Mr Joshua Harkins-Ford[5], Mr Mark Ford[5]
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**Title: Intergenerational transmission of Rak Mak Mak Marranunggu traditional knowledge around Country and climate change.**

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Indigenous knowledge translation through teaching on Country deployed to engage and teach younger generations of "Mak Mak" people about climate change. Our connection to Country is crucial. Various mediums are utilised to represent the 'seasons. Eden is my granddaughter. Eden has depicted her understanding of HEAL. Eden prepared her medium about her livelihood. What is the future of living in tropical Australia? Eden's journey to her country and her understanding of climate change is represented in pictorial form. She is 38 months old and has been involved in HEAL Welcome to Country for the fourth time this year. Eden has already been taught Mak Mak Indigenous Knowledges about caring for Country and discharging her cultural obligations as a primary custodian by her mother, aunty, and grandmother. Understanding Eden's learning style and pedagogical contributions provides us with the insights of how she is cognisant of her environment. This is reflected in her participation in the 2024 HEAL Conference, as she prepared for the video recording of the Welcome Ceremony. Her worldview of Healthy Environments and Lives includes the integration of her thought processes with aspects of familiarity such as her Mak Mak Indigenous knowledge, family, HEAL, and her Country as one. Eden's worldviews and observations contrast with the current consensus around climate change as illustrated in pictorial form on her way to record her Welcome to Country. This reality of HEAL and climate change should not be underestimated, as her future growing up in these changing climatic, environmental and political contexts on her Country is under threat.

# Indigenous Truth-Telling: Ethnographic Philosophy on Traditional Foods, Country and Climate Change

Ms Sharna Motlap[1], Associate Professor Linda Ford[1], Dr Nicolas Bullot[2], Ms Collethy, K Jaru[2]
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Led by an Indigenous researcher in the nutritional value of bushfood (SM) and an expert Mak Mak Marranunggu philosopher (LF), this presentation deploys ethnobotanical Indigenous philosophies and truth-telling to show the added value of using Indigenous Knowledges of nutrition and food security for responding to climate change challenges. The research aims to inform potential solutions to Indigenous and non-Indigenous stakeholders, policy makers, and researchers. We begin with a discussion of the Mak Mak Marranunggu custodian's art of tracking long yams and other plants in the coastal bushland of northern Australia and disclose truths about season cycles, local vegetation, Indigenous uses of plants, the nutritional value of bush food, and Mak Mak Marranunggu laws regarding ecological sustainability. We then expand the scope of the analysis to include additional areas of Indigenous Knowledges and expertise from Northern Australia and Anga Tribe (Papua New Guinea) from the standpoint of Indigenous geography (CKJ) and decolonised social philosophy (NJB). We provide evidence to identify potential biases and epistemic malpractices regarding Indigenous Knowledges that can act as barriers to climate change solutions.

# A relational process of co-design - healing health of community and Country with Indigenous story-data mapping.

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First Nation Australians have cared for Country over millennia, developing deep understandings of how to live in harmony with each other and the environment. These valuable knowledge systems have persisted and continue to strengthen, despite the extreme oppressions of colonisation and now climate change.

The project Healing Country: Weaving knowledge systems to meet climate challenges aims to support the implementation and evaluation of community-led adaptation strategies to address local climate challenges across three Aboriginal communities: Noongar Country (Perth, WA), Bundjalung Country (Northern Rivers, NSW), and Warumungu Country (Tennant Creek, NT).

To taking into account each project sites unique climate and community context, the project operates in parallel across locations, giving an opportunity for cross-site and cross-cultural sharing and learning. Highlighting a relational process of co-design, we will share the outcomes of a whole-of-project gathering where space was created for sharing of stories and knowledges across different landscapes and learning two ways to bring knowledge from different Countries together.

The workshop also aims to strengthen capacity of community researchers through sessions on participatory research methods, data sovereignty, story-telling, climate adaptation and mitigation action planning, evaluation and community story-data mapping technologies.

During the gathering, the beginnings of a prototype digital story-data map is being developed by Bundjalung knowledge holders, showcasing their ancient and contemporary wisdom, as well as relevant environmental and health data, to be used as a communication tool for communities to advocate for change. These maps will help communities lead decision-making around climate change adaptation and mitigation strategies, which in the long-run will improve the health and wellbeing of both community and Country.

This presentation will report on the outcomes of this gathering, including story-data mapping in practice and a demonstration of the Bundjalung prototype.

# Staying Healthy in Hot Times

Melissa Catada, Summer Porter
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Aboriginal and Torres Strait Islander People have been successfully managing their land and water resources by implementing sustainable management practices for thousands of years. First Nation communities worldwide contribute the least to carbon emission yet are inequitably subjected to earlier and more severe effects of climate change. Climate change presents an opportunity for the empowerment of Aboriginal and Torres Strait Islander communities to lead climate action planning based on their intimate traditional and historical knowledge of Country.

The Aboriginal Health Council of WA (AHCWA) acknowledges the link between hot weather and its effects on the environment and health. WA Aboriginal Community Controlled Health Services manage a large patient load with a high prevalence of renal disease, heart disease, diabetes and rheumatic heart disease. Each of these conditions is at risk of complications or disease progression due to extreme heat.

With little to no Aboriginal focused climate health resources nationwide and temperatures in WA reaching up to 50 degrees in warmer seasons, this can have serious effects on community. This is especially true for those who have little knowledge of heat related health risks and almost no access to cooling appliances to keep cool water and to store medication for those with chronic diseases. It is essential as health professionals we emphasise the importance of community education around heat related health effects and raise awareness in this space.

Aboriginal focused projects provide better outcomes for Aboriginal people and their health. AHCWA, alongside 3 of our member services, have collaborated to develop a heatwave adaptation planning tool kit to educate our communities and provide culturally appropriate health messages on how to be safe and keep healthy during heatwaves. These include Aboriginal focused messaging on how to prepare our homes, how to prepare ourselves and how to prepare our mob for hot weather.

# Indigenous Peoples' Spiritual Connection To Place, Nature, Environment And Responsibility For Country: Practical Applications

Dr Stewart Sutherland[1]
[1]School of Medicine and Psychology, Chair Indigenous Health Framework, Associate Dean First Nations CHM, The Australian National University, Canberra, Australia

Dr Sutherland will address how the connection that humans have with the environment is undeniable, so much so that 'solastalgia' is a current term that describes the how we feel about the changing environment or loss of our familiar habitat. For Indigenous people the connection to the land is a core and part of our identity. The fires of 2020 had a profound effect on the social and emotional wellbeing (SEWB) of many. This could be true for many sectors of the community, due to the loss of property, life and landscape.

For Aboriginal people, there are compounding effects: the connection to place and the land is more than a feeling of belonging, it is spiritual, and comes with responsibilities. Totems for which they are stewards were decimated. Many outside the fire zones also feel the loss of these totems on such a large scale, with the accelerating loss of diversity of wildlife species. Cultural practices rely on a healthy environment; many could not enter vast areas to undertake ceremony or cultural activities. This then involves 'communities' connectives', and how individual behaviour varies in relation to community norms, which then starts a cycle of trauma (Dudgeon Sutherland & Rosen,2023) .

Dr Sutherland will talk to the work that his Australian National University group have been undertaking with Mogo Local Aboriginal Land Service, on mental health and the environment after the 2020 fires, and the protective factors regarding SEWB.

# Health And Social And Emotional Wellbeing Achievements Of Aboriginal And Torres Strait Islander Communities During The Covid-19 Pandemic Era And In Tackling Suicidality And Social Determinants Of Mental Ill-Health

Prof Pat Dudgeon
[1]School of Indigenous Studies, The University of Western Australia, Perth, Australia

Professor Dudgeon will describe lessons learned and applied for the Australian Aboriginal and Torres Strait Islander national response to the COVID-19 pandemic which has resulted in far better physical health outcomes, including avoidance of infections, hospitalisations, intensive care unit admissions and deaths directly related to COVID-19 than for many other Indigenous peoples worldwide. This has been an achievement of global significance, although subsequently eroded when governments dropped the ball on vaccination and protection of remote communities from infected travellers, and inadequate facilities to isolate if infected in these overcrowded yet officially 'high priority' populations. Professor Dudgeon will also describe the related implications of the pandemic and other climate change impacts for mental health or social and emotional wellbeing (SEWB), including suicidality, for these communities. She will also address the importance of proactive consultative planning and networking via the National Aboriginal Community Controlled Health Organisation (NACCHO) and regional Aboriginal Community Controlled Health Organisations (ACCHOs) and adequate government funding for national initiatives such as this throughout the pandemic and other climate change-related mental health impacts, for 'closing the gap' for social and cultural determinants of SEWB, and for rigorous researching and dissemination of these learnings (Dudgeon P et al 2020,2021,  Moodie N et al 2020,Rosen A 2021, Dudgeon Sutherland & Rosen, 2023).

# Applying Traditional Strengths Of First Nations To Overcome Mental Health Impacts Of Climate Change Events – Droughts, Fires, Pandemic And Floods

Alan Rosen[1,2,3]
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We consider how some aspects of the internationally emerging and now-recognised mental health conditions that relate to climate change (e.g. eco-anxiety and solastalgia (Albrecht et al, 2007) , may have been familiar to First Nations since loss of familiar environments, custodial roles and sovereignty due to colonisation. Are our wider societies possibly catching up, and beginning to understand Indigenous concerns better, especially since Australia's prolonged droughts, floods, extreme bush-fires and the continuing COVID-19 pandemic?

We briefly review the globally anticipated risks and existential threats of climate change to all Indigenous peoples, and their strengths invoked in overcoming them nationally and regionally by Aboriginal and Torres Strait Islander communities through mobilising community controlled strategies (Eades S et al. 2020,). The constructive advocacy to bring these outcomes to national and international attention was initially thwarted, possibly related to dismal expectations of inevitably pessimistic outcomes for Indigenous peoples with the pandemic and other climate change events in many countries, projected by many clinicians, researchers and governments, possibly softening them up to be resigned to this fate (Talley NJ et al, 2021, Rosen A,2021,Dudgeon Sutherland & Rosen,2023). Subsequently, these achievements were partially eroded when our governments 'dropped the ball' on vaccination and protection of remote communities from infected travellers, and inadequate isolation facilities if infected in these overcrowded yet officially 'high priority' populations.

What have been the lessons for Aboriginal and Torres Strait Islander and other First Nations communities for preventing, ameliorating and healing mental health impacts of climate change? How can our wider communities learn and benefit from valuing the practical application of such traditional cultural strengths, practical knowledge and wisdom? Will we heed and learn how to apply these lessons to resetting and building new personalised, community controlled and determined mental healthcare ecosystems (Rosen A, 2022a+b).

# Mental Health Impacts Of Climate Change On Aboriginal & Torres Strait Islander & Other First Nations Communities, And Community Controlled Mobilising Effective Community-Controlled Responses

Prof Pat Dudgeon[1,2], Alan Rosen[3,4,5], Dr Stewart Sutherland[6,7]

[1]School of Indigenous Studies, The University of Western Australia, Perth, Australia, [2]Bardi woman, from the Kimberley in Western Australia, , , [3]Brain & Mind Centre, The University of Sydney, Sydney, Australia, [4]Graduate School of Medicine, Faculty of Science, Medicine & Health, formerly Australian Health Services Research Institute, The University of Wollongong, Wollongong, Australia, [5]Far West LHD Mental Health Services, , Australia, [6]Wiradjuri man raised in Wellington, NSW, on Wiradjuri country, Australia, , , [7]School of Medicine and Psychology, Chair, Indigenous Health Framework, The Australian National University, Canberra, Australia

Objectives:  a) Should Indigenous populations be a priority when addressing both the physical and mental health impacts of climate change, because of their post-colonial vulnerabilities?
b) Should First Nations be valued and heeded for their persistent concern, strong advocacy and practical care of nature, and the considerable strengths, skills and determination of their communities, relevant to preventing and dealing with climate change impacts on all the peoples, lands, waters, and species of our planet?

Findings: A UN Environment report (2020), concludes that, 'Indigenous people with close emotional and ancestral ties to the land are also likely to be disproportionately affected by environmental change and extreme weather events.' First Nations peoples must be priority populations for addressing climate change impacts, but they have skill-sets, attitudinal and spiritual strengths and commitment to caring for nature and our planet that can assist wider societies in preventing and dealing with climate change threats and impacts.

Discussion: We consider how some aspects of the internationally emerging and now-recognised mental health conditions that relate to climate change (e.g. eco-anxiety and solastalgia (Albrecht et al, 2007), may have been familiar to First Nations since loss of familiar environments, custodial roles and sovereignty due to colonisation. Are our wider societies possibly catching up, and beginning to value Indigenous concerns, strengths & skills better, especially since Australia's prolonged droughts, floods, extreme bush-fires and the  COVID-19 pandemic?

Conclusions: First Nations peoples can effectively mobilize their resilience in the face of climate change, and help to enhance that of wider societies in surrounding nation states. Such strengths are rooted in traditional wisdom and ecologically sustaining practices of global Indigenous cultures, which can be deployed as tools to modify our values and actions, improving our wellbeing, while healing our planet and its species (Rosen, 2020b, Dudgeon Sutherland & Rosen, 2023).

# At-Risk Populations, Early Life Effects And Life-Course Solutions

# Sustainable Asthma Care Roadmap for Australia

Dr Mike Forrester[1]
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The National Health and Climate Strategy Action 4.14 is to improve respiratory health outcomes and reduce greenhouse gas emissions from respiratory inhalers.

One in 9 Australians has asthma, and unfortunately around half have poor control. The total cost of asthma to Australians was estimated at $28 billion in 2015.

The carbon footprint of 20 million pressurised metered dose inhalers (pMDI) in Australia due to hydrofluorocarbon propellants, is over 600,000 tonnes CO2e – equivalent to the emissions of 350,000 vehicles, or the sequestration potential of 60 million trees per year.

Aims:

1. Critically assess evidence regarding the potential environmental co-benefits of transitioning to high value asthma care.

2. Collaboratively develop a comprehensive system map to identify the key drivers of the high emissions footprint of asthma care in Australia.

3. Collectively generate high-impact implementation goals and recommendations to achieve improved asthma care with a significantly reduced environmental impact.

Method:

Asthma Australia hosted and Deakin researchers facilitated 2 in-person and 2 online system-oriented roundtables, engaging representatives from 50 key organisations including consumers, researchers, health professionals, peak bodies, pharmaceutical industry, and government.

Outcomes:

Stakeholders agreed there is a co-benefit opportunity to improve high-value, current evidence-informed treatment regimens (as per GINA24), with a co-benefit reduction in greenhouse emissions associated with pMDI asthma reliever overuse (15million/year). Supporting people with asthma to also consider a transition to low carbon inhalers where appropriate would have a large decarbonisation impact.

The attached Roadmap details 8 collaboratively developed goals and supporting recommendations and was launched by Assistant Health Minister Ged Kearney 18th September.  This will inform the development of a detailed national implementation plan.

Conclusion:

This co-benefits-oriented Roadmap presents a compelling vision for the future of asthma care in Australia.  Governance and resourcing are now required to progress a national implementation strategy.

The report is linked here https://asthma.org.au/wp-content/uploads/2024/09/Asthma-Roundtable-Report_DIGITAL_FINAL.pdf

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# Bushfires, Air Pollution, And Their Impact On Physical, Mental, And Community Health

# Transport of pollutants from Pilliga Forest wildfires in northern New South Wales in December 2023 and its impact on air quality in New South Wales

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Smoke exposure events from large wildfires have become increasingly common in Australia and throughout the world. Wildfires emit numerous air pollutants including BC, CO, NOX, organic aerosols in the air. Pollutants emitted from these fires can have impacts in the close proximity to the fire and over downwind areas where the smoke plume can be transported.  The ability to study the impacts of high smoke aerosol exposures from these events on the affected areas is limited by the availability of high-quality, spatially resolved estimates of pollutants concentrations.

In mid-December 2023, a large wildfire in Pilliga Forest, Duck Creek, has rapidly spread out of control due to the high temperature recorded at the start of the austral summer. This wildfire had a widespread impact on air quality over a number of towns and cities in the central and coastal NSW areas including the Hunter regions and metropolitan area of Sydney. Of interest is the fast transport of the smoke plumes in the upper troposphere southward inducing pyrocumulonimbus clouds formation and causing thunderstorms along the plume transport path and the intrusion of smoke plumes to the ground over the upper and lower Hunter and the Sydney metropolitan areas causing high particle episodes.

The WRF-Chem (V4.4.2) was used to analyse the transport of air pollutants from the fire. The model results give insights on the vertical structure of transported plumes which is also compared and validated with aerosol profiles from ceilometer data at Merriwa, the global MERRA reanalysis data and CALIPSO satellite. Wildfires in remote forest areas by its nature are spontaneous but they can cause widespread effect on air quality in populated areas far from the fire sources. Lessons on the future preparation of these types of wildfires with respect to air quality forecasting in the metropolitan areas will be discussed.

# Building resilience during and after bushfires: Lessons from the 2019-20 bushfires in southern NSW and the ACT

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In the summer of 2019-20, many communities across southern NSW and the ACT were impacted by one of the most intense and catastrophic bushfire seasons recorded in Australian history. The 'Building resilience during and after bushfires' study aims to identify and understand the factors that most help and hinder people and communities living in this region to prepare for, respond to, recover from and rebuild post bushfire. Using a mixed method approach, this study explores the different aspects of resilience resources that make people and communities resilient. Quantitative analysis of survey data from various waves of the Regional Wellbeing Survey (RWS) was used to explore experiences of people impacted by the 2019-20 bushfires and identify which resilience resources are important for predicting distress during bushfires, and positive mental health states in the years following. Qualitative interviews were conducted with people who experienced varying range of impacts from the bushfires and were asked about the things that were helping and hindering their recovery.

Findings from both the qualitative and quantitative research highlighted that while having access to a range of resilience resources across numerous domains is important for supporting good mental health during and following bushfires, financial resources, good general health and effective community leadership were key to good recovery. Having psychological resources that supported preparing, responding and recovering from the bushfires as well as good access to social resources from friends, family and community members were important for feeling recovered from the bushfires. Findings from this research suggest that building resilience in bushfire impacted communities requires a focus on both generalised resilience resources, along with bushfire specific resilience resources related to preparedness, response, and recovery from disasters.

# Archetypes and change in wildfire risk perceptions, behaviours and intentions among adults in Tasmania, Australia

Dr Sharon Campbell[1], Dr Grant Williamson[2], Prof Fay Johnston[1,3], Prof David Bowman[2]
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Anthropogenic climate change globally increases wildfire risk. Understanding how wildfire threats impact community-wide risk perceptions and response options will critically inform education strategies aimed at keeping communities as safe and resilient as possible. Our study aimed to gain an increased understanding of wildfire risk perceptions and self-evacuation intentions among residents in the highly wildfire-prone state of Tasmania, Australia. In 2023, we co-designed survey questions with stakeholders from local emergency management, health and community recovery services, and delivered a computer-aided telephone interview to survey Tasmanian residents aged over 18 years. Numerical classification analysis, linear regression and descriptive statistics were used to analyse survey data. We identified four archetypes – the 'immediate leaver', 'prepared stayer', 'unprepared leaver' and 'informed leaver', each with distinct sociodemographic characteristics. Key variables were gender, age, location and income, with women most likely to leave and lower-income householders from rural areas most likely to stay. Previous wildfire experience and owning a home were significantly associated with increased preparedness actions. When compared to data from the 2016 Tasmanian Population Health Survey, which included the same questions on bushfire threat and leave intention, we found a significant increase in the proportion of residents intending to leave their property, with urban women most likely to leave, and rural men most likely to stay. Recent education campaigns have likely driven increases in wildfire threat-related self-evacuation, yet the existence of distinct archetypes argues for more tailored messaging and education programs. Collaboration with the Tasmania Fire Service to pilot a targeted education intervention is underway.

# Field Evaluation of Low-Cost Sensors in Urban Environments

Ms. Pratika Chawala[1,2], Dr Nigel Goodman[1,2], Professor Sotiris Vardoulakis[1,2], Dr. Suzanne Carroll[1], Dr. Suzanne Mavoa[3]

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Smoke from wood heaters and bushfires is a major concern in many Australian towns and cities. Exposure to smoke-related air pollution is associated with adverse health effects, including asthma exacerbations. Due to the limited number of regulatory monitoring stations localised areas of air pollution can be overlooked. Therefore, highly spatially resolved air quality monitoring is required to understand the distribution and concentration of particulate matter (PM) to help inform strategies to reduce smoke exposure. Low-cost sensors (LCS) offer an approach to monitor air pollution at greater spatial resolution. However, quality assurance of LCS (i.e., by colocation and calibration) is important to ensure the accuracy of the data collected. The present study aimed to evaluate the performance characteristics of PurpleAir-II (PA-II) sensors in two Australian cities: a residential area affected by wood heater smoke and an urban site impacted by various air pollution sources, including traffic and woodsmoke. The sensors were evaluated against three instruments: TSI DustTrak DRX 8533, Teledyne API T640X, and Beta attenuation mass (BAM). The PA-II showed high inter-correlations (r = 0.99) and good accuracy (MAE < 1 µg/m3) for PM2.5 measurements. The PA-II showed very high correlations with DustTrak and T640x, however, correlations with BAM were only moderate, R2 ~ 0.9, 0.8, and 0.66 respectively. In addition, increasing the temporal aggregation (i.e., from 2 min to 24-hour intervals) resulted in improvements in the associations between the DustTrak and T640x and the PA-II sensors, no improvements were seen with the BAM. The higher correlation with DustTrak and T640x is due to the use of the similar technology (light scattering) for PM2.5 measurement. Future work will apply these correction factors to a network of PA-II sensors used to study indoor and outdoor levels of woodsmoke in homes of people with asthma

# Temperature attributable burden of infectious diseases: a population-based study for enteric infections

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In Australia, Campylobacter and Salmonella are the leading causes of enteric infections. As climate change continues, there is a concern regarding the transmission and prevalence of these infections. The aim of our study was to estimate the current and future burden of Campylobacter and Salmonella infections attributed to the rising temperatures in Australia.

Data on years of life lost (YLL) and years lived with disability (YLD) were extracted from the Australian Institute of Health and Welfare (AIHW) Burden of Disease database for the period 2003-2018. We conducted a meta-analysis to obtain relative risk per 1°C increase in temperature for Campylobacter and Salmonella infections. Temperature data was obtained from the Commonwealth Scientific and Industrial Research (CSIRO). Future projections were considered under two greenhouse gas emissions scenarios (RCP4.5 and RCP8.5), considering potential changes in population growth and possible adaptation scenarios.During the baseline period (2003-2018), the increase in mean temperatures was attributed to 28.1±3 DALYs (8.5%) of the observed burden of Campylobacter infections and 41.8 DALYs (11.2%) of Salmonella infections in Australia. The burden attributed to mean temperatures varied across different climate zones and jurisdictions. The projected results show an increase in the burden of Campylobacter and Salmonella infections in the future. By the 2050s, under RCP8.5 and a medium population growth scenario without any adaptation measures, the total burden of Campylobacter and Salmonella infections could potentially reach 41.2±3.5 DALYs and 67.9±3.4 DALYs, respectively. However, in the same period implementing a 10% adaptation strategy under the same population growth scenario and RCP could potentially reduce the burden of Campylobacter and Salmonella infections to 29.5±3.0 and 61.8±3.8 DALYs, respectively. This study highlights the need for climate-informed public health policies and to implement region-specific adaptive measures into public health planning, and targeted interventions to reduce the impact of climate-sensitive enteric infections.

# Mobilising the aged care sector for heat health resilience of elderly Australians

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Rationale:
Climate change is driving increased heat-health risks, with elderly people most at risk. Australia's aged care sector is uniquely placed to support climate resilience in this vulnerable group. But while an overwhelming amount of general resources exist on heat stress detection and mitigation, BlueCare identified a need to design and deliver these in a timelier, actionable format relevant for aged care workers and vulnerable older people.

Aim:
Build the capability of aged care workers and clients to prevent and respond to heat-related health impacts in vulnerable older people.

Process:
Between 2020–2022, initial problem and solution scoping work was completed in partnership with Griffith University, funded through the Queensland Government's Health and Wellbeing Climate Change Adaptation Plan (H-CAP).

In summer 2023-24, BlueCare deployed these insights into an internal-and-external-facing Heat Safety campaign, using a three-pronged approach to distribute targeted heat safety tips, fact sheets and resources to:
1. BlueCare staff: Toolbox talks, posters, internal newsletters, intranet knowledge hub.
2. BlueCare clients: Fridge magnets, invoices, news media.
3. General public (many of whom have informal carer roles): Social media ads, BlueCare 'Heat Safety' website, news media.

Outcomes:
Campaign impact stats include:
• 30,000 home care clients received heat safety advice on their invoices;
• 13,000 fridge magnets provided to aged care workers to distribute to clients across Queensland;
• 502,000 people reached through Facebook ads, sharing heat safety tips to regions with forecast extreme heat events.

This 'evergreen' campaign will be run again in summer 2024-25.

# Asthma medication usage after environmental exposure to wildfire smoke: a systematic review

Ms Cathy Etherington[1], Mrs Anne-Marie Rushby[2], Dr Van Nguyen[2], Ms Vanessa Thompson[3], Dr Nina Lazarevice[1], Professor Sotiris Vardoulakis[4]

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Asthma is a chronic respiratory condition exacerbated by exposure to particulate air pollution. Smoke from landscape fires has been associated with increased mortality, asthma-related admissions to emergency and other hospital departments, and uptake in primary care services.
With climate change and more frequent landscape fires, healthcare systems must prepare for disaster, including surges in asthma medication demand. Past reviews have not resolved the direction and magnitude of the association between PM2.5 exposure during landscape fires and asthma medication use.

The aim of this review was to investigate the relationship between exposure to landscape fire smoke and the use of asthma medications.

We conducted a systematic review of PubMed, Scopus, and Web of Science, identifying peer-reviewed articles that examined asthma medication usage following environmental exposure to landscape fire smoke.

After a full-text review, we identified twelve articles, six from North America and six from Australia, with five being retrospective cohort studies. Despite differences in study design, outcome and exposure measurement, the included studies reported a consistent increase in asthma medication use after exposure to wildfires. The largest associations reported were for uptake in the use of the reliever medication salbutamol. Increases in other asthma management medications were also consistently identified.

Increases in demand for asthma medications after exposure to wildfire smoke highlight the urgent need to address the growing frequency and intensity of wildfires driven by climate change.

# A systematic review of interventions for reducing exposure to air pollution from landscape fires

<u>Dr Nigel Goodman</u>[1], Dr Sharon Campbell[2], Dr Penelope Jones[2], Prof Fay Johnston[2], Professor Bandana Saini[3], Ms Morgan Brain[2], Ms Danielle Cameron[6], Professor Veronica Matthews[6], Professor Karima Laachir[4], Professor Sotiris Vardoulakis[1], Dr Nico Borchers-Arriagada[2], Dr Michael Tong[4], Dr Erin Walsh[4], Dr Amanda Wheeler[5]

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Background: Emissions from more frequent and prolonged landscape fires (wildfires, prescribed risk reduction fires, agricultural burning) can expose populations to high levels of air pollution and exacerbate a range of health conditions. This systematic review aims to map, evaluate, and synthesise the scientific literature reporting interventions that aim to reduce exposure to landscape fire smoke (LFS).

Methods: Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we searched PubMed, Scopus and Web of Science and reviewed relevant literature published up to December 2023.

Results: Twenty-seven studies from four countries (Australia, Canada, United States of America, and Singapore) met the eligibility criteria. Of the interventions evaluated, air filtration was the most frequently reported, and included use of portable air cleaners (PACs) with high efficiency particulate air (HEPA) filters, ventilation systems with upgraded filters, and self-assembled fan filter units. Effectiveness for indoor reduction of PM2.5 ranged between 24%–83% for studies involving multiple measurements using PAC. Interventions that focused on naturally ventilated buildings reduced indoor PM2.5 levels by 14–45% over short durations of LFS. Mechanical ventilation in buildings can reduce PM2.5 levels by 18–30%, with additional reductions (up to 66%) when using higher rated filters. Communication interventions, including smartphone apps and alerts or messages from various media sources had mixed results. Facemasks (N95/P2) were found to be an effective (90-94%), but relatively underutilised intervention.

Conclusions:  Effective strategies for LFS exposure reduction include upgrades to building ventilation systems, use of portable air cleaners with HEPA filters, and use of N95/P2 facemasks. Emerging solutions include the use of smartphone apps with enhanced features and clean air shelters. Further research is needed on the effectiveness of interventions during prolonged smoke events, such as those lasting for several days, weeks or months, and in socioeconomically disadvantaged communities particularly in low- and middle-income countries.

# The Impact of Heatwaves and High Temperature on Morbidity and Mortality Among Older Adults: A Systematic Review and Meta-Analysis

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Heat exposure is linked to increased mortality and morbidity, particularly among older adults. With climate change expected to intensify heatwaves and high temperatures, understanding their impacts on older adults is crucial for informing targeted interventions.

This systematic review and meta-analysis quantified the impact of heat exposure on morbidity and mortality among older adults, focusing on disease categories, climate zones, and demographic factors. We searched PubMed, Embase, Web of Science, Scopus, CINAHL, and AgeLine for observational studies published between January 1990 and May 2023 that examined morbidity and/or mortality among older adults during high temperatures or heatwaves. A random-effects meta-analysis was used to pool relative risks (RR).

The analysis included 405 studies. A 1°C temperature increase raised morbidity risk by 1.9% (RR=1.019, 95% CI: 1.014-1.024) and mortality risk by 2% (RR=1.02, 95% CI: 1.018-1.022). The highest morbidity risks were linked to heat-related illnesses, external causes, and endocrine diseases, with overall morbidity being highest in tropical climates. Mortality risk was elevated for respiratory, cerebrovascular, and cardiovascular diseases, with overall mortality highest in Mediterranean climates. Individuals aged 85 years experienced the highest morbidity and mortality per 1°C increase. Heatwaves increased morbidity by 22.4% (RR=1.224, 95% CI: 1.167-1.284), especially affecting endocrine diseases, external causes, and mental health, with the highest impact on those aged 75-84 years and in temperate climates. Mortality rose by 11.5% (RR=1.115, 95% CI: 1.103-1.128) during heatwaves, notably in cerebrovascular, respiratory, and endocrine diseases, with the greatest risk for those aged 85 years and older, particularly in continental climates. Heat exposure significantly elevates morbidity and mortality in older populations, underscoring the need for climate policies to address these escalating risks.

# Wildfire risk prediction in southeast Australia using machine learning and deep learning and their application to climate change projection of wildfire risks

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Southeast Australia frequently has wildfires mostly during the austral spring and summer period. Recent occurrence of wildfires is more frequent with widespread intensity in spatial extent and longer in time causing economic damage and public health impact in population exposure to air quality degradation. The drivers for wildfire risk include high temperature, low soil moisture and humidity, high fuel load, low moisture contents. By using historical data of wildfire occurrences and the above environment factors, the wildfire risks can be predicted using AI methods such as machine learning and deep learning methods. Previous studies mostly focused on the MacArthur Forest Fire Danger Index (FFDI). But this index is rigidly formulated and does not take into account fuel load. In this study, we examine and analyse wildfire records in New South Wales for the past 50 years from 1970 to the present and weather data from BOM and reanalysis global datasets during the wildfire occurrence to determine the probability or risk of wildfires. The AI model is then applied to assess the wildfire risks across eastern Australia under different climate change scenarios.

# Acute effects of bushfire-specific fine particulate matter and its carbonaceous components on perinatal outcomes in New South Wales, Australia: a multicity cohort study

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Background: Climate change is increasing the frequency, duration, and intensity of bushfires in Australia. However, the impacts of bushfire-specific fine particulate matter (PM2.5) and its carbonaceous components (organic carbon, OC; and black carbon, BC) on perinatal outcomes are limited and were investigated in this study.

Methods: A total of 9,743 singleton births during the wildfire seasons between 01/09/2009 and 31/12/2015 across six cities in New South Wales were linked with daily bushfire-specific PM2.5, OC, and BC quantified specifically from bushfire using satellite observations and machine-learning models. Spatial clustering distributed lag Cox regressions were performed to estimate daily and cumulative covariate-adjusted hazard ratios (aHRs) during the last four gestational weeks for preterm birth, stillbirth, nonvertex presentation, low 5-min Apgar score, special care nursery/neonatal intensive care unit (SCN/NICU) admission, and caesarean section.

Results: There were nearly inverted 'U'-shaped daily positive associations. The daily cumulative aHRs increased with the increasing duration of the exposure. For the last week before birth delivery (lag 0-6 days), the aHRs per 10 μg/m3 PM2.5 increment were 1.17 (95% CI: 1.04, 1.32) for preterm birth, 1.40 (95% CI: 1.11, 1.78) for stillbirth, 1.20 (95% CI: 1.08, 1.33) for nonvertex presentation, 1.12 (95% CI: 0.93, 1.35) for low 5-min Apgar score, 1.01 (95% CI: 0.94, 1.08) for caesarean section, and 0.99 (95% CI: 0.83, 1.19) for SNC/NICU admission. OC and BC for lag 0-6 days also showed positive associations and the highest aHRs were 1.09 (95% CI: 1.03, 1.15) and 4.57 (95% CI: 1.96, 10.68) for stillbirth per 1 μg/m3 OC and BC, respectively. Female births and births to mothers with low socioeconomic status and high biothermal exposure were most vulnerable.

Conclusions: Acute in-utero exposure to wildfire-specific PM2.5 and carbonaceous components increased the hazards of adverse perinatal outcomes with sociodemographic vulnerability, suggesting urgent climate actions and public health interventions.

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# Ethos digital system – An early warning tool for older adults

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Extreme heat events are a growing public health concern, highlighting the necessity of public health preparedness and protective measures, especially for vulnerable populations like older adults. Heat-health early warning systems (HEWS) are a highly recommended means to protect public health during extreme heat events. We developed an individualized HEWS designed for older adults (≥65 years) in Southeast Queensland, Australia, called the Ethos (extreme heat and older persons) HEWS. The Ethos HEWS consists of a tablet device (the interface to interact with), four temperature and humidity sensors (3 indoor and 1 outdoor sensors), and a Wi-Fi router (to record and show real time information from the sensors to the device).

We conducted the first in-home testing of the Ethos HEWS in 78 homes from Dec 2023 to Feb 2024. In this in-home testing, the Ethos HEWS demonstrated a high usability score (mean of 78 on the System Usability Scale) and using the Ethos HEWS was associated with improved preparedness ($p<0.001$, marginal homogeneity tests) among the study participants. In this HEAL conference presentation, we will present key insights from the in-home testing (e.g., quantitative and qualitative outcomes). We will also discuss research processes that contributed to our field implementation and positive user feedback.

# Staying Healthy in Hot Times

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Aboriginal and Torres Strait Islander People have been successfully managing their land and water resources by implementing sustainable management practices for thousands of years. First Nation communities worldwide contribute the least to carbon emission yet are inequitably subjected to earlier and more severe effects of climate change. Climate change presents an opportunity for the empowerment of Aboriginal and Torres Strait Islander communities to lead climate action planning based on their intimate traditional and historical knowledge of Country.

The Aboriginal Health Council of WA (AHCWA) acknowledges the link between hot weather and its effects on the environment and health. WA Aboriginal Community Controlled Health Services manage a large patient load with a high prevalence of renal disease, heart disease, diabetes and rheumatic heart disease. Each of these conditions is at risk of complications or disease progression due to extreme heat.

With little to no Aboriginal focused climate health resources nationwide and temperatures in WA reaching up to 50 degrees in warmer seasons, this can have serious effects on community. This is especially true for those who have little knowledge of heat related health risks and almost no access to cooling appliances to keep cool water and to store medication for those with chronic diseases. It is essential as health professionals we emphasise the importance of community education around heat related health effects and raise awareness in this space.

Aboriginal focused projects provide better outcomes for Aboriginal people and their health. AHCWA, alongside 3 of our member services, have collaborated to develop a heatwave adaptation planning tool kit to educate our communities and provide culturally appropriate health messages on how to be safe and keep healthy during heatwaves. These include Aboriginal focused messaging on how to prepare our homes, how to prepare ourselves and how to prepare our mob for hot weather.

# Understanding Heat Health Risks in Australia's Growing Cities

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Extreme heat is increasingly recognized as a significant public health hazard. In Australia, heatwaves are the leading cause of death among all natural hazards. The anticipated rise in extreme heat events due to climate change, coupled with a projected population surge to around 49.2 million by 2066, poses a significant challenge to the nation's health infrastructure. This challenge is compounded by rapid urbanization, densification, and the escalating demand for new housing in Australian urban areas. These factors highlight the critical need for climate-sensitive urban planning and design strategies to mitigate the health impacts of extreme heat.

This study captures areas-in-need using a Heat Health Vulnerability Index, leveraging demographic factors, environmental conditions, and urban morphology to derive comprehensive spatial layers at a fine-grained level (SA1) in selected regions in New South Wales, Australia. The index methodology utilizes multiple PCA factors scaled by explained variability to produce more complex and data-driven indices from up to 44 indicators of heat exposure, population sensitivity, and adaptive capacity, pinpointing regions particularly susceptible to heat and examining the interplay between human health and the built environment.

This study compares underlying characteristics as well as the resulting vulnerability indices to individual health records received from the New South Wales Ministry of Health, facilitated by the Centre for Health Record Linkage (CHeReL) and the Secured Unified Research Environment (SURE). These new indicators and metrics provide critical data for evidence-based policymaking and planning in health and social infrastructure. The outcomes are expected to lead to more liveable neighbourhoods, enhanced health services, targeted interventions, and a reduction in preventable diseases and their associated economic costs.

# Assessing the risk of biomass combustion-specific ambient PM2.5 exposure on stillbirths and preterm births: A case-control study in Sydney, Australia for 2010-2020

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Biomass combustion, including bushfires and residential wood burning, is a significant source of PM2.5 in Australia. However, the specific impact of biomass-related PM2.5 on adverse pregnancy outcomes remains unclear. This study aimed to quantify the relationship between pregnancy exposure to ambient biomass-specific PM2.5 and the risk of preterm birth and stillbirth in Sydney, Australia, from 2010 to 2020. We conducted case-control studies nested within a cohort of 572,681 singleton pregnancies in Sydney. Cases included 29,954 preterm births and 2,928 stillbirths. Controls were randomly selected using a risk set sampling approach. Biomass-specific PM2.5 exposure was estimated using the Centre for Safe Air CARDAT dataset. We employed conditional logistic regression to analyse associations between biomass-specific PM2.5 exposure and outcomes, adjusting for socioeconomic status, temperature, relative humidity, and temporal trends. The odds ratios for preterm birth per interquartile range increase in biomass-specific PM2.5 were 1.00 (95% CI: 1.00-1.01) for entire pregnancy, 1.00 (95% CI: 1.00-1.01) for the first trimester, 1.00 (95% CI: 1.00-1.00) for the second trimester, and 1.00 (95% CI: 0.99-1.02) for the third trimester. For stillbirth, the odds ratios were 1.00 (95% CI: 0.99-1.02) for entire pregnancy, 0.99 (95% CI: 0.96-1.02) for the first trimester, 1.00 (95% CI: 0.99-1.01) for the second trimester, and 1.01 (95% CI: 1.00-1.01) for the third trimester. Sensitivity analyses, including adjustment for additional confounders, a time-varying cox proportional hazard model, and alternative exposure definitions, yielded similar results. These findings suggest that in Sydney, a setting with generally good air quality but increasing bushfire events, biomass-specific PM2.5 exposure during pregnancy may not significantly increase the risk of preterm birth or stillbirth. However, given the limitations of our study and the emerging evidence of hazardous health effects of biomass specific PM2.5 on other health outcomes further research is needed.

# Exploring regional variability in mortality risk of total and bushfire-specific PM2.5

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Introduction
PM2.5 exposure has been shown to increase the risk of all-cause mortality. However, due to Australia's relatively large size, and relatively low PM2.5 exposure, aggregate measures may obscure variability at sub-national levels, bias national estimates towards those from the most populous areas, or obscure differences due to different patterns of seasonal variability. The current study aimed to explicitly explore variability across sub-national regions.

Methods
Newly developed high resolution (5km² grid) 20-year Australia-wide daily PM2.5 surfaces were decomposed into daily seasonal, trend and remainder components. Bushfire days were identified using a combination of environmental exposure flags. Regression models utilising an underlying quasi-Poisson distribution were fitted, with increasing complexity across linear, non-linear and distributed lag models at the Statistical Area Level 4 area. Grid searches were used to determine optimal model fit using quasi-Akaike's Information Criterion (qAIC). Aggregate estimates were obtained at either national or Greater Capital City levels using mixed-effects meta-regression.

Results
While national estimates showed a positive, dose-dependent risk relationship between PM2.5 and all-cause mortality, regional estimates were considerably more variable. Greater Sydney and Adelaide, regions with similar latitude, reflected national estimates. However, regions with higher temperature fluctuation and a greater reliance on woodfire smoke heating, such as Greater Melbourne, showed little evidence of a relationship.

Discussion
Regional results suggest a more variable relationship between PM2.5 and all-cause mortality, likely dependent on region-specific seasonal and atmospheric factors, as well as population density and housing type. This variability persisted after adjusting for population size, model complexity, and estimates of socioeconomic status by area. Caution is urged when applying national risk estimates to specific regions, as national estimates may not adequately reflect this heterogeneity.

# Investigating Bushfire Smoke Impact on Brain Health of Vulnerable Communities.

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Climate change is leading to a rapid and sustained increase in bushfire frequency and intensity across Australia and internationally. Bushfire smoke is a major form of air pollution and contains a highly complex mixture of toxic compounds. Yet, the health impact of this growing problem has received relatively little attention. A large body of work has demonstrated critical links between air pollutants and brain impairment, including dementia, and studies suggest that both inflammatory and cerebrovascular impacts may have a central role in driving air pollution (and bushfire smoke)-mediated brain impairment. However, the relationship between bushfire smoke generated air pollution and human brain health remains poorly studied.

We are spearheading a new research focus to uncover the impact of increasing bushfire smoke exposure on human brain function and disease, particularly for those who are the most highly affected. This includes front-line rural firefighters and rural communities, as well ageing populations. Our unique research program integrates broad expertise in neurodegenerative diseases at the cell and molecular level with cohort biomarker studies, and epidemiological impacts of bushfire smoke on brain health. Our research program covers several themes including: Studies on neurotoxicity, neuroinflammation, and cerebrovascular effects, using human brain cell models; Health impacts of bushfire smoke exposure on neurological impairment in front-line rural firefighters and the broader affected populations; Integration of molecular analysis and health studies to identify biomarkers of neurological health impairment; and Proposed implementation of information and policy advice to reduce future risk of brain health impairment from the growing bushfire risk in Australia.

# Biosecurity, And Emerging Infections In The Context Of Environmental Change

# Risk assessment to identify Dengue hot spots for early interventions

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Dengue is posing Public Health concerns globally due to significant burden not only in terms of health but also in terms of economic lost. However, current intervention measures are driven by index cases which lead to late and insufficient response because Dengue virus could be transmitted to mosquitoes and other people prior the detection of index cases. In addition, current early warning tools have not yet reached sub-commune level, the intervention measures still have to encounter to many challenges and difficulties of feasibility and intervention scale in the context of resources limitation. Our study aims to determine the risk factors then to develop risk assessment for identifying the dengue hotspots for early intervention at the sub-commune level in the Mekong Delta Region of Vietnam.

A cross-sectional survey with cluster sampling technique was conducted in in 4 provinces where the Dengue distribution and other natural and socio-economic is characterised to Dengue in the whole country of Vietnam. Outcome was Dengue epidemic status at sub-district level and was collected alongside with potential risk factors including history of Dengue endemic, human movement, socio-economy data and entomological indexes including BI (Breteau Index) and HI (House Index). The accuracy and positive predicted value (PPV) of risk factors were identified by multivariate logistic regression and validated by running ROC. Additionally, prediction scores were developed by logit regression to standardise and round the scores.

This study will provide criteria for Dengue hotspot identification through risk assessment and will also be integrated with current forecasting tools to guide local staff to narrow down and target intervention scale to make it more feasible, more effective and cost-saving.

# Evaluating the Impact of the Modifiable Areal Unit Problem on Ecological Model Inference: A Case Study of COVID-19 Data in Queensland, Australia

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Accurate identification of spatial patterns and risk factors of disease occurrence is crucial for public health interventions. However, the Modifiable Areal Unit Problem (MAUP) poses challenges in disease modelling by impacting the reliability of statistical inferences drawn from spatially aggregated data. This study examines the effect of MAUP on ecological model inference using locally acquired COVID-19 case data from 2020 to 2023 in Queensland, Australia. Bayesian spatial Besag-York-Mollié (BYM) models were applied across four Statistical Area (SA) levels, as defined by the Australian Statistical Geography Standard, with and without covariates: Socio-Economic Indexes for Areas (SEIFA) and Overseas Acquired COVID-19 cases. Results indicated that finer resolutions, SA1 and SA2, captured more detailed spatial variability and clearer patterns compared to coarser scales SA3 and SA4, which led to increased uncertainty. At SA4, a high spatial random effect ($\sigma\_u^2$= 3.29 [95% CI: 0.96, 11.04] without covariate, 6.28 [95% CI: 1.21, 23.25] with covariate) highlights this uncertainty. Including covariates, particularly SEIFA improves model fit by reducing spatial autocorrelation in residuals (Moran's I) and both spatial ($\sigma\_u^2$) and unstructured random effects ($\sigma\_v^2$) at SA1 and SA2. However, it can be extremely challenging to obtain detailed health data at SA1 level. SA2 offered the best trade-off between geographic resolution and model stability, with spatial variances $\sigma\_u^2$ improving from 1.00 to 0.98 and $\sigma\_v^2$ from 0.32 to 0.31. At SA2, Moran's I also improved from 0.047, p = 0.053 to 0.032, p = 0.110, indicating reduced autocorrelation in modelled residuals. These findings underscore the critical influence of MAUP on model inference and emphasise the importance of selecting appropriate spatial scale and covariates in infectious disease modelling. The study advocates conducting sensitivity analyses across different spatial scales and incorporating relevant covariates to better understand the extent to which MAUP influences spatial analyses and to avoid misleading conclusions.

# Early warning signals of infectious disease outbreaks after a disaster event: NSW and QLD 2022 floods

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Background: Severe flood and climate-related disaster events, as occurred in New South Wales (NSW) and Queensland (QLD) in 2022, have been associated with increased risk of certain infectious diseases. Despite this, there is little examination of the NSW and QLD 2022 flood events and the corresponding increase in infectious disease notifications. Use of open-source data surveillance systems can assist with retrospective examination of disease burden relative to the flood events and they also provide an understanding of community sentiment regarding the event.

Methods: Descriptive analysis of EPIWATCH reports was conducted. EPIWATCH reports that were geotagged for flood affected NSW and QLD areas were collected between February 2021 and March 2023, to include a non-flood period (pre-February 2022), flood period (February and March 2022) and a year after the flood (April 2022 – March 2023). Case data was extracted to create a line list of cases where possible.

Results: There were a total of 51 EPIWATCH reports included in the analysis. The breakdown of reports for infectious diseases relative to the flood period is as follows: 5 (pre-flood), 5 (mid-flood), 4 (0-3 months post-flood), 21 (4-6 months post-flood), 12 (7-12 months post-flood) and 7 (spanning a period from pre-flood, up until 4-6 months post flood). Notably, three of the reports in the mid-flood period were for an outbreak of acute gastroenteritis in Lismore with the articles specifically mentioning flooding and 2 of the reports were regarding two new Japanese encephalitis cases in flood affected areas, with article publication dates of March 2022, indicating they provided early-warning signals. Reports increased by 87% post-flood.

Conclusion: It is suggested that some infectious disease notifications were related to flood events. Open-source intelligence surveillance systems have the capacity to provide early-warnings of infectious disease outbreaks during climate-related disaster events such as floods for Australian communities.

# Clean Energy for Healthy Environments and Lives

# Empowering Rural India: A Case Study on Solar Microgrids

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This case study investigates the adaptability and feasibility of solar microgrids in Pandeshwaram, a rural community in Tamil Nadu, South India, illustrating the barriers and enablers of migrating to clean energy solutions. Despite the well-established advantages of renewable energy for the economy, environment, and health, many rural communities still lack access to the technology. Like many rural Indian communities, Pandeshwaram's homes mostly rely on solid fuels like firewood and dung for cooking, which adds to indoor air pollution, unfavourable health effects, and environmental degradation.

The study examines how solar microgrids, as a decentralised energy solution, might lessen reliance on solid fuels while meeting the energy needs of Pandeshwaram's residences and agricultural operations. Tamil Nadu's high solar potential makes it a good candidate for solar energy generation, but the primary difficulties remain initial capital expenditures, technical accessibility, and community readiness.

Through an assessment of energy demand, the study discovers that solar microgrids might considerably reduce the village's reliance on inefficient, polluting energy sources. Clean electricity would be made available for small-scale farming, cooking, and lighting as a result of this shift, which would also cut carbon emissions and deforestation while improving public health by lowering indoor pollution exposure.

Economic research shows that although solar microgrids may require a large initial investment, the system may become financially feasible over time due to long-term cost savings and possible government subsidies. Furthermore, the project's long-term viability and upkeep may be maintained by the community's ownership and involvement.

According to the case study's findings, solar microgrids provide a scalable and sustainable way to access clean energy in remote places like Pandeshwaram. With proper implementation and financial support, this model could enhance energy security, promote better health, and advance sustainable development for rural communities across India.

# Co-designing interventions to reduce wood heater smoke in Mount Barker.

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Background

Air pollution is a source of global concern due to its impact on health and climate. Domestic wood heater smoke is the largest source of particulate air pollution in many Australian cities and towns. Reducing wood heater smoke has the potential to improve health, environment and climate. This research project in Mt Barker, South Australia, involved co-designing a communication intervention to increase community awareness of the impact of smoke from wood heaters and increase uptake of healthier heating technologies.

Method

A participatory action research approach was adopted to codesign air quality interventions tailored to community needs. Three activities; two world café workshops and one focus group discussion were held during 2024. Participation was open to wood heater users in Mt Barker district council who were interested in working with the Mt Barker council to design wood heater smoke interventions. World café workshops were facilitated by an external facilitator.

Results

Twenty-nine community members and two council members took part in the world cafés and focus group discussions. The world café format was effective in bringing together stakeholders with diverse perspectives and encouraged open dialogue among community members. The first world café was effective in generating ideas for interventions to reduce wood heater smoke pollution. However, not all the suggestions were feasible and some met resistance, especially suggestions that restricted wood heater usage. The focus group enabled community members to identify their preferred intervention along with feedback on how to improve it before piloting in the broader community. At the second world café, participants shared their feedback on the piloted intervention "the Chirpy Chimney campaign".

Conclusion

The participatory research approach was effective for generating and refining ideas and fostering community engagement. However, there is need for ongoing collaboration between the community and local government to build trust and encourage change.

# Award-winning "Dharray manymakkuŋ pawaw ga gapuw" Energy Efficiency Project with Very Remote Indigenous Communities: Ground-breaking Features & Learnings

Professor Elaine Ḻäwurrpa Maypilama[1], Dr Petra Buergelt[1]
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Before European colonisation, Indigenous peoples were healthy and well. However, historical and contemporary colonisation led to the health and wellbeing of Indigenous peoples living in very remote Indigenous communities sharply declining and to diverse interdependent challenges emerging. Indigenous peoples accessing energy is critical for preventing and addressing health and other social inequalities, and restoring health and wellbeing. Parallel to these cultural and social disasters, climate change and 'natural' disasters are increasingly compromising the provision of power. Yet, utilizing ancient Indigenous ways of being-knowing-doing combined with appropriate innovative Western knowledges and technologies could create novel pathways for preventing and addressing the diverse challenges by (re)building and using Indigenous capabilities and capacities, reducing dependence on traditional energy sources, and utilizing the emerging carbon neutral economy. To start turning the tide, an intersectorial consortium conducted over three years an innovative $12 million Commonwealth funded community-based participatory action research project with six very remote Indigenous communities in East Arnhem Land (NT). The project, which won several national awards, employed, worked together with and educated over 80 community-based Yolŋu educators to educate their fellow Yolŋu to use power wisely and 16 community-based Yolŋu researchers to find out how Yolŋu use power, identify barriers to and enablers of using power wisely, and evaluate the project. The research/evaluation component was co-led, co-designed and co-implemented by a Yolŋu and an ally researcher, utilizing Yolŋu and appropriate Western worldviews, methodologies and methods. In this presentation, we will provide insights into the design, implementation and outcomes; what worked and what did not work as well; suggestions for improvement; and key barriers and enablers of Indigenous peoples and allies working together with Indigenous peoples living in remote Indigenous communities. While this project focused on enhancing power efficiency, the design and learnings will be of value for working with Indigenous peoples generally.

# Climate Change And Mental Health And Wellbeing

# Lived Experiences of Solastalgia in Viet Nam: A Community Perspective

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Solastalgia, described as the distress experienced when your home environment is transformed and degraded due to climate change, is a relatively new concept and to date there have been very limited first-hand accounts of the true impacts of solastalgia on communities. Using semi-structured interviews, this study aimed to create an elementary risk-map of solastalgia in Viet Nam. Semi-structured interviews were conducted with 22 community and ethnic minority group members across Viet Nam between April and August 2024. Preliminary findings showed that solastalgia is more evident for at risk communities, including those living in climate vulnerable areas and Ethnic Minority groups. However, communities living in major cities were significantly less impacted and less worried about climate change, despite higher levels of education. Community members living in major cities also shared their assumption that Ethnic Minority groups would not care about climate change as they would be more focussed on surviving to tomorrow, however, rural community members and Ethnic Minority group members were often more aware, more concerned, and more active about being productive against climate change effects than their city counterparts. Overall, community resilience is already evident, and operates at an individual and community level as Government support is limited. Lastly, solastalgia as a term does not resonate in Viet Nam the same way it does when it was created to represent Indigenous Australians. The mental health effects of climate change are prevalent and some meanings of solastalgia apply, but the term as a whole may need to be reconceptualised if being applied to different countries and cultures.

# Living a good life knowing what we know. A Practice Insight.

Karen Grant[1]
[1]Outdoor Counselling, Hobart, Australia
Living a good life, knowing what we know: A Practice Insight

Karen Grant, BPsySci, DipCouns, DipSustLiv

Abstract:
As news of the environmental and economic impacts of climate change becomes increasingly bleak, it is clear there are, and will continue to be, considerable psychological impacts as well. Research has focused on identifying the types of impacts being experienced (mostly anxiety), the people most at risk (young people), and the treatments most effective (self-care and peer support). While important work, there is a significant gap in the research, that being the heavy emotional toll being experienced by those whose work requires them to present devoid of emotion; these are the scientists working on climate change. Their research is critical, the findings are often dire, and the reception is mostly unfavourable. Yet there is arguably no work more important right now and the wellbeing of climate scientists should be a priority. This practice insight is based on a series of interventions undertaken by the author over several months. Working with scientists from various institutions, across a range of disciplines, the author reflects on the experience and examines the value of developing bespoke therapies for those whose emotional responses to climate change are regularly proven, by their own work, to be unequivocally valid.

# Heat Anomalies and Suicide in Australia: a time-series regression analysis (2000-2019)

Dr Lucas Hertzog[1], A/Prof Fiona Charlson[2], Prof Petra Tschakert[1], Prof Geoffrey Morgan[3], Prof Richard Norman[1], Prof Gavin Pereira[1], Dr Ivan Hanigan[1]
[1]Curtin University, , , [2]University of Queensland, , , [3]University of Sydney, ,

Background: Although environmental determinants play an important role in suicide mortality, the quantitative influence of climate change-induced heat anomalies on suicide deaths remains relatively underexamined.

Objective: The objective is to quantify the impact of climate change-induced heat anomalies on suicide deaths in Australia from 2000 to 2019.

Methods: A time series regression analysis using a generalised additive model was employed to explore the potentially non-linear relationship between temperature anomalies and suicide, incorporating structural variables such as sex, age, season and geographic region. Suicide deaths data were obtained from the Australian National Mortality Database, and gridded climate data of gridded surface temperatures were sourced from the Australian Gridded Climate Dataset.

Findings: Heat anomalies in the study period were between 0.02°C and 2.2°C hotter than the historical period due to climate change. Our analysis revealed that approximately 0.5% (264 suicides, 95% CI 257 to 271) of the total 50 733 suicides within the study period were attributable to climate change-induced heat anomalies. Death counts associated with heat anomalies were statistically significant (p value 0.03) among men aged 55+ years old. Seasonality was a significant factor, with increased deaths during spring and summer. The relationship between high heat anomalies and suicide deaths varied across different demographic segments.

Conclusions and implications: This study highlights the measurable impact of climate change-induced heat anomalies on suicide deaths in Australia, emphasising the need for increased climate change mitigation and adaptation strategies in public health planning and suicide prevention efforts focusing on older adult men. The findings underscore the importance of considering environmental factors in addition to individual-level factors in understanding and reducing suicide mortality.

# Reasons to Protect Nature: A Qualitative Exploration of Australians' Avoidance/Approach Motivations and Emotions

Lyndal Kilgannon[1], Dr Anna Klas, Olivia Jones, Dr Kate Barford
[1]Deakin University, ,

Significant changes to Australians' behaviours toward the natural environment are needed to mitigate a climate emergency. Yet, Australian's existing concerns for the natural environment have not translated into meaningful action. To address this, a qualitative analysis explored Australians' avoidance/approach motivations and negative and positive emotions when reporting reasons to protect the natural environment. A qualitative secondary data analysis was employed with a sample of 482 Australians aged 18-84 years (M = 45.55, SD = 15.76) recruited via an online survey. Utilising a content analysis methodology, results showed that participants reported avoidance motivations of loss, destruction, death and suffering. Approach motivations were also reported with anthropocentric and eco-centric drivers. Negative emotions of fear, contempt and hopelessness were identified, while positive emotions of compassion, gratitude, awe, beauty, and enjoyment were also conveyed. These findings illustrate the diversity of pro-environmental motivations in Australia, suggesting a multi-pronged approach may be beneficial for environmental communications.

# Climate change anxiety positively predicts antenatal distress in expectant female parents

A/Prof Amy Lykins[1], A/Prof Suzanne Cosh, Dr Cassandra Sundaraja, Ms Mary Bonich
[1]University Of New England, Armidale, Australia

Clinical and subclinical levels of anxiety and depression are common experiences during pregnancy for expectant women; however, despite rising awareness of significant climate change anxiety around the world, the extent to which this particular type of anxiety may be contributing to overall antenatal psychological distress is currently unknown. Furthermore, the content of concerns that expectant women may have for their existing or future children remains unexplored. To address this gap in knowledge, 103 expectant Australian women completed standardised assessments of antenatal worry and depression, climate change anxiety, and perceived distance to climate change, and responded to several open-ended questions on concerns they had for their children. Results indicated that climate change anxiety accounted for significant percentages of variance in both antenatal worry and depression scores and, unexpectedly, neither child number nor perceived distance to climate change moderated these relationships. Content analysis of qualitative data highlighted the significant health-related anxieties for participants' children related to climate change (e.g., disease, exposure to extreme weather events, food/water insecurity). Given the escalating nature of climate change, further investigation of this relatively new stressor contributing to the experience of anxiety and distress, particularly in uniquely vulnerable groups such as expectant women, is urgently needed.

# FRAMEWORK ANALYSIS FOR YOUTH MENTAL HEALTH EDUCATIONAL INTERVENTION PACKAGE WITHIN ACADEMIC INSTITUTIONAL IN MALAYSIA: A NARRATIVE REVIEW

Ms Nur Iziatul Athirah M Daud[1], Profesor Dr Rosnah Sutan[2]
[1]National University Of Malaysia, Kuala Lumpur, Malaysia, [2]National University Of Malaysia, Kuala Lumpur, Malaysia

BACKGROUND:Youth is a national asset that has the potential for academic enhancement and skills for career opportunities. Recent publication highlights strategic interventions that can be seen as best practice. Mental health problems continue to rise alarmingly even though various initiatives have been implemented. OBJECTIVE:This review is aimed to identify the prevalence of stress, anxiety and depression, mental health challenges, barriers to access mental health services and quality of life to set up a completed health promotion and intervention package among youth in academic institutional. DESIGN:A systematic review using electronic literature databases published between January 2023 and December 2025 was conducted. DATA SOURCES: PubMed and Scopus were used. METHODOLOGY:The following databases were searched in September 2018, to identify the relevant literature. Summarizing relevant published evidence using PRISMA-ScR based on youth population (P), mental health promotion as the context (C), and mobile apps concept (C).The inclusion criteria include publication type of journal articles, written in English, timeline within five years only (2018 to 2023), and determined with PCC model was used to guide this review.The output presented is based on reviewing previous studies according to identifying knowledge gaps, and intervention strategies and frameworks used. RESULTS: A total of 15 papers were identified and reviewed for quality using the MMAT checklist. Promoting mental using mobile apps is limited in Malaysia but has been implemented in most countries. The strategy should focus on personal or family-related issues, work-life balance, and overcoming financial burdens to affect resilience and personal health functionality and increase sosial concerns. CONCLUSION: There is an urgent need to identify effective strategies to curb the mental health crisis among the youth where their welfare is often neglected, lack of support from family members, and lack of attention whose academic achievements are poor and unsatisfactory. Keywords: stress; anxiety; depression; mental health; youth; intervention

# Healing Ourselves Alongside Country

Jessie Panazzolo[1]
[1]Lonely Conservationists, ,

Doctors seek care from medical professionals and psychologists receive psychological help. Conservationists play a pivotal caring role in our society, but who is caring for us?

Founded in 2019, Lonely Conservationists is a pioneering community that provides helpful resources, opportunities for care, and a voice to budding and burnt out environmentalists. Since it's humble beginnings as a blog, this community platform has since gone on to represent the wellbeing of global conservationists at international forums such as the Earth Optimism Summit and World Species Congress.

Western societies often forget the reciprocal nature of human relationships and how they integrate with the other components of Earth's ecosystems. Acknowledging that we are too, an integral part of nature, reminds us that it is essential to make time to heal ourselves whilst we invest time, resources, and energy into healing Country.

# INDIGENOUS PEOPLES' SPIRITUAL CONNECTION TO PLACE, NATURE, ENVIRONMENT AND RESPONSIBILITY FOR COUNTRY: PRACTICAL APPLICATIONS

Dr Stewart Sutherland[1]
[1]School of Medicine and Psychology, Chair Indigenous Health Framework, Associate Dean First Nations CHM, The Australian National University, Canberra, Australia

Dr Sutherland will address how the connection that humans have with the environment is undeniable, so much so that 'solastalgia' is a current term that describes the how we feel about the changing environment or loss of our familiar habitat. For Indigenous people the connection to the land is a core and part of our identity. The fires of 2020 had a profound effect on the social and emotional wellbeing (SEWB) of many. This could be true for many sectors of the community, due to the loss of property, life and landscape.

For Aboriginal people, there are compounding effects: the connection to place and the land is more than a feeling of belonging, it is spiritual, and comes with responsibilities. Totems for which they are stewards were decimated. Many outside the fire zones also feel the loss of these totems on such a large scale, with the accelerating loss of diversity of wildlife species. Cultural practices rely on a healthy environment; many could not enter vast areas to undertake ceremony or cultural activities. This then involves 'communities' connectives', and how individual behaviour varies in relation to community norms, which then starts a cycle of trauma (Dudgeon Sutherland & Rosen,2023) .

Dr Sutherland will talk to the work that his Australian National University group have been undertaking with Mogo Local Aboriginal Land Service, on mental health and the environment after the 2020 fires, and the protective factors regarding SEWB.

# HEALTH AND SOCIAL AND EMOTIONAL WELLBEING ACHIEVEMENTS OF ABORIGINAL AND TORRES STRAIT ISLANDER COMMUNITIES DURING THE COVID-19 PANDEMIC ERA AND IN TACKLING SUICIDALITY AND SOCIAL DETERMINANTS OF MENTAL ILL-HEALTH

Prof Pat Dudgeon
[1]School of Indigenous Studies, The University of Western Australia, Perth, Australia

Professor Dudgeon will describe lessons learned and applied for the Australian Aboriginal and Torres Strait Islander national response to the COVID-19 pandemic which has resulted in far better physical health outcomes, including avoidance of infections, hospitalisations, intensive care unit admissions and deaths directly related to COVID-19 than for many other Indigenous peoples worldwide. This has been an achievement of global significance, although subsequently eroded when governments dropped the ball on vaccination and protection of remote communities from infected travellers, and inadequate facilities to isolate if infected in these overcrowded yet officially 'high priority' populations. Professor Dudgeon will also describe the related implications of the pandemic and other climate change impacts for mental health or social and emotional wellbeing (SEWB), including suicidality, for these communities. She will also address the importance of proactive consultative planning and networking via the National Aboriginal Community Controlled Health Organisation (NACCHO) and regional Aboriginal Community Controlled Health Organisations (ACCHOs) and adequate government funding for national initiatives such as this throughout the pandemic and other climate change-related mental health impacts, for 'closing the gap' for social and cultural determinants of SEWB, and for rigorous researching and dissemination of these learnings (Dudgeon P et al 2020,2021,  Moodie N et al 2020,Rosen A 2021, Dudgeon Sutherland & Rosen, 2023).

# APPLYING TRADITIONAL STRENGTHS OF FIRST NATIONS TO OVERCOME MENTAL HEALTH IMPACTS OF CLIMATE CHANGE EVENTS – DROUGHTS, FIRES, PANDEMIC AND FLOODS

Alan Rosen[1,2,3]
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We consider how some aspects of the internationally emerging and now-recognised mental health conditions that relate to climate change (e.g. eco-anxiety and solastalgia (Albrecht et al, 2007) , may have been familiar to First Nations since loss of familiar environments, custodial roles and sovereignty due to colonisation. Are our wider societies possibly catching up, and beginning to understand Indigenous concerns better, especially since Australia's prolonged droughts, floods, extreme bush-fires and the continuing COVID-19 pandemic?

We briefly review the globally anticipated risks and existential threats of climate change to all Indigenous peoples, and their strengths invoked in overcoming them nationally and regionally by Aboriginal and Torres Strait Islander communities through mobilising community controlled strategies (Eades S et al. 2020,). The constructive advocacy to bring these outcomes to national and international attention was initially thwarted, possibly related to dismal expectations of inevitably pessimistic outcomes for Indigenous peoples with the pandemic and other climate change events in many countries, projected by many clinicians, researchers and governments, possibly softening them up to be resigned to this fate (Talley NJ et al, 2021, Rosen A,2021,Dudgeon Sutherland & Rosen,2023).  Subsequently, these achievements were partially eroded when our governments 'dropped the ball' on vaccination and protection of remote communities from infected travellers, and inadequate isolation facilities if infected in these overcrowded yet officially 'high priority' populations.

What have been the lessons for Aboriginal and Torres Strait Islander and other First Nations communities for preventing, ameliorating and healing mental health impacts of climate change? How can our wider communities learn and benefit from valuing the practical application of such traditional cultural strengths, practical knowledge and wisdom? Will we heed and learn how to apply these lessons to resetting and building new personalised, community controlled and determined mental healthcare ecosystems (Rosen A, 2022a+b).

# MENTAL HEALTH IMPACTS OF CLIMATE CHANGE ON ABORIGINAL & TORRES STRAIT ISLANDER & OTHER FIRST NATIONS COMMUNITIES, AND COMMUNITY CONTROLLED MOBILISING EFFECTIVE COMMUNITY-CONTROLLED RESPONSES

Prof Pat Dudgeon[1,2], Alan Rosen[3,4,5], Dr Stewart Sutherland[6,7]
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Objectives:  a) Should Indigenous populations be a priority when addressing both the physical and mental health impacts of climate change, because of their post-colonial vulnerabilities?
b) Should First Nations be valued and heeded for their persistent concern, strong advocacy and practical care of nature, and the considerable strengths, skills and determination of their communities, relevant to preventing and dealing with climate change impacts on all the peoples, lands, waters, and species of our planet?

Findings: A UN Environment report (2020), concludes that, 'Indigenous people with close emotional and ancestral ties to the land are also likely to be disproportionately affected by environmental change and extreme weather events.' First Nations peoples must be priority populations for addressing climate change impacts, but they have skill-sets, attitudinal and spiritual strengths and commitment to caring for nature and our planet that can assist wider societies in preventing and dealing with climate change threats and impacts.

Discussion: We consider how some aspects of the internationally emerging and now-recognised mental health conditions that relate to climate change (e.g. eco-anxiety and solastalgia (Albrecht et al 2007), may have been familiar to First Nations since loss of familiar environments, custodial roles and sovereignty due to colonisation. Are our wider societies possibly catching up, and beginning to value Indigenous concerns, strengths & skills better, especially since Australia's prolonged droughts, floods, extreme bush-fires and the  COVID-19 pandemic?

Conclusions: First Nations peoples can effectively mobilize their resilience in the face of climate change, and help to enhance that of wider societies in surrounding nation states. Such strengths are rooted in traditional wisdom and ecologically sustaining practices of global Indigenous cultures, which can be deployed as tools to modify our values and actions, improving our wellbeing, while healing our planet and its species (Rosen, 2020b, Dudgeon Sutherland & Rosen, 2023).

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# If not today, then tomorrow?: Climate anxiety and the 'future-switching' of climate concerns in Australia.

Dr Alexandra Smith[1], Prof Roger Patulny[2], Dr Jordan McKenzie[3], A/Prof Rebecca Olson[1], Fiona Charlson[1,4], Prof Mary Holmes[5], Adj/Prof Andreas Hernandez[6]
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Climate anxiety is now entrenched in many societies, though the predictors and motivations behind it vary. While many population majorities now accept climate science, and the serious reality of the threat it poses, it is not clear how current and future-oriented climate concerns are prioritised, and whether they might be drowned beneath other, everyday concerns: for example, material prosperity, particularly in times of high unemployment; rising prices; and housing unaffordability.

We use data from the 2022-23 Australian Social Attitudes Survey, a nationally representative dataset, to examine perceptions about the greatest present, and future, social challenges Australia faces. We interrogate this data with a focus on climate change, seeking to understand the factors involved in respondents' selection of this as the most significant challenge today and into the future (i.e., over the next 30 years). Analysis reveals the importance of political voting patterns (i.e. ideology) over other factors, with left-leaning Green party voters significantly more likely to name climate change as the greatest challenge both today and in future, while right-leaning National Party/Other voters are significantly less likely to do so. However, when looking at 'future switching' – meaning, those who see climate change as the most important future but not present challenge – demographic effects are as important as political ideology. Higher education positively predicts switching to climate change as the biggest challenge, while experiencing financial hardship negatively predicts it, regardless of political ideology. This suggests that while political ideology may drive anxiety (or lack thereof) over climate change today, an informed self-interest based on educated, material prosperity may be starting to drive greater recognition of the danger climate change poses into the future. This presents implications for understanding not only the impacts of climate anxiety now, but also its relationship with future-oriented intentions toward individual and collective climate action.

# Effects of weather extremes on mental illness: Newfound evidence from Australia

Dr Benjamin Vu[1]
[1]University Of Canberra, ACT, Australia

Extreme weather and climate events include different forms such as heat waves, cold waves, heavy precipitation, drought, and cyclones, and they have caused harmful impacts and losses to people's assets and health including mental illness (WMO, 2024, IPCC, 2022). According to AIHW (2024), in Australia in 2024, one of five people aged 16-85 years (i.e., 22% or 4.3 million) experienced mental disorder. About 3.4 million Australians (i.e., 17%) faced an anxiety disorder, around 1.5 million people (i.e., 8% Australians) experienced an affective disorder, and approximately 0.65 million (i.e., 3%) suffered from a substance use disorder. Mental illness is a serious public health issue in Australia that requires access to mental health services (Nghiem et al., 2020, AIHW, 2024). This study investigates to what extent weather extremes negatively affect people's mental illness in Australia. It also examines if the existing preventative and adaptive strategies help mitigate the adverse effects of weather extremes on Australians' mental illness. In addition, the study explores and recommends potential preventative and adaptive solutions to better cope with future extreme weather events, and to mitigate their adverse effects on people's mental illness in Australia. Our study uses modelling techniques to analyse the direct and indirect links between weather extremes and mental illness using data collected from the Commonwealth Department of Health and Aged Care, Australian Bureau of Statistics, the Household, Income and Labour Dynamics in Australia Survey and the Bureau of Meteorology. We also use systematic review, surveys, focus groups and interviews for preventative and adaptive strategies. Based on the findings the study extends international discourse, informs public policy and community practice, creates more effective preventative and adaptive responses to weather extremes and mental illness for communities, especially for vulnerable people as well as reduces the burden on the Australia's health system.

# Simulating the effects of extreme weather events and natural disasters on the social and emotional wellbeing of a rural Queensland community

Ms Eryn Wright[1,2], Fiona Charlson[1,2]

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Growing evidence indicates that climate change is already having an impact on the mental health of communities in Australia. Rural communities that rely heavily on agriculture face an array of challenges as extreme weather events and natural disasters increasingly threaten harvest yields and sustainable livestock production in addition to lives, homes and critical infrastructure. These conditions are expected to intensify long-standing emigration trends to urban centres, where health services, education and employment opportunities are more readily accessible. Between 2016 and 2022, the rural community of Stanthorpe in Queensland was repeatedly impacted by adverse events including a prolonged period of drought, a bushfire, flood and the Covid-19 pandemic. In 2021, preliminary qualitative work was undertaken with local stakeholders to identify and map the most important ways in which these events directly and indirectly affected the overall social and emotional wellbeing of community members using participatory systems modelling. The project highlighted key concepts including the compounding impacts of these events on financial stability in the region, preferences towards self-reliance and stoicism over accessing external support, and the gradual erosion of local resources and social frameworks that promoted wellbeing and enabled the community to rally through past challenges. Here, we present the work currently underway to convert the initial qualitative structure, known as a causal loop diagram, into a quantitative simulation model able to reliably reproduce the behaviour of the system influencing social and emotional wellbeing during the chosen period. This process aims to retain the central themes identified by stakeholders, while also balancing the practicalities of data limitations with the components required in a computational model. Together, the models will help to correct any inaccurate assumptions of the mechanisms influencing mental health in such circumstances and provide a platform for identifying possible intervention points to improve outcomes in the future.

# Data And Decision Support Systems For Environmental Health Applications

# Dengue early warning system: challenges and prospect

Mr Kien Quoc Do[1]
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Dengue is posing Public Health concerns globally due to significant Health burden and economic losses. Current intervention measures are late and insufficient. Early warning system (EWS) will navigate the decisions of when and where to conduct interventions proactively hence control the spread and emergence of Dengue epidemics.

Despite of that, the manipulation of these tools in Dengue prevention and control facing many difficulties and challenges. First and foremost is the lack of reliable evidence on its effectiveness on reducing Dengue incidence or reducing vector population to persuade stakeholders to integrate them into routine platform. Secondly is the unstandardized input data for feeding the prediction tools as these data come from different sources and stored in different standards. Last but not least is the acceptance of end-users as the operation of these tools requires skilled and experienced staff to confer and translate complex forecasting results into indications for intervention. Regarding that, the development of EWS for Dengue should comply with the framework that not only prove its usability which means the tool must have high accuracy, high predicted values and simplified outcomes to confer, but also provide a high level of confidence study design to prove its effectiveness on the reduction of Dengue incidence or vector population to persuade related stakeholders to manipulate it in routine operation. Moreover, the development of this EWS needs to provide tool to standardize automatedly input data to feed the prediction. Lastly, this framework should conduct acceptance surveys to design and modify forecasting tools in accordance with the needs of end-users.

Once these challenges are overcome, Dengue EWS will be accepted, manipulated and sustained alongside routine Dengue prevention. In addition, the effectiveness of Dengue EWS will be optimized when it is incorporated with high efficacy intervention measures for instance Dengue vaccine, release mosquito carried Wolbachia.

# Validated model to predict high spatial resolution landscape fire smoke related PM2.5 for continental Australia, 2001 to 2020.

Dr Karthik Gopi[1], Dr Jingyi Shao[1,2], Dr Nicolas Borchers Arriagada[4], Miss Cassandra Yuen[2], Mr Joseph Van Buskirk[2], Dr Edward Jegasothy[2], Dr Ivan Hanigan[1,5,6], Prof Geoffrey Morgan[1,2,3,7]
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Bushfire intensity and frequency are increasing due to climate change, and they release harmful particulate matter (PM2.5) that poses substantial risks to respiratory and cardiovascular health. In Australia, PM2.5 monitoring is limited, making it difficult to assess bushfire-specific exposure outside capital cities. Our team developed high spatial resolution (5kmx5km) 20-year Australia-wide daily PM2.5 predictions with the total PM2.5 predictions also decomposed into the daily seasonal, long-term trend and remainder components. It is generally difficult to separate out days that may potentially be affected by bushfire smoke. This study aimed to utilise daily decomposed PM2.5 data, in conjunction with flags derived from satellite and fire-related data, and statistical thresholds, to accurately determine days influenced by fire smoke emissions. We applied a classification and regression trees (CART) model to predict and flag potential fire smoke affected days, which were compared to the validated Biomass Smoke Events Database previously compiled by our team. A combination of the following flags: predicted PM2.5 >95th percentile in the region, the month, and urban/rural classification led to the best predictions of potential days affected by bushfire smoke. The findings of this study will be invaluable to epidemiological studies looking at the impacts of bushfire on human health.

# Climate change and Environmental Health Reporting Framework and Indicators

Dr Vanessa Prescott[1], Ms Georgie Amoyal[1], Ms Micaella Watson[1]
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Increasing pressures from climate change and our surrounding environment are having a negative impact on human health. Yet Australia lacks a set of nationally representative environmental health indicators as identified by the National Preventive Health Strategy 2020–2030 and National Health and Climate Strategy.

Climate change and environmental health indicators play an important role in monitoring the effects of current and emerging environmental hazards on health. Understanding the extent to which the environment affects health, and monitoring changes over time, can inform strategies, policies and indicator development.

To address this gap, the AIHW has developed a framework of climate change and environmental health indicators informed by extensive literature reviews, sub-national and international examples of indicator frameworks. Topics important to monitor were informed by the Driving force, Pressure, State, Exposure, Effect, Action (DPSEEA) framework, selection and data sources criteria, expert stakeholder consultation and evidence of causal association between exposure and health effects based on burden of disease methodology and available health data.

Thirty reportable indicators specific to Australia were identified and arranged within 8 broad domains: air quality (indoor/outdoor), water quality, UV and sun radiation, climate and extreme weather, housing, built environment, food environment and waste. Indicator profile specifications were developed to provide information on aspects such as rationale, measures, data sources/frequency and disaggregations.

A further 24 indicators with known data gaps and requiring development were identified. Whilst they are relevant, suitable and may be necessary for inclusion, issues such as data availability and evidence, prevent this. It is intended that these indicators would become reportable, if data gaps are filled, or development occurs.

It is envisaged that reportable indicators will inform baseline reporting on climate change and the environment's impact on health in Australia. Ongoing surveillance and monitoring will be important to assess health impacts now and into the future.

# Food, Soil And Water Safety And Security In A Changing Environment

# Community-led advocacy for food security in remote Aboriginal and Torres Strait Islander communities

Ellie Chan[1], Ms Caroline Deen[2], Emma Chappell[1], Emma Stubbs[3], Emma Tonkin[1], Katherine Cullerton[1], Sue Kleve[4], Abdolvahab Baghbanian[3], Melinda Hammond[5], Megan Ferguson[1]
[1]The University of Queensland, Brisbane, Australia, [2]The University of Sydney , Sydney, Australia , [3]Central Australian Aboriginal Congress, Alice Springs , Australia, [4]Monash University, Melbourne, Australia , [5]Community Enterprise Queensland, Cairns, Australia

Introduction:
Improving food security is a priority for remote Aboriginal and Torres Strait Islander communities serviced by Apunipima Cape York Health Council (Apunipima), Queensland, and Central Australian Aboriginal Congress (Congress), Northern Territory. The 'call to action' from these organisations resulted in a joint research project co-designed by Apunipima, Congress, community stakeholders and researchers that aimed to explore and advocate for community-led solutions to improve food security in remote communities and included a focus on translation.

Methods:
In partnership with Community Advisory Groups, the co-designed research project was implemented across ten remote communities in Central Australia and Cape York.  Following on from a two-year data collection phase, representatives from all participating communities across both regions came together to determine collective priorities and solutions, and consider advocacy options, to inform a community-led framework and policy translation plan to improve food security in remote communities.

Results:
Solutions were identified across the priority areas of healthy food prices; supply and range of quality foods; road conditions and access to transport; income, employment and training; and health promotion education. The project has supported the translation of these findings, by capitalising on existing state and national opportunities, with and in ways determined by community representatives.

Conclusion:
For success and sustainability of any policy it's essential that community voices are heard. Representatives from remote Aboriginal and Torres Strait Islander communities have developed a community led framework of solutions to improve food security and have directed and participated in the advocacy needed to see these solutions translated into policy.

# How safe is roof-harvested rainwater? An investigation of pathogenic and resistant bacteria.

Dr Mira Cooper-Beknazarova[1], Dr Ben van den Akker, Dr Barbara Drigo, Associate Professor Harriet Whiley, Professor Kirstin Ross, Professor Craig Williams
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Roof-harvested rainwater has been used worldwide as an alternative water supply minimising demand on natural water reservoirs (1-11) in response to climate change.

High proportion of Australians use rainwater from their tanks for drinking and other purposes. There is however a knowledge gap in the quality of rainwater stored in domestic tanks (12).

The quality of tank rainwater is influenced by the contaminants from the roof, gutter or pipes and the tank (13, 14) (i.e. animal and bird faeces). The introduction of rainwater tanks coincided with the rapid installation of household solar panels in Australia in the early 2010s (15). Solar panels have been reported to attract pest birds by providing perching and nesting sites (16-18). It is widely documented that free-living birds carry pathogenic bacteria, antimicrobial resistance bacteria (ARB) including E. coli (19-22), Campylobacter spp. (23-25), and antibiotic resistance genes (ARGs) (26). Having solar panels on the roof may introduce new human exposure pathways to health risks from birds and their faeces that need to be investigated. This creates a potential risk of bird-transmitted ARGs spreading from tank rainwater to humans and the environment, promoting another pathway for AMR dissemination. Exposure to these pathogens can significantly harm human health (14, 27), and the risks of transmitting ARGs need further investigating, as antimicrobial resistance (AMR) is a global threat with AMR infections resulted in nearly 1.27 million deaths in 2019 (28).

The aims of my study are (i) assess the microbial diversity and abundance of roof-harvested tank-stored rainwater; (ii) identify and analyse pathogenic and resistant bacteria in rainwater (iii) study the association between a) solar panels and bird-transmitted bacteria and ARGs in rainwater, b) solar panels and physicochemical levels in rainwater and c) microbial communities and physicochemical levels in rainwater; and (iv) compare rainwater quality in communities of different vulnerabilities.

# Pesticide-induced emergence of clinically relevant chemical resistance and virulence-associated genes in soil microbial community

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With the growing emphasis on One Health and Planetary Health, soil health is increasingly recognized as essential for global biodiversity conservation and is fundamental to both ecosystem and human health. While agrochemicals are known to impact soil biodiversity and health, the spread of clinically relevant chemical resistance and virulence-associated genes in agricultural soils is not well understood. In this study, we conducted a 28-day laboratory soil microcosm experiment using metagenomic analysis to assess the expression profiles of clinically relevant chemical resistance determinants, virulence-associated genes, and mobile genetic elements in response to the insecticide imidacloprid, the fungicide azoxystrobin, and the herbicide metolachlor. Our results demonstrated a significant increase in the abundances of common bacterial pathogens following pesticide application, particularly Shigella spp. and Mycobacterium spp. Azoxystrobin exposure led to increased abundances of extended-spectrum beta-lactamases (e.g., veb, tla, ges) and copper resistance genes (mctB). Imidacloprid exposure resulted in higher levels of macrolide-lincosamide-streptogramin resistance genes (e.g., ereB) and virulence-associated genes (e.g., Pse5Ac7Ac and mce7). Additionally, we observed a remarkable increase in the abundances of mobile genetic elements following pesticide application, particularly the transposase IS21 family, recombinase RmuC, and integrase traSA, all of which are associated with nosocomial infections. Overall, this study highlights the relationship between pesticide exposure and the emergence of cross-resistance to clinically relevant chemical resistance genes, along with the emergence of virulence-associated genes within the soil microbial community. Further research, particularly through whole-genome sequencing, is needed to gain more profound mechanistic and ecological insights.

# Synergistic Effects of Environmental Toxins on Kidney Health Using Ensemble Learning Techniques

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Chronic Kidney Disease of Unknown Aetiology (CKDu) presents a significant health challenge, particularly for agricultural communities. The aetiology of CKDu remains highly contentious, with several risk factors proposed, including exposure to heat and environmental toxins, but little firm evidence. Analysing the National Health and Nutrition Examination Survey (NHANES) 1988-2018 we used novel machine learning techniques to assess several environmental toxins. We performed a cross-sectional observational study of N=62,603 participants, using logistic regression and ensemble learning algorithms to investigate if pesticides and heavy metals were associated interactively and/or independently with renal injury indicative of CKD. Heavy metals cadmium and lead exhibited an independent association with reduced renal function. Although pesticides did not demonstrate an independent association with reduced renal function, malathion diacid and 2,4-D exhibited a robust synergistic interaction, which reduced renal function. Heavy metals and pesticides are two contributing aetiologies of CKD. The aetiology of CKD is multifactorial, which may explain the difficulties in narrowing CKDu pathology to a single entity - longitudinal studies will offer a more comprehensive investigation into the individual effect of potential risk factors.

# Health System Resilience To Climate Change And Sustainability

# Comparability of efficacy and safety of medications delivered by different inhalers for asthma and COPD: a systematic review and meta-analysis

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BACKGROUND
Inhaled therapies are a cornerstone of management for asthma and chronic obstructive pulmonary disease (COPD). Metered dose inhalers (MDIs) contain propellant gas with an incredibly high global warming potential; in the UK they are responsible for 3% of the entire National Health Service carbon footprint. There is growing interest in strategies to safely reduce the carbon footprint of respiratory care.

METHODS
PubMed, Embase and CENTRAL were searched in January 2024 for randomised trials that compared MDIs with the non-propellant devices dry powder inhalers (DPIs) or soft mist inhalers (SMIs), for patients with asthma or COPD when the drug(s) and doses administered were broadly equivalent. Eligible studies were assessed for risk of bias and synthesised in meta-analysis. Certainty of the evidence was rated using GRADE.

RESULTS
Forty-two studies were included; 30 on asthma maintenance therapy, five on acute asthma exacerbations, and seven on COPD. No clinically important differences were found between inhaler types. For asthma maintenance, the mean difference in peak expiratory flow rate was 0.99L/min (95% CI -1.11 to 3.09, moderate certainty). For COPD, the mean difference in FEV1 was 0.01L (95% CI -0.01 to 0.02, moderate certainty). Little or no difference was observed in symptom control scores, reliever use and exacerbations (moderate certainty), and in adverse events (moderate or low certainty). Low certainty evidence also indicated little or no difference between inhaler types for acute asthma exacerbations for primary outcomes.

CONCLUSIONS
This systematic review found DPIs and SMIs have similar effectiveness and safety compared to MDIs for treating asthma and COPD. While the choice of optimal inhaler for an individual patient is a multi-faceted decision, this review provides reassurance that non-MDI devices can perform equally well and can inform national and international efforts to reduce the outsized carbon footprint of inhaler therapies.

# Australian and Canadian clinicians' views and application of 'carbon health literacy': a qualitative study

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Background: Clinical care contributes to at least 50% of the carbon footprint of healthcare. This includes the 40% of healthcare that is harmful or low value, adding avoidable emissions without improving health or quality of care. Clinicians are well-placed to mitigate emissions associated with the provision of clinical care. This study aimed to explore clinicians' views on a new construct we have termed 'carbon health literacy' and to understand how their carbon knowledge, skills and capacities may be applied in clinical practice.

Methods: Qualitative interviews were conducted between August 2022 and February 2023 with clinicians from Australia (n = 15) and Canada (n = 13). Clinicians with an interest in climate change and healthcare environmental sustainability were sampled from a variety of clinical specialty areas, such as primary care, nursing, anaesthetics, and emergency. Clinicians were recruited through advertising on social media and via professional networks. A pre-piloted interview schedule was used to guide the interviews. Interviews were audio recorded, transcribed verbatim and analysed using framework analysis.

Results: Participants viewed carbon health literacy as an increasingly important skill, though they reported the level of carbon health literacy and knowledge needed varies by job roles, clinical specialty areas, and individual capacity to generate healthcare system change. Many clinicians reported implementing strategies to mitigate their work-related carbon footprint, such as reducing waste or choosing lower-carbon commuting options. There was limited awareness of reducing low-value care as a strategy to decrease emissions. All participants had encountered barriers to providing low-carbon care, including managing patient expectations, inadequate training and information, and limited capacity to generate system change in their organisational roles.

Conclusions: To support the application of high-value and low-carbon healthcare, further work is needed to build the carbon health literacy of clinicians and remove barriers to low-carbon practice.

# Peer-reviewed evidence on strategies for climate-resilient health systems in Australia: preliminary findings from a literature review

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Background: Australia has developed a National Health and Climate Strategy to build climate-resilient health systems and prevent climate change-associated health threats. This review aims to document evidence-based recommendations for climate-resilient health systems to support the implementation of Australia's health and climate strategy.

Methods: Peer-reviewed studies (2011 – 2023) that investigated approaches to adapt any of the six building blocks (leadership and governance, health workforce, health information systems, essential medical products and technologies, service delivery and financing) of the health systems to climate change in Australia were included. Studies on the impact of climate change on health or health systems were excluded.

Findings: Broadly, five of the six building blocks of the health systems were addressed in these peer-reviewed articles. Collaboration among stakeholders, including the community, was highlighted as one of the potential strategies to build climate-resilient governance. Overall, building the service providers' competence, including combating the stress of extreme weather and climate health literacy, were recommended as strategies to build the resilience of the health workforce to climate change. Improving climate literacy in the community was highlighted as a potential strategy for fostering climate resilience in service delivery. Planning based on strong monitoring of weather predictions and assessment of hospitals' capacity to respond to extreme weather events were some of the recommended strategies for building the climate resilience of the health information systems. Cost-benefit assessment of heat health warning systems and insurance for service providers to cover the health effects of extreme weather events were among the strategies recommended for climate-resilient financing.

Conclusion: Existing peer-reviewed evidence on climate-resilient health systems in Australia is insightful but based on small-scale regional studies. Rigorous studies guided by the assessment needs stated in the National Health and Climate Strategy could provide more evidence required to develop Australia's climate-resilient health systems.

# Towards Disaster Resilient Hospitals: Investigating Perspectives and Opportunities for Empowering Healthcare Workers and Leaders

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Introduction

Climate change-related hazards increasingly threaten hospitals, leading to more frequent disasters that strain healthcare systems. Transformational leadership is critical for developing effective hospital disaster management strategies. Disasters disrupt hospital functions, affecting resources, healthcare worker performance, and safety. While enhancing hospital resilience is widely recognised as necessary, there is limited guidance for decision-makers. This study addresses how hospital leaders and decision-makers can enhance hospital resilience for healthcare workers during disasters.

Methods

This research employed a multi-phase approach, drawing on several frameworks related to hospital disaster resilience, including Resilience Engineering, the Deming Cycle, the Resilience Framework for Public Health Emergency Preparedness, the Disaster Management Cycle, the Hospital Safety Index and the Transformational Leadership Theory.

Phase 1 involved a literature review examining disaster terminology, impacts, and management strategies. Phase 2 analysed lessons from past disasters through an integrative review. Phase 3 included semi-structured interviews with middle-management hospital staff. Finally, Phase 4 involved interviews with leaders and senior hospital staff.

Results

The study developed practical and applicable evidence-based tools for hospital leaders. Phase 1 created resilience evaluation methods and a Decision-Support Model, while Phase 2 resulted in the Hybrid Resilience Learning Framework (HRLF), which identified nine critical areas for resilience evaluation. Phase 3 identified factors influencing healthcare workers' performance and developed the Healthcare Workers' Conceptual Framework. Phase 4 produced an assessment checklist and competency framework to improve resilience, equipping hospital leaders with essential tools for disaster management.

Discussion

Transformational leadership is critical and the cornerstone of building hospital disaster resilience. The HRLF and Healthcare Workers' Conceptual Framework provide practical tools for evaluating staff capabilities. Coordination between middle and senior management is essential for improving disaster preparedness.

Conclusion

This research offers evidence-based strategies to enhance hospital disaster resilience and empower healthcare workers. Leadership is vital to achieving hospital and staff resilience.

# Economic and environmental impacts of commercial milk formula in Indonesia: Estimates using the Mothers Milk Tool and Green Feeding Tool

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The health importance of breastfeeding for infants, young children and their mothers is increasingly acknowledged but the economic and environmental impact of suboptimal breastfeeding is less recognised. Breastfeeding has been declining, and sales of commercial milk formula (CMF) are rising rapidly in East Asia Pacific Region, including Indonesia. This study aims to analyse the economic and environmental impacts of CMF marketed for infants 0-6 months in Indonesia.

We assessed economic and environmental impacts of CMF in Indonesia using the Mothers Milk Tool (MMT) and the Green Feeding Tool (GFT). These tools estimate countries' production of human milk, and carbon and water footprints using UNICEF datasets on births and infant and young child feeding practices, and key assumptions about infants' daily milk intake, and carbon and water footprints of CMF.

The MMT analysis reveals a substantial economic loss from CMF displacing breastmilk in Indonesia: at least 62 million liters of breastmilk were lost in 2020 due to introduction of CMF among infants aged 0-6 months. The estimated monetary value of lost breastmilk is approximately US\$45.5 billion. Also in 2020, 27,200 tonnes of CMF were sold in Indonesia. The GFT estimated a carbon footprint of 213.80-272.10 million kg of $CO_2$ and a water footprint of 92,460 million liters.

In conclusion, current breastfeeding practices in Indonesia are associated with substantial economic production loss, as well as carbon and water footprints. For informed policy-making, we recommend including breastmilk in national food balance sheets to facilitate its inclusion in GDP, and strengthening advocacy for breastfeeding as a measure to improve the environment.

# How will health systems cope with the effects of climate change? An assessment of their capacities and preparedness

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Introduction: Much of the international health-related literature on climate change has focused on human health. Here, we consider the global literature on climate change and health systems.

Methods: We performed an analysis of peer-reviewed and grey literature to assess how healthcare systems are coping and projected to cope with climate change. This analysis was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement. Seven electronic databases (Business Source Premier, CINAHL, Cochrane Reviews, Embase, Health Business (EBSCO), MEDLINE, and Web of Science) were searched from their respective inception dates, and Scopus from 1990, to May 2022.

Results: Seven investigators screened 29,681 publications for inclusion. Data from the 129 included publications were classified into seven categories: Workforce skills, education and preparation (n=61); Tools and frameworks (n=59); Infrastructure and urban planning in the context of healthcare (n=59); Communication failures and adaptation planning (n=43); Surge capacity and increased burden on the system (n=40); Health services interruption (n=37); and Financial costs of climate-related events (n=19). Our review includes assessments of specific healthcare settings' responses to disasters (e.g., emergency departments), and differences in response capabilities based on country resource level (high, middle, low income).

Recommendations were developed from the literature on how to cope with future eventualities, including the need for greater planning, a more prepared workforce, more robust infrastructure and resilient plant, equipment and buildings.

Conclusions: Our analysis suggests that many health systems are underprepared for the consequences of climate change. Health systems need to be future-proofed through implementation of effective policies; recruitment, retention and support of well-trained health workforces; and redesigned climate-resilient infrastructure to meet the additional burdens of climate change. Strategies, preparations, and responses need to be setting-appropriate because climate change-related burdens differ across low and high resource countries, as well as within countries.

Registration: PROSPERO (CRD42022383719)

# A proposal to recognize investment in bsreastfeeding as a carbon offset

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Policy-makers need to rethink the connections between the economy and health. The World Health Organization Council for the Economics Health for All has called for human and planetary health and well-being to be moved to the core of decision-making to build economies for health. Doing so involves valuing and measuring what matters, more and better health financing, innovation for the common good and rebuilding public sector capacity.

We build on this thinking to argue that breastfeeding should be recognized in food and wellbeing statistics, while investments in breastfeeding should be considered a carbon offset in global financing arrangements for sustainable food, health and economic systems.

Breastfeeding women nourish half the world's infants and young children with immense quantities of a highly valuable milk. This care work is not counted in gross domestic product or national food balance sheets, and yet ever-increasing commercial milk formula sales are counted. Achieving global nutrition targets for breastfeeding would realize far greater reductions in greenhouse gas emissions than decarbonizing commercial milk formula manufacturing. New metrics and financing mechanisms are needed to achieve the health, sustainability and equity gains from more optimal infant and young child feeding.

Properly valuing crucial care and environmental resources in global and national measurement systems would redirect international financial resources away from expanding carbon-emitting activities, and towards what really matters, that is, health for all. Doing so should start with considering breastfeeding as the highest quality, local, sustainable first-food system for generations to come.

# Impact of Climate Change on Health Workers: A Scoping Review

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Abstract

Aim: Climate change is the most pressing global challenge of the 21st century and has recently been declared as a public health emergency due to its widespread environmental, social, economic and health impacts. This scoping review aims to map existing evidence on the impact of climate change on health workers.

Subject and Methods: We followed the JBI guidelines for scoping reviews and the PRISMA-ScR protocol. Systematic searches were conducted in databases including PubMed, MEDLINE, ProQuest, SCOPUS, Web of Science, EMBASE, CINAHL and PsycINFO. Peer-reviewed articles published between 01 January 2014 and 03 May 2024 were included. The findings were presented numerically and thematically, and a narrative synthesis summarised the evidence.

Results: We analysed 23 studies from different regions and identified four main areas of climate change impacts: physical health impacts, mental health impacts, occupational safety impacts, and impacts on the capacity and resilience of health workers. This review also identified barriers and challenges to health workers' ability to respond to climate change, including time constraints, gaps in knowledge and training, strains on infrastructure and supply chains, difficulties in resource allocation, and coordination challenges between organisations.

Conclusion: The review highlights the substantial physical health, mental health, and occupational safety impacts of climate change on health workers. These effects undermine the resilience of health workers and the operational integrity of health services. To increase health workers' resilience to climate change impacts, it is essential to implement a comprehensive strategy that includes targeted training, infrastructure upgrades, policy updates, and improved inter-agency coordination.

Keywords: Climate change . Occupational health . Health services . Health workers . Scoping review

# Financial and Environmental Impacts of Caesarean Packs in the Obstetrics Department of a Regional Tertiary Health Service in Australia: A Cost-Minimisation Analysis

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Introduction
Healthcare systems face the dual challenges of managing climate-related health impacts and reducing emissions. Addressing Scope 3 emissions, particularly from supply chains and healthcare delivery, is crucial for sustainability. Caesarean births, a common surgical procedure, significantly contribute to these emissions. This study aims to (1) integrate environmental impacts into a cost-minimization analysis of caesarean instrument packs and (2) offer strategies to reduce their carbon footprint.

Methods
A five-year cost-minimization analysis compared the financial and environmental costs of 'current' caesarean packs with 'revised' packs that included reusable variants of single use items. The study assumed no difference in clinical outcomes between the packs. Environmental emissions were measured in carbon dioxide equivalents ($CO_2e$), and waste in tonnes. Environmental costs were calculated using the World Bank's shadow price for carbon and landfill costs from the Productivity Commission. Financial costs were assessed from the healthcare provider's perspective. A scenario analysis also evaluated the impact of using coal versus renewable energy for sterilization.

Results
Over five years, the current caesarean packs emitted 12.83 tonnes $CO_2eq$, while the revised packs emitted 11.59 tonnes, a 9.63% reduction. Waste from current packs totalled 5.89 tonnes, while revised packs produced 4.06 tonnes, a 32% reduction. Total costs were 4% lower for the revised packs. The most significant emissions reduction (15%) occurred when renewable energy was used for sterilisation alongside pack revisions.

Conclusion
Incorporating environmental considerations into healthcare cost analyses is feasible and beneficial. Simple changes, like using reusable instruments, can reduce emissions and costs. Scaling these efforts across healthcare departments can enhance sustainability, with further research needed to develop a broader decision-making framework.

# Health system adaptation to extreme weather events in Australia: A scoping review

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Extreme weather events (EWEs) are increasing in both prevalence and intensity. They will likely present several challenges for human health and the systems in which they operate, including healthcare systems. This paper details the findings of a scoping review examining Australian health system adaptation in preparation and response to the risks presented by EWEs and how these adaptations have been evaluated. Databases including Medline, PsycINFO, Scopus and Web of Science were searched, resulting in 33 peer-reviewed articles of relevance published between 2014 and 2024. The included articles primarily documented adaptations that, consistent with WHO's health system building blocks, focused on: the health workforce; health information systems; leadership and governance; and supply of medical commodities including vaccines, and devices. Notably, minimal attention was directed towards service delivery and health system financing. Adaptations most commonly addressed floods, extreme heat, bushfires, and storms, likely reflecting the frequency of Australian EWEs. Adaptations to the health workforce, leadership and governance, and medical commodities appeared to focus on preparing the healthcare system for future events. In contrast, health information systems, service delivery, and financing were oriented towards response and recovery. A range of evaluation methods were employed the findings of which reported positive outcomes d. To improve the Australian healthcare system's resilience to EWEs, a greater focus on responding to and recovering from EWEs and integrating preparedness-based adaptations with a particular emphasis on service delivery and financing are paramount.

# Climate resilience in the blood supply chain: safety and sustainability

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Climate change will likely threaten human health, including impacting on the safety and sufficiency of blood and blood components. Natural disasters and pandemics strain public health systems, causing substantial social and economic disruptions. Blood donation centers face unique challenges during these crises. In Australia, intense and unpredictable extreme events and weather pose continuous threats, yet their effects on blood supply management remain largely unexplored.

This study examines the connections between climate change and blood safety and supply and the impact of COVID-19, bushfires, and floods on blood donation numbers in Australia. While existing literature discusses climate change and emerging infectious diseases related to blood supply, a comprehensive understanding of climate change's overall effects on blood safety and sufficiency is still lacking. To address this, we conducted a scoping review of articles published from 1975 to 2024, focusing on the impact of climate change on blood safety and availability. We also analyzed weekly data on blood donation counts, cancellations, and staff availability from Australian Red Cross Lifeblood, covering 2019 to 2022 alongside COVID-19 pandemic, bushfires and floods events. Out of 10,002 articles identified, 34 were reviewed, leaving two studies that focused on the effects of climate change during the collection stage of the blood supply chain. Our review emphasizes the need for further research throughout the blood supply chain, including testing, processing, and distribution. It also highlights potential indirect impacts on blood donors, such as increased psychological stress and logistical challenges. Our data analysis reveals spatial and temporal variations in blood donation and their management, providing insights into areas most impacted by these disasters and aiding in the development of adaptive strategies for future crises. Developing comprehensive strategies that address both direct and indirect effects is essential for ensuring a stable and safe blood supply amidst evolving climate-related threats.

# Rural And Remote Health And Climate-Related Disasters

# Development of a co-designed online tool to improve drought resilience in rural Australia using available wellbeing and mental health support resources

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Drought affects the wellbeing and mental health of people who live and work in rural, regional and remote (RRR) communities. A vital component of adapting to drought is improving and maintaining community and individual wellbeing because high (low) adaptive capacity is associated with good (poor) mental health and wellbeing. In collaboration with the Southern Queensland and Northern New South Wales Drought Resilience Adoption and Innovation Hub, an online toolkit is being developed to assist individuals and communities in RRR locations to enhance their wellbeing and mental health to improve drought resilience. Phase 1 of the toolkit focused on providing resources, ideas and tips for anyone supporting the wellbeing of others in their RRR community. Phase 2 compares available online resources that aim to improve wellbeing and mental health and assesses their suitability and usefulness for meeting the different needs of individuals affected by drought. The online toolkit, that has been co-designed with RRR communities and stakeholders from multiple sectors, empowers individuals to recognise the support they need, allows individuals to make an informed choice about the support that is best for them and their situation, and saves time and confusion caused by the large number of resources available.

# Exploring adaptive capacity to arid heat using a vulnerability-resilience framework in very remote communities of Central Australia

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Extreme heat has been linked to increased mortality and high demand for health services internationally and across Australia. A review of heat-health articles in Australia revealed abundant literature (n=132) but found limited evidence on the effects of heat on Aboriginal and Torres Strait Islander people living in remote communities. This study aimed to explore hot weather-related vulnerability and resilience factors that affect residents living in very remote communities in Central Australia.

Yarning sessions were conducted with thirty community members across four very remote Aboriginal communities in Central Australia. Participants were recruited using a mixed approach of purposive and snowball sampling. Responses were transcribed and coded using a hybrid coding approach. The sample size was determined by information saturation.

Extreme heat conditions were perceived to affect people's health. Children, the elderly, women, and people with pre-existing medical conditions or disabilities were perceived to be at higher risk. Participants described how hot weather affected their day-to-day activities, including hunting, collecting bush tucker, travelling to visit families or for medical reasons, and playing sports. Vulnerabilities caused by poor infrastructure (housing issues, energy poverty), environmental uncertainty (low rainfall and limited potable water), and limited knowledge of effective adaptation practices were reported by participants. A range of cooling strategies were adopted, including using air conditioners and electric fans, resting under shady trees, using bush tucker, and swimming in creeks or water holes. To improve preparedness for increasingly hot weather, participants recommended introducing heat-health education to raise awareness, investing more in community infrastructure, and targeting health promotion programs to suit culture, language, and literacy.

Temperature projections for Central Australia suggest an urgent need to reduce vulnerabilities and strengthen resilience to climatic changes in remote Aboriginal communities. Local adaptation infrastructure investments, strengthening of local adaptation knowledge and co-production of adaptation knowledge are essential for climate-resilient remote communities.

# Climate change, wellbeing and social housing in remote Indigenous communities

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Climate change projections in remote Indigenous communities in Australia are diverse due to geographic location. However, many impacts will expose or exacerbate existing challenges that affect health and wellbeing- including extreme weather events such as heatwaves and cyclones, disruptions to food sources and food supply chains, and insecurity of water and other essential resources. When health and wellbeing are considered from an Indigenous perspective that is more holistic than merely the absence of disease, climate health risks are even greater than the general population. An additional stressor present in these projections is the status of social housing that can often be poorly maintained by the authorities that own and manage these and with unintended crowding due to a shortage of housing. This creates further health risks. This presentation draws from several years of collaboration with communities in Central Australia (Tennant Creek) and the Torres Strait (outer islands) to outline current and project climate health risks. It identifies pathways to change that are culturally appropriate, health protective, and already have successful precedents.

# Disaster governance, collaboration and community organising in the Northern Rivers, NSW: gendered experiences and contributions to community health and well-being

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Background:  Whilst gendered violence and other gendered health impacts of disasters are well rehearsed in the literature, relatively less attention has been paid to women's important role for health and wellbeing of communities during the peak and aftermath of extreme weather-related events such as floods.

Objectives: This presentation explores the gendered dimensions of rural Australian community disaster responses and resilience building highlighting women's experiences of and contributions to community health and wellbeing, disaster governance and leadership of self-organising groups in the community setting.

Design: The case study is from the Northern Rivers region of New South Wales, Australia, a rural area on the front line of the climate crisis having been subjected to compounding disasters in the last decade including catastrophic flooding.

Methods: The qualitative study draws upon semi-structured interviews with community members, government, not for profit and businesses; notes from public events (in person and online); research diary and transcripts from a NSW Government flood response inquiry.

Results: The results of this study suggest that following the 2022 floods, women made significant and enduring local contributions to the health, wellbeing and recovery of communities across the Northern Rivers region. Despite challenges in accessing power and decision making, women played an essential role in community problem solving and circumnavigated challenges using collaborative local approaches. However, women often paid the cost of undertaking these roles through negative impacts on their own health and wellbeing.

Conclusion: This study reveals how after disasters, gender influences the visibility of work that contributes to the health and wellbeing of disaster affected communities in recovery. Masculinised labour in disaster response benefits from support and recognition while the prolonged work of women in community disaster recovery persists without these privileges. Rural women's leadership and community-based organisations require further support in the context of increasing climate risk.

# Particulate matter and health in remote Australia

Dr Rishu Thakur[1]
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Poor air quality, particularly Particulate Matter (PM) concentrations have been linked to respiratory diseases, renal problems, mental and behavioural disorders diabetes and poor perinatal outcomes in Australia and internationally. There have been limited number of studies that have examined the relationship between air quality and health outcomes for remote Australians. This is because of the limited ground-based air quality monitoring covering the sparsely populated remote Australian towns and communities. Most ground-based air quality monitoring is concentrated on urban centres. This study focused on this data gap and used low-cost Environmental Monitoring Sensors (EMSs) to collect PM data for Alice Springs. Five low-cost fixed EMSs were installed around the town. PM data from one of these sensors were validated against a DustTrak sensor. PM data of various sizes - PM10, PM2.5 and PM1 analysed. Impact of meteorological factors including temperature, windspeed, relative humidity and atmospheric pressure on PM concentrations was also analysed. PM data analysis showed that the mean daily PM concentrations were relatively low and within the regulatory standards, but peaks were observed in the hourly concentrations at times. The highest values recorded include 76 µg/m3 PM2.5 when exceptional events such as bushfires occurred, which is 3 times higher than regulatory standards. Higher concentrations were observed during winter which suggests that controlled burnings and/or campfires could be sources of the higher PM concentrations. Spikes were also linked to wind speed, with PM concentrations dissipating quickly.
Conclusion
This study presents first-of-its-kind data on PM concentrations for central Australia using low-cost sensor networks. While low-cost sensors are used as an extension of regulatory sensor networks in urban Australia, it could be used to ensure there is at least some base line environment data that can be linked to the health of remote Australians, rather than assuming good air quality in general.

# Air in Alice: A Community Response to understand and reduce Future Environmental Risks

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Poor air quality and extreme weather conditions, such as extreme heat, have been linked to increased mortality and morbidity risks across urban Australia. There have been limited studies that have focused on such health impacts or place-based adaptation practices for people in remote Australia. This study synthesises lived experiences, data collected through low-cost environmental monitoring sensors (EMSs) and participation of citizen scientists in Alice Springs, a remote town in central Australia. Five fixed EMSs were installed around the town. Temperature and particulate matter (PM) data from these sensors were monitored and analysed. PM data was validated against a DustTrak sensor, while temperature data was validated by co-locating the low-cost sensor with the local Bureau of Meteorology station. Local long term and temporary resident participated as citizen scientists by wearing temperature sensors and taking thermal imageries of the town. Lived experiences of residents, including of those living in the town camps of Alice Springs were collected. Mean daily PM concentrations were observed to be mostly within the regulatory standards, but peaks were observed in the hourly concentrations. Higher concentrations were observed during winter which suggests that controlled burnings and/or campfires could be sources of the higher PM concentrations. For temperature observations, BoM temperature observations were significantly different compared to data from the installed town sensors. Citizen science data reported varying temperature exposure observations, which is indicative of the varying levels of individual exposures. Qualitative data collected from residents indicated several climate health impacts as well as enablers and barriers to adaptation.

Conclusion

Remote Australia, being socio-economically and demographically different from urban Australia, there is a need for place-based evidence and community owned solutions to climate adaptation. The Air in Alice project demonstrates the potential use of citizen science approaches and low-cost sensor monitoring to improve environmental health surveillance in remote Australia.

# Science Communication, Citizen Science, And Risk Perception

# Exploring the Influence of Emotional Communication Framing on Public Acceptance of Synthetic Biology Technology

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Can good science communication increase public acceptance of new conservation technologies? And do emotions matter? We explore these questions in the context of novel synthetic biology (synbio) interventions designed to lessen the detrimental impact of Chytridiomycosis on native frog species. Synbio is an emerging multidisciplinary field of science that applies principles of engineering to biology. These technologies can be used to design novel systems or characteristics in organisms. These innovative technologies may offer effective and long-term solutions to persistent scientific challenges, particularly for conservation. However, the implementation of synbio technologies is contingent upon public support, which heavily influences policy and funding. Much like other emerging technologies, public uncertainty and unease concerning the potential risks involved in the implementation of synbio technologies may influence acceptance and support. The question then remains, is there an effective way to increase public support of synbio technologies? While knowledge informs individuals' opinions of synbio technologies, it has been suggested that emotional responses to the technology largely drive public acceptance. Our study, using a large, representative sample (N = 372) of the Australian public, found that both negative and positive emotions significantly predicted support for synbio. However, interestingly and independently of emotions, understanding of and interest in the topic were also important predictors of support. Implications of these findings for best practice science communication and suggestions for future investigations will be discussed.

# Black Summer Arson—Testing the Impact of Climate Misinformation and Corrections on Reasoning

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Climate misinformation has been identified as a barrier to mitigative action. One prominent example was the claim that the 2019/2020 Black Summer bushfires were caused primarily by arson—a claim that is cognitively attractive because of its simplicity and was widely publicised at the time, but also thoroughly debunked. In two experiments (N > 1000), we investigated the impact of the arson misinformation on participants' reasoning and associated donation behaviour. Australian (Exp. 1) and Canadian (Exp. 2) participants read a narrative portraying arson as an important cause of the Black Summer fires. This was followed by either no correction, a correction statement refuting arson as the cause, or a statement that bolstered the correction by portraying climate change as an important causal factor through its impact on risks and that emphasized multicausality of natural disasters. A control condition made no mention of arson. We measured participants' reasoning about the Black Summer and future fires, and requested a donation to a climate organisation, which was hypothetical for most but implemented for a random subset of participants. Secondary measures were perceived psychological distance from climate change, climate-change concern, support for climate action, and environmental-action intent, as well as a measure of reasoning about a novel natural disaster, to test for generalisation. The misinformation significantly influenced participants' reasoning about the Black Summer and future fires; it also reduced donations in Australian participants, and influenced reasoning about a novel disaster in Canadian participants. Corrections were able to largely mitigate this impact, with the bolstered correction particularly effective and potentially also increasing climate-change concern relative to a plain correction. Secondary measures were otherwise largely unaffected by the misinformation and interventions. Results demonstrate that despite the debunking efforts of journalists and the scientific community, climate disinformation can potently affect reasoning, with corrections likely only temporarily effective.

# Citizen scientists' motivations, experiences and outcomes: insights from Renter Researchers, a citizen science and advocacy project

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Background: Citizen science, broadly defined as the active involvement of the public in research, is increasingly being used as a tool to enable citizens and civil society organisations to collect evidence on, and voice, important issues. In Australia, citizen science approaches have recently been utilised as a way for NGOs to advocate for improvements to housing infrastructure so that it is safer and more affordable. One such example is a citizen science and advocacy project entitled 'Renter Researchers', which engaged people living in rental properties across Australia to measure their indoor temperature and humidity over consecutive summers and winters from 2021 to 2024. The data were then used to advocate for minimum energy efficiency standards in rental properties.

Objective: Understanding why citizen scientists got involved and want to continue their involvement in Renter Researchers, their experiences during the project, and the outcomes of their participation is important for informing how analogous activities are designed and implemented in future. Accordingly, our study examines the motivations, experiences and outcomes for citizen scientists as a result of their participation in Renter Researchers.

Methods: Employing a mixed methods approach that makes use of both primary and secondary data, we administered an online survey to citizen scientists  (n=38), obtained the final cohort's project evaluation responses (n=26), and conducted follow-up semi-structured interviews with citizen scientists who completed the latter (n=12).

Findings:  Preliminary results indicate that citizen scientists' reasons for partaking in Renter Researchers were principally aligned with intrinsic motivations, for example, the project being congruent with their values. Experiences of Renter Researchers were positive overall, with the level of support provided by staff an important factor in fostering citizen scientists' engagement. Outcomes from participating in the project ranged from developing skills, knowledge and awareness to improvements to housing conditions and continued involvement in advocacy efforts.

# Flat-Pack Instructions for Ethical Science Communication

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In a world overwhelmed with information, how can researchers cut through all the noise? Too often, good research exists in the 'ivory-tower' vacuum. In our post-truth, post-expert, and information saturated world, presenting scientific information is far more nuanced than a didactic transfer of knowledge. Pressing global issues, like climate change, political unrest and pandemics - along with rapid technological advancements such as social media - have not only modernised communication, but have also democratised access to information and misinformation alike. These socio-political shifts necessitate a redefining of the roles and responsibilities of the researcher today. Science communication now prioritises fostering accessible dialogue to enhance knowledge exchange, critical engagement, and trust; over simply addressing knowledge deficits. With this, researchers face the dual challenge of effectively communicating their findings, while encouraging public engagement. This presentation introduces a comprehensive handbook for the evolving scientist, and emphasises their ethical responsibility within society to bridge the gap between academia and the diverse public. We outline fundamental concepts in science communication, including the anatomy of good research translation, and borrow transdisciplinary knowledge, such as design principles, to enhance message accessibility. It encourages researchers to adopt a flexible, iterative approach that acknowledges audiences' diverse science identities, and offers actionable strategies to create clear, accurate, and compelling messages. By equipping researchers with essential skills for translating complex information, this resource advocates for a transformative shift in how science is communicated, emphasising that effective translation is not merely an extension of research, but a vital component of responsible scholarship that can enhance public trust, understanding and participation in broader societal issues.

# Strengthening Research Translation within the HEAL Network: Preliminary Findings and Insights

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Research translation is a continuous and collaborative process that bridges the gap between research and policy by fostering strong relationships between researchers and policy stakeholders. This process involves the co-design of research projects and policy-relevant questions, ensuring that key stakeholders are engaged throughout. By iteratively refining research questions, methods, and outcomes, the relevance to practical policies and interventions is enhanced.

The HEAL Network has developed a comprehensive Research Translation, Implementation, and Impact Strategy, which emphasizes key elements such as communication, trust, partnerships, and co-design with communities, policy actors, and decision-makers. To support the execution of this strategy, the Centre for Health in All Policies Research Translation, with oversight from the HEAL Research Policy Implementation and Translation Standing Committee, has launched several projects to explore collaboration within the network. These projects include:

1.      The HEAL Network Survey: Engaging researchers, policy actors, community members, and practitioners.
2.      HEAL Network Analysis: Focused on research translation and multidisciplinary collaboration.
3.      HEAL Network Case Studies: Documenting examples of successful research translation.

So far, 70 survey responses have been collected, and 10 case studies have been received, while descriptive data for the network analysis being conducted. This presentation will share preliminary findings from these initiatives, offering a snapshot of research translation efforts within the HEAL Network and providing valuable insights into ongoing collaborations and impact.

# Empowering Vulnerable Communities through Citizen Science in Air Quality

Dr Shilpi Tewari[1]
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Citizen science has become an influential tool in environmental research, particularly in monitoring air quality, as it encourages community-driven initiatives to gather and address localised environmental data. Vulnerable communities, often disproportionately exposed to higher levels of air pollution due to socio-economic and geographic disadvantages, play a pivotal role in these projects. This review examines the distinct contributions of these populations to citizen science air quality monitoring, focusing on how their involvement promotes environmental justice, strengthens local advocacy, and generates data that is often overlooked in traditional government or institutional monitoring systems.

By actively participating in data collection and analysis, vulnerable communities help to highlight air pollution issues in their neighbourhoods, advocating for cleaner environments and improved public health outcomes. These efforts often result in the identification of pollution hotspots and provide evidence that can drive policy reform and better regulatory measures. The engagement of marginalised groups not only raises awareness of air quality issues within their communities but also fosters resilience by equipping them with the tools and knowledge necessary to advocate for sustainable changes.

However, these communities often face unique challenges in participating in citizen science projects, including limited access to resources, technological barriers, and a lack of institutional support. This review will address these obstacles and propose strategies to enhance their involvement. Through an analysis of case studies and research findings, this paper will demonstrate that the inclusion of vulnerable communities in air quality citizen science is critical for advancing environmental equity, amplifying local voices in environmental governance, and driving actionable, data-based solutions to air pollution.

# Assessing the Efficacy of Low-Cost Mosquito Traps: A Citizen Science Approach to Vector Surveillance in South Australia.

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This is a citizen science-based study that evaluated the efficacy of four mosquito traps including Clay Pot, Sticky Box, Resting Bucket, and BG GAT for spatial distribution, species composition, and abundance of mosquitoes, including vectors from Aedes and Culex. Traps were deployed for four weeks across four distinct locations in Adelaide (Pooraka, Globe Derby Park, St. Kilda, and Parkside) and inspected once a week during the sampling period. The results showed differences in trap efficiency, species selectivity, and environmental suitability. BG GAT emerged as the most effective trap, capturing 46 specimens, predominantly Aedes notoscriptus females (45), indicating species-specific efficacy. Resting Bucket captured 34 mosquitoes, displaying a higher species diversity, including significant captures of Culex molestus (12 females) and Culex quinquefasciatus (4 females, 7 males). Clay Pot recorded 22 mosquitoes, primarily dominated by Aedes vigilax (13 females, 3 males). Sticky Box exhibited the lowest efficacy, with 5 mosquitoes, though still capturing several Aedes vigilax and Culex quinquefasciatus. Species diversity varied across locations, with Pooraka, a suburban area, and Globe Derby Park, a salt marshes area, showing higher species richness. The data demonstrated a strong species-specific response in the Parkside location, an urban area where the BG GAT trap selectively attracted Aedes notoscriptus females. Resting Bucket exhibited a broader capture spectrum, suggesting it may be an effective tool for general mosquito surveillance and showed versatility in capturing multiple species of male and female mosquitoes. The deployment of simple, low-cost traps enhances community engagement in monitoring vector populations, allowing for the integration of real-time data into epidemiological models, thereby improving the detection and control of vector-borne diseases. This approach strengthens public health initiatives and offers scalable solutions to the rising threat of mosquito-borne diseases.

# Urban Health, Built Environment And Nature Based Solutions

# The health and wellbeing co-benefits of policies and programs to address climate change in urban areas: a scoping review

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Existing research suggests that a health-centred response to the climate crisis would support immediate and more ambitious action that minimises adverse health outcomes of climate change whilst providing additional co-benefits for population health. This review aimed to identify and assess literature that examines the health and wellbeing co-benefits of climate action in urban areas and to identify potential co-benefits that could be incorporated into policy or programme evaluation. We searched Scopus, PubMed and Web of Science, and screened titles, abstracts, and full-text. Peer-reviewed studies in English were included if they focused on health and wellbeing co-benefits of climate change adaptation and/or mitigation policies and programmes specific to urban areas. Our analysis found that all 39 studies in this review identified positive health and wellbeing co-benefits, with the majority focusing on transport policies and cross-sectoral mitigation and adaptation. All included studies employed a diverse array of modelling methodology, with multiple models and interdisciplinary approaches to evaluate co-benefits. Co-benefits ranged from reduced or avoided mortality and morbidity to social and economic health benefits. The degree of co-benefits differed according to the policies themselves; the policy sector; and vulnerability, demographic and/or geographic factors. Nine studies identified negative trade-offs of climate action. The review's findings add to existing literature in support of the value and importance of assessing the health and wellbeing co-benefits of climate action. The review also highlights the need for further identification and quantification of a comprehensive set of health and wellbeing co-benefits, improved data reporting and granularity, as well as research evaluating the impact of climate action that considers how vulnerability, demographic, geographic or other factors interact with policy implementation. This research is critical in informing the cost-effective prioritisation and coordination of climate policies that maximise human health benefits and promote health equity by minimising trade-offs for vulnerable groups.

# Residential dampness/mould exposure and mental health: state of the science

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Background: While it is well-established that exposure to dampness or mold in homes negatively affects physical health, the association with mental health remains less well evidenced. As plausible psychosocial and biological pathways exist between dampness and mold exposure and poor mental health, a review of evidence is required. This state-of-the-science review sought to assess what is known about the mental health effects of dampness and mould exposure.

Methods: A comprehensive search of electronic databases (MEDLINE, Embase, PsycInfo, Global Health, Web of Science, and Scopus) was conducted to identify relevant studies published from 2003 to 2023. Eligible studies included observational study designs such as cohort and cross-sectional studies. Target studies for review assessed the effect of dampness and/or mold exposure in the home on mental health outcomes.

Results: Of the 1,169 records retrieved, 19 papers addressed the damp/mould-mental health association in a residential setting. The available evidence described positive associations between residential dampness/mold exposure and poor mental health. In adults, associations were observed for outcomes such as depression, stress, and anxiety, while for children, associations were observed for emotional symptoms and emotional dysregulation.

Conclusions: This review provides a comprehensive overview of the existing literature on the impact of residential dampness and mould exposure on mental health. The identified gaps and variations in methodologies underscore the necessity for further research to better understand the extent and reasons for this association and provide impetus for interventions to mitigate the mental health impacts of poor quality housing.

# Outdoor airborne allergens: Characterization, behavior and monitoring in Canberra, Australia

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Allergic rhinitis affects half a billion people globally, including a fifth of the Australian population. In Canberra, the nations capital, more than 1 in 3 people suffer from the disease and this can cause significant negative impacts on community wellbeing as well as the local economy. In this presentation we provide the latest information on the seasonal nature of the most significant airborne tree pollen, herb pollen and spore types for the Canberra region. We also consider why Canberra is a hotspot for hay fever in Australia and discuss how pollen and spore exposure is likely to be altered by future climate change.

# Supporting lymphatic filariasis elimination by monitoring mosquitoes in the household environment.

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Background: Lymphatic filariasis (LF) is a globally prevalent vector-borne disease. In Samoa, the primary vector is Aedes polynesiensis, which breed in small containers of water, for example around the home or workplace. Transmission is therefore influenced, among other factors, by the natural and built environments where people live and work. The objective of this study is to assess if molecular xenomonitoring of mosquitoes around the household provides a more sensitive indicator than human surveys for evaluating the impact of the mass drug administration (MDA) interventions being implemented as part of national elimination efforts.

Methods: We conducted mosquito surveys in 15 households in eight primary sampling units in Samoa in 2018 (pre-MDA), 2019 (10 months-post MDA) and 2023 (5 years post-MDA). Mosquito surveys used BioGents Sentinel Mosquito traps with attractant lures, left onsite for 48 hours. Mosquitoes were classified by species and pooled for PCR analysis. Human surveys were conducted in the same villages, either at the same time or within three months of the mosquito surveys, and used finger prick blood samples to test for antigen (Ag) and microfilaria (Mf).

Results: PCR-positive pools were observed for each mosquito genus, with Aedes having the highest prevalence of PCR-positive mosquitoes. Adjusted prevalence in Aedes mosquitoes was 2.0% (95% CI 1.1-3.1%) prior to MDA in 2018, decreasing in 2019 (10 months post-MDA) to 1.4% (95% CI 1.0-1.8%). In 2023, five years post-MDA, prevalence had increased to 2.3% (95% CI 1.9-2.8%). No significant change in Ag or Mf was observed between the three years.

Conclusion: Mosquito surveys at the household level can provide a sensitive indicator of changes in LF infection prevalence. Understanding how the prevalence of infection in mosquitos around the home environment relates to Ag and Mf prevalence in humans, can help to improve LF surveillance and better inform elimination efforts.

# Do Modelled and Perceived Residential Noise Exposures Influence the Use of Psychotropic Medication?

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Background

Road-traffic noise is a known risk factor for annoyance and sleep disturbance and cardiovascular disease. There is insufficient evidence linking road-traffic noise and mental health outcomes. We hypothesize that severe or chronic noise-associated mental health disorders may be related with medication use.

Methodology

We conducted a survey to assess perceived noise exposures and mental health statuses of adults in the Helsinki region of Finland. Respondents were randomly sampled from the Finnish Population Register. Modelled outdoor noise levels were geo-referenced to the residential addresses of respondents. The use of sleep medication, anxiolytics, and antidepressants were assessed as proxies of mental health outcomes. The relationships between perceived or modelled façade-noise levels and mental health were modelled using the binary logistic regression with smooth function. The models were adjusted for socioeconomic, lifestyle, and exposure-related factors.

Results

The respondents' perception of increasing levels of road-traffic noise showed a linear trend with higher categories of modelled noise. The proportion of respondents who took either sleep medication, anxiolytics, or antidepressants was approximately 15%, 7%, and 7%, respectively. Those who took more than one of these medications in combination were <2.5%. Perceived noise exposure was associated with anxiolytic drug use, OR=1.49 (95% CI: 1.10 - 2.02), but not with sleep medication or antidepressant use. There was a suggestive association between modelled noise and anxiolytic or antidepressant use. Modelled noise was more clearly associated with antidepressant use in respondents without a quiet façade. Noise sensitivity did not seem to modify the relationships between noise exposure and the outcomes, but was independently associated with increased use of the medications assessed in the study.

Conclusion

In a cold climate with good indoor sound insulation, we observed some associations between noise and psychotropic medication use. Noise sensitivity was independently associated with psychotropic medication use.

# The moderating effects of neighbourhood disadvantage on the longitudinal association between residential density, walking for transport, and body mass index

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Background
Longitudinal evidence regarding the associations between residential density, walking for transport (WfT), and body mass index (BMI) is limited, and how these relationships vary across different neighborhood socio-economic contexts is not yet known. Therefore, we examined the moderating effects of neighborhood disadvantage on the longitudinal mediating associations between residential density, WfT, and BMI.

Methods
Data from the HABITAT multilevel longitudinal (2007-16) study of 11,035 middle-aged adult residents of 200 neighbourhoods in Brisbane, Australia, were used.  Residential density was objectively assessed within a 1 km network buffer around residents' homes, and BMI was calculated from self-reported height and weight. Participants self-reported their previous week's minutes of WfT. Generalised structural equation modelling was used to estimate the mediating effect of WfT in explaining residential density-BMI associations across the quintiles of neighbourhood disadvantage, adjusting for time-varying and time-invariant confounders, including distance to Brisbane Central Business District (CBD) and residential self-selection.

Results
Residents living in high-density neighbourhoods were found to engage in more WfT and maintain lower BMI. WfT explained approximately 14.31% of the density-BMI relationships when accounting for distance to CBD. These longitudinal relationships remained consistent in moderately disadvantaged neighborhoods but differed in areas with other levels of disadvantage.

Conclusion
Residentially dense neighbourhoods facilitate transport-related walking, potentially reducing the risk of weight-related chronic conditions. However, these impacts vary across different neighbourhood socioeconomic contexts. Urban planning and policy efforts should focus on context-specific measures to leverage the anticipated benefits of residential density.

# The nature connection project: Understanding nature connection in Australia through storytelling and a national survey

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The Australia State of the Environment report concludes that 'Overall, the state and trend of the environment of Australia are poor and deteriorating as a result of increasing pressures.' Enhancing people's connection to nature is one way to help reverse this trend, with nature connection shown to bolster support for environmental initiatives. This not only has beneficial outcomes for the planet, but also can help to improve the wellbeing of individuals.

This presentation will introduce research being undertaken by the Nature Connection Project, funded through the National Environmental Science Program. Firstly, we will present some findings from a national survey with over 4,000 individuals in Australia which identified the groups who are more connected with nature, the barriers to engaging with nature, and the associations between nature connection, wellbeing, and pro-environmental behaviours. We will then discuss the storytelling project which collects and shares stories from Australians about their unique and diverse connections with nature. These written stories, poems, videos and artworks give us insights into the scope and impacts of our relationships with nature.

With the number 1 goal for Australia's Strategy for Nature 2019-2030 being 'Connect all Australians with nature', it is crucial that policy provides all Australians with the opportunity to connect with nature. Our research has identified several ways that this can be achieved, such as increasing green spaces in urban areas, enhancing opportunities for meaningful interactions with nature, and mitigating structural inequalities to engaging with nature. By taking steps to enhance nature connection, we have the potential to generate positive change for people and planet.