

What are the most effective ways to communicate climate change and health – a scoping study

Joanne Walker, Milly Burgess, Fiona Armstrong

Abstract

Introduction: There is increasing scientific evidence demonstrating that climate change is negatively impacting on human health and that these impacts are occurring now. If urgent mitigation and adaptation action is not taken to reduce greenhouse gas emissions and transition to a more ecologically sustainable way of living, negative health impacts are predicted to increase in the future. Although there is some understanding of the impacts of climate change on the environment among health professionals and the public, how climate change harms human health is less well known or understood, making communicating about climate change and health impacts a challenge. We conducted a scoping study to identify and investigate effective ways to communicate about climate change and health to inform the work of the Climate and Health Alliance.

Methods: The study was informed by the scoping study framework developed by Arskey and O'Malley (2005). The search strategy involved searching peer-reviewed grey literature from the ProQuest database, hand search and key stakeholders published between 2010 and 2020.

Results: A total of 31 articles were included. These articles included surveys (n=8), education resources or guidelines (n=7), commentaries (n=5), literature reviews (n= 4), experimental study designs (n=3) , qualitative studies (n=3) and case studies (n=1). The majority of the articles were from the United States of America (n=22). All other articles were from Australia (n=2), Canada (n=2), France (n=1), Malta (n=1), Spain (n=1), Sweden (n=1), and the United Kingdom (n= 1).

Conclusion: Based on the findings of this scoping study, the most effective ways to communicate about climate and health start with a message using climate change and health risk framing that is delivered by a trusted voice. Health professionals and health organisations are amongst the most trusted in most societies and are well positioned to be the trusted voice to deliver climate change health risk messages. Climate change and health risk messages need to adopt a risk communication style that focuses on short term actions to raise awareness and outline clear steps for action, akin to messages used during short term extreme weather events. However, for health professionals to be effective communicators they need to build their capacity to undertake communication strategising and planning, and embrace a pluralistic approach to designing and delivering a message via multiple platforms. Community engagement and participation is an integral component of this. For messages to be effective they need to be tailored to the local context and consider a number of vulnerability factors. They should also emphasise the co-benefit win- win scenarios to build individual and collective efficacy.

Introduction

There is increasing scientific evidence demonstrating the impacts from climate change on human health are occurring now. If urgent mitigation and adaptation action is not taken to reduce greenhouse gas emissions (GHGs) and to transition to a more ecologically sustainable way of living, the health impacts are predicted to increase in the future.

Climate change is defined as any change in the climate, lasting for several decades or longer, including changes in temperature, rainfall, or wind patterns (Climate Council n.d.) and is caused by natural climate system changes and human activity. Over the last 50 years, human activity from the burning fossil fuels, increased agriculture, and deforestation, and increasing waste (landfill) has released excessive amounts of GHGs, such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), into the Earth's atmosphere (Climate Council n.d.). These GHGs are trapping the sun's heat in the atmosphere and this causes the Earth's average temperature to rise (Climate Council n.d.). This increase in global warming is causing sea levels to rise, glaciers to melt and rain patterns to change with more frequent intense weather events and drought. The impact of climate change is not only influencing weather patterns, but it is also affecting human health and wellbeing. The Intergovernmental Panel on Climate Change (The IPCC) states ambitious goals are needed to limit global warming to 1.5°C and that taking this action will avert risks to human health, livelihoods, food and water supplies, security, and economic growth that are likely to occur with 2°C of warming (IPCC 2018). Some of the health effects reported are from: extreme heat; air pollution and aeroallergens (pollens); changing patterns of vector borne diseases; food and water insecurity; increases in the risk of diarrhoeal disease; and, impacts on mental health (WHO n.d.).

As climate change has so many health impacts, the World Health Organization has sent out a global call to action to all health professionals stating that:

Health professionals have a duty of care to current and future generations. You are on the front line in protecting people from climate impacts - from more heat-waves and other extreme weather events; from outbreaks of infectious diseases such as malaria, dengue and cholera; from the effects of malnutrition; as well as treating people that are affected by cancer, respiratory, cardiovascular and other non-communicable diseases caused by environmental pollution (WHO 2015)

Since the call to action was made by the WHO, there is a slow but growing awareness of climate change and its health impacts amongst health professionals, some of whom are taking up the call to action to advocate, educate, research and communicate the climate and health issues. Some Australian health professional peak body organisations such as the

Australian Medical Association, the Royal Australian College of General Practitioners, Australasian College for Emergency Medicine and the Australian Nursing and Midwifery Federation, have also declared a “Climate Emergency”. However, despite this, climate change is still not part of the mainstream health policy, research, and practice.

The Climate and Health Alliance (CAHA) was formed with the purpose of catalysing action on climate change within the health sector, nationally and internationally, and to make climate change core business. To build capacity in the health care sector, CAHA provides a broad range of services. These services include: education programs for health professionals and communities; assisting the health care sector to become more sustainable through the Global Green and Healthy Hospitals network; participating in research; and undertaking advocacy campaigns, such as the ‘*Our climate Our health*’ campaign and the development of the *National Strategy on Climate, Health and Well-being for Australia*. The results of a survey undertaken by CAHA showed that there is a high level of climate literacy among some health professionals in Australia (Patrick et al 2017). However, results also showed survey respondents had serious concerns about the inability of the health workforce and health sector to respond effectively to the worsening health impacts of climate change (Patrick et al 2017). This indicates a need for more capacity building programs, research capacity, and infrastructure to support health professionals to take effective climate change mitigation and actions.

CAHA has recently secured funding to undertake a project called RUN (Real- Urgent-Now). This project aims to increase the number of climate and health leaders in the field and equip them with the knowledge, communication skills and confidence to talk about climate change and health to a range of audiences, including the media. This scoping study is being conducted for two purposes. First, to identify effective ways to communicate about climate change and health. This knowledge will be used by CAHA to benchmark their own communication practices and to investigate if there are new climate change and health communication strategies for CAHA to incorporate into their communication processes; and second, that the findings will also inform the development of the education and communication products as part of the RUN project.

Method

This scoping study is based on the 6 stage methodology described by Arskey and O’Malley (Arskey & O’Malley 2005) (see the stages listed in Box 1). Scoping studies are useful in mapping the extent, range and nature of knowledge published on a topic and in identifying

*Box SEQ Box * ARABIC 1 Scoping Study Review Framework, as per Arskey & O’Malley (2005)*

- | |
|---|
| <p>Stage 1: identifying the research question</p> <p>Stage 2: identifying relevant studies</p> <p>Stage 3: study selection</p> <p>Stage 4: charting the data</p> <p>Stage 5: collating, summarising, and reporting the results</p> <p>Stage 6: consulting</p> |
|---|

gaps in the literature. A scoping study usually has a broad research question that enables the researcher to include many different study designs and sources of data. Due to the diverse range of included papers, the quality is not usually part of the scoping study protocol. Arskey and O'Malley propose that stage 6 is an optional step. However, the researchers believe that consulting with stakeholders about the findings of this scoping study may lead to additional sources of information, perspectives, and interpretations (Levac et al 2010) that will be valuable to inform the future work of CAHA and the RUN project. This report is focusing on the first 5 stages of the scoping study protocol.

The scoping study is guided by the overarching research question '*What does the literature tell us about the most effective ways to communicate about climate change and health?*' In addition to the overarching research question, the following research questions are also used to guide the scoping study search strategy:

1. What are the current ways that climate change and health is being communicated in the peer-reviewed literature?
2. What are the messages, or narratives, or modes, or messengers that are most effective? i.e. in ways that move people to acceptance of the science, and towards taking or supporting action on climate change; and
3. What are the research gaps in communicating climate change and health?

A strength of scoping studies is the breadth of information they include on a topic. However, as there is a small research team undertaking the review process, for practical reasons the search strategy is limited to searching one database (ProQuest) with a narrow search term and searching for papers in English only, hand searching from reference lists and seeking input from existing key stakeholders. There are no limitations on the type of communication, medium, country or study design. Initially the WHO call to action in 2015 was used as the reference point to commence the scoping study. However, the initial search yielded few papers from the electronic database and an agreement was made with the research team to extend the timeframe to include papers from 2010-2020. The search strategy is summarised

Box SEQ Box 1 ARABIC 2 Summary of Scoping Study Search Strategy*

Papers written in English only
Published between 2010-2020
Peer reviewed literature listed in the electronic database
ProQuest using the search term Communicat* AND Climate
AND health OR Climate change AND health OR health AND
climate change
Hand search using recent literature to source key works.
Existing networks and relevant organisations – four climate
change communication experts were contacted to see if they
could recommend any key works, (from Australia (n=2), USA
(n=1) and UK (n=1).

in Box 2.

The electronic database search strategy found 134 articles, which were screened out on title and abstract, duplicates and those not written in English. This reduced the list to 56 articles. These articles were further screened and included if they answered two or more of the following screening questions:

- (i) Does the article address climate change and health, not solely one or the other?
- (ii) Does the article specifically describe ways to communicate (about climate change and health)?
- (iii) Does the article include an evaluation of communication processes/ practices, tools, or frameworks?

Articles were excluded if they were repeats (n=12), if they did not describe a communication practice (n =7), reported solely on climate change (n= 13) or solely on health (n= 3), leaving 18 articles to be included. Additional articles were located through hand search (n=2) and from consulting key stakeholders (n=11). The total number of articles included in the scoping study reached thirty one. As per the Arskey and O'Malley framework, articles were charted to determine the nature and distribution of the studies by country; type of article/ design of study, the main messages / narratives, and key points (Table 1). Following this, and informed by the research questions, the articles were thematically analysed by using content analysis and thematic analysis to identify prominent or recurring themes in the literature.

Following the content and thematic analysis 6 themes were identified as follows:

1. Climate health risk framing
2. Building capacity of trusted voices to deliver climate and health messages
3. Communication strategising and planning
4. Vulnerability Factors
5. Co-benefits

Results

The scoping study searched the literature for articles that can provide guidance as to how to effectively communicate about climate change and health. Thirty one articles were included. The majority of the articles were from the United States of America (USA) (n=22). All other articles were from Australia (n=2), Canada (n=2), France (n=1), Malta (n=1), Spain (n=1), Sweden (n=1), and the United Kingdom (UK) (n= 1). Articles fell into one of the following categories: surveys (n=8), education tools or guidelines (n=7), commentaries (n=5), literature reviews (n= 4), experimental study designs (n=3), qualitative studies (n=3) and case studies (n=1). Article summaries are presented in Table 1.

Table 1 Article included in the scoping study

| Author / citation | Design | Country | What are the messages /Narratives | Key Points |
|--|----------------------------------|---------|--|--|
| Education resources and guidelines | | | | |
| Maibach, E Nisbet, M Weathers, M (2011) Conveying the Human Implications of Climate Change: A Climate Change Communication Primer for Public Health Professionals. Fairfax, VA: George Mason University Center for Climate Change Communication. | Education guidebook | USA | <p>This education resource sets out the background why public health professionals should communicate about climate change and outlines the threats to health and wellbeing. Because of the health risks public health professionals have an obligation to prevent climate change from harming human health. The primer outlines who public health professionals should be communicating with and gives tips on how to get the message out. Offers a wide range of strategies for public health communicators to use to disseminate messages. These include:</p> <ul style="list-style-type: none"> - Community engagement: community forums that can also be useful ways to get local media coverage and raise awareness with target audiences. Public consultation initiatives should also be conceived of as informal mechanisms for “democratizing” decisions related to climate change and the management of related risk. - Building capacity in the health workforce to identify, recruit, and train become climate change leaders. <p>Use the acronym SUCCES -Simple, Unexpected, Concrete examples, Credibility, Motion, and Story. (Chip & Dan Heath, C., & Heath, D. (2007). <i>Made to stick: Why some ideas survive and others die</i>. New York: Random House) to guide good communication process</p> | <p>Key points from this guidebook are: To not frame messages as an environmental problem, emphasise the immediate win-win. This includes complementary policies and programs that are not specifically focused on climate change “Smart cities”. Use multiple platforms and processes. Identify, train and nurture future opinion / speakers and engage the community in deliberative exercises.</p> |
| Chadwick, A (2016) Climate Change, Health, and Communication: A Primer. Health Communication. Vol. 31, NO. 6, 782–785 http://dx.doi.org/10.1080/10410236.2014.1002030 | Education awareness guide | USA | <p>This primer explains what climate change is and its impacts on health. It also provides some explanation of the vocabulary associated in the climate change literature such as mitigation and adaptation. Discusses anthropogenic causes of climate change and references IPCC reports. Provides recommendations on the role health communicators have in sharing climate and health messages that starts with understanding communication processes, tools, and strategies. Health communicators also have a role in planning mitigation and adaptation activities and research knowledge translation. Key points are referenced particularly on the role health professionals can play. However, it does not have too much detail on solutions for mitigation or adaptation.</p> | <p>The value of this primer is the introduction to climate change vocabulary. The primer also describes ways to decrease health impacts and identifies roles for health professionals to communicate climate change and its health effects. The communication process goes beyond thinking about the media and involves active participation strategies with the community / key stakeholders.</p> |
| ecoAmerica: (2016). Let’s Talk Health and Climate: Communication Guidance for Health Professionals, Climate for Health, Washington, D.C. | Web based Communication tool kit | USA | <p>15 steps: how to create your own message. The guide provides logical steps to creating your own climate and health communication strategies. The guide also does not go into depth about climate health risks but gives an overview of some health impacts and exposure pathways. This guide focuses on health framing e.g. around air pollution risk, emphasises the need to use a trusted messenger, and the needs for solutions that will bring personal benefit and to ditch doom and gloom. Gives tips on how to phrase messages “clean transport” and what words to avoid.</p> | <p>A good resource to use as a guide for a health professional that is already well informed about climate and health but is looking for some guidance on crafting their message.</p> |
| Weathers, M Maibach, E and Nisbet, M (2017) Communicating the Public Health Risks of Climate Change. Oxford Research Encyclopedia of Climate Science DOI: 10.1093/acrefore/9780190228620.013.428 | online education resource | USA | <p>This paper is targeting a general health professional audience and provides a narrative that includes an overview of direct/ indirect threats to human health, that public health has a successful track record of engaging the public on issues such as HIV/ AIDS, cardiovascular disease and smoking. There are many lessons that have been learnt along the way and these can be very useful in communicating climate change and health impacts. The paper outlines why peoples’ health is already being harmed by climate change; that climate change efforts have been focused on environmental dimensions of the threat. Introducing the public health voice into the public dialogue can help communities see the issue in a new light. However, public awareness of health consequences is low</p> | <p>Public Awareness of Health consequences remains low. But, introducing the public health voice, with local relevance, into the public dialogue can help communities see the issue in a new light. In framing the message using health risk communication methods, authors reiterate the</p> |

| | | | | |
|---|--------------------------------|-----|---|---|
| | | | <p>and there's a need to raise awareness and promote that and many actions that slow or prevent climate change also protect health from harm. By framing climate change as a local public health issue, it is possible to replace people's mental associations of climate change as being geographically and socially distant with more proximate and relevant mental associations such as the risks to children, the elderly, and the poor in their own communities.</p> <p>3 Simple messages:</p> <ol style="list-style-type: none"> 1. There is scientific consensus about human-caused climate change 2. Climate change is harming people's health everywhere 3. Actions will limit climate change and make communities healthier <p>Getting the message out strategies:</p> <ul style="list-style-type: none"> - Simple clear messages - Repetition - Trusted messengers | <p>following key points to use when communicating with the public about climate change and health:</p> <p>It's real—i.e., climate change is real.</p> <p>It's us—i.e., climate change is human-caused</p> <p>Experts agree—i.e., there is consensus among climate scientists that human-caused climate change is happening.</p> <p>It's bad—i.e., climate change is harmful to people.</p> <p>There's hope—i.e., human actions can limit climate change (Sarfaty & Maibach, 2015):</p> |
| Rudolph, L., Harrison, C., Buckley, L. & North, S. (2018). Climate and Health Communications, In Climate Change, Health, and Equity: A Guide for Local Health Departments. Oakland, CA and Washington D.C., Public Health Institute and American Public Health Association. | Guide | USA | <p>This guideline provides background comprehensive explanations about climate change, its causes and health impacts. Although other papers refer to vulnerable groups in their discussions, this guideline is explicit about equity. The guide also has sections dedicated to health benefits (in agriculture, urban infrastructure, transport, and energy) and a section outlining the types of projects health organisations can undertake to address climate change and health equity. The guide provides a detailed step by step in how to develop and deliver climate change and health messages. Provides lists of evidence based resources to draw on. Refers to IPCC, Lancet and SDG goal 7. Reinforces the message:</p> <p>"It's real. It's us. It's bad. Scientists agree. There's hope"</p> <p>Anthony Leiserowitz, Yale Project on Climate Change Communication.</p> | <p>This guideline's key point of difference is its emphasis on inequity i.e. climate change and health inequities share the same root causes. The guide uses this approach: Environmental Trigger + Solution + Values + Scientists Agree = Message</p> <p>Health professionals have an important role and are well placed to communicate about climate change and health. And there is a need to promote "we're in this together", that change is possible, there is a pathway with others.</p> |
| Corner, A., Demski, C., Steentjes, K. and Pidgeon, N. (2020) Engaging the public on climate risks and adaptation: A briefing for UK communicators. Oxford: Climate Outreach | Guideline / education resource | UK | <p>This briefing paper is a guideline based on survey results from the RESiL RISK survey data in the UK. Survey findings show there's been a shift in attitudes and awareness about climate change risks and it is getting 'closer to home' in the UK. The results also show the importance of framing messages about climate impacts in relation to health risks and human well-being. Seven recommendations are outlined for communicators and practitioners working to engage the public on climate risks and adaptation. The guide suggests connecting climate impacts to widely shared values, framing messages around familiar risks, and using shared experiences of extreme heat and flooding as 'common ground' for climate conversations, with evidence-based facts, as ways of furthering public engagement with climate risks and resilience. Using frames of health risks and wellbeing with mitigation and adaptation are useful in making the connection that to address one is to address the other two sides of the same coin. Engaging community participation in exploring mitigation and adaptation strategies is an important part of communicating about climate change. Climate conversations need to go beyond discussions of emissions targets – and a 'just transition' applies to include a 'just adaptation' as well.</p> | <p>Key points from this paper are that evidence based health and wellbeing frames that reflects people's experience and familiar risks are useful in helping people make the connections between ways to mitigate and adapt to climate change risks. Equity is raised as an issue and the need for climate conversations to include 'just transitions' and 'just adaptation' to build efficacy by making the link to constructive solutions. People's values, their sense of identity, and their political/ cultural worldviews are fundamental influences on how people engage with climate change</p> |
| Maibach, E Sarfaty, M Gould, R Damle, N and Armstrong, F (2020) A call to action by health professionals in W. K. Al-Delaimy, V. Ramanathan, M. Sánchez Sorondo (eds.), Health of People, | Book chapter | USA | <p>Book chapter targeting general health professionals' audience. Authors argue that the world's health professionals—doctors, nurses, midwives, and other allied health professionals are uniquely suited to lead the effort to persuade the world's leaders to increase their commitments to the goal of the Paris Agreement. Authors press that there is an urgent need to work together to bring the collective power health professionals have</p> | <p>The strength in this book chapter is the clarion call to all health professionals around the world that climate change is a health issue and if health professionals do not raise awareness or take action to protect health who will?</p> |

| | | | | |
|--|-----------------------------------|------------------|--|---|
| <p>Health of Planet and Our Responsibility, https://doi.org/10.1007/978-3-030-31125-4_33 pp397-</p> | | | <p>around the world and make it clear what is at stake and what must be done about it. Authors ask the questions, “If not us (health professionals), who? If not now, when? We are among the most trusted members of every society worldwide”. Authors propose an immediate call to action for all health professionals globally to join forces with each other and existing climate health alliances and initiatives; to recruit more voices and strategically organise to deliver 5 key messages:</p> <ol style="list-style-type: none"> 1. The health harms of climate change and air pollution are happening now. 2. We must take immediate action to protect our communities. 3. Prevention offers the most powerful protection against future harms. 4. Preventive actions will create immediate health and economic benefits. 5. We must double our commitment to reducing carbon pollution—and then live up to it. | <p>This book chapter outlines 5 key messages to educate the public, health professionals, media, business, and policy makers about the impact of climate change on health.</p> <p>“Climate solutions are health solutions and health solutions are economic solutions”</p> |
| <p>Experiments</p> | | | | |
| <p>Connor, P et al (2016) Interpersonal communication about climate change: how messages change when communicated through simulated online social networks. <i>Climate Change</i> 136: 463-476 DOI 10.1007/s10584-016-1643-z</p> | <p>Social media Experiment</p> | <p>USA</p> | <p>Experiment used a simulated Facebook-like format platform with 200 Facebook using participants. Used five content domains: nature, competence, capability, development and health. Results showed that Climate change is seen as an environmental issue. Messages about climate change impacts on nature or health were more likely to spread via social networks. Nature-focused messages that link climate change to natural disasters and other environmental effects are more conventional than society focused messages. Of all of the messages health focused messages were a public concern.</p> | <p>Messages that are more framed on conventional climate change (and health) issues with using again frame are more likely to spread via social networks initially. However, messages that use a loss frames (e.g. costs of non-mitigation) are more likely to be spread throughout society over the longer term.</p> |
| <p>Perlata ,C et al. (2017) Selective exposure to balanced content and evidence type: The case of issue and non-issue publics about climate change and health care. <i>Journalism & Mass Communication Quarterly</i> vol 94(3) pp833-861</p> | <p>Experiment Online material</p> | <p>USA.</p> | <p>Experiment using a 15-minute online study with Dynamic Process Tracing Environment (DPTE). Participants were issue publics and non-issues publics. According to Wikipedia (https://en.wikipedia.org/wiki/Publics) issue publics are groups of people who pay attention to one particular issue, are well informed about the issue(s) and also have a very strong opinion on it/them. They tend to know more about politics than the average person, and, therefore, exert more influence, because these people care so deeply about their cause(s) (Source Covington et al 2008). In this study participants are presented with 12 headlines about climate change and 12 about health care on separate screens. Each headline was shown 3 times. Study draws on motivated reasoning theory to test if people select information to validate and protect their existing attitudes, beliefs and behaviours or are they looking for accuracy motivation –Results showed that issue publics are both driven by numbers and narrative for climate change and health care.</p> | <p>Overall, balanced content with facts that are numerical, and narrative content are useful in discussing both health care and climate change issues. In this study numerical statistics are more credible for health care content. But both groups sought numerical content over narrative content for climate change.</p> |
| <p>Kary, A et al (2018) What makes for compelling science? Evidential diversity in the evaluation of scientific arguments. <i>Global Environmental Change</i>. 49; 186-196</p> | <p>Experiment</p> | <p>Australia</p> | <p>This Australian study draws from applied cognitive psychology looking and the diversity effect. i.e. the balance of evidence that can shape the likelihood that people are convinced by information on climate change and public health. Authors examined how the presentation of factual scientific evidence affects lay reasoners (people with little formal training in either discipline) acceptance of science. Authors looked at whether the following had any effect:</p> <ul style="list-style-type: none"> •geographical diversity – evidence taken from different parts of the world (e.g. Australia and the UK) or similar parts of the world (e.g. Australia and New Zealand) •socio-cultural diversity – e.g. Australia and the UK, or Australia and Papua New Guinea), or •temporal diversity – evidence taken from the 1990s and the 1950s, or both pieces of evidence from the 1990s. <p>Result: non-experts' conclusions about sea levels rising across the globe was better supported by evidence taken from distant geographical locations (e.g. Australia and the UK) than geographically nearby locations such as (Australia and New Zealand). But they were not influenced</p> | <p>The study suggests that when discussing climate change emphasising evidence that comes from different sources convinces non-experts more than presenting evidence coming from similar sources but when discussing the health angle it does not matter if the evidence is from a similar or diverse place or social cultural group.</p> |

| | | | | |
|---|-----------------------------|-----------------------|---|--|
| | | | either way whether evidence came from the socio-culturally similar Australia and UK or the socio-culturally dissimilar Australia and Papua New Guinea with regards to public health. | |
| Case Study | | | | |
| Akerlof, K et al (2020) Governmental Communication of Climate Change Risk and Efficacy: Moving Audiences Toward "Danger Control" Environmental Management (2020) 65:678–688 | Case study | USA | In this case study, three videos that were developed to support a state's government climate change public engagement agenda were used as the focus of this study to evaluate how this governmental communication using the frames of health, science, and local effects influences two theoretically important constructs, risk perception and collective efficacy. The study used the Extended Parallel Process Model (EPPM) (Witte 1992). This model describes how individuals weigh their risks of experiencing the threat against the actions that they can take to avert it. Researchers widened the model to include perceived collective efficacy and looked at three variables that represent characteristics of vulnerable audiences—health status, stress, and feelings of lack of control. Results showed that there was no evidence for framing effects of climate change using local effects and health messaging, as opposed to scientific information across the three videos. This contrasts with other research where the perception is that using local health frames makes a difference to attitudes and efficacy. However, researchers did find that efficacy is a key factor regardless of the frame. | Findings suggest that academics should take caution in recommending specific frames for evidence-based communication. However, the paper offers a useful discussion on efficacy. Efficacy messages need to move people toward feelings of 'Controlling the Danger' and that there is a path forward to assist them to do this. This is especially relevant to audiences who are particularly vulnerable to climate change. Short videos as communication tools can effectively be used by governments in communicating with citizens on climate change issues regardless of the frame. |
| Surveys | | | | |
| Akerlof, K et al (2010) Public Perceptions of Climate Change as a Human Health Risk: Surveys of the United States, Canada and Malta. Int. J. Environ. Res. Public Health 2010, 7, 2559-2606; doi:10.3390/ijerph7062559 | Survey | USA, Canada and Malta | Using nationally representative surveys conducted in the United States, Canada and Malta between 2008 and 2009 to answer three questions: researchers asked: Does the public believe that climate change poses human health risks, and if so, are they seen as current or future risks? Whose health does the public think will be harmed? In what specific ways does the public believe climate change will harm human health? Results showed: majority of people in all three nations said that it poses significant risks. With regard to timing, about one third of Americans believe that health impacts are already occurring, while about half of Canadians and two thirds of Maltese believe that people are being harmed now. However, climate change appears to lack salience as a health issue in all three countries. | There is a need to raise awareness in the general public about the link between climate change and health. Use simple clear messages, repeated often, by a variety of trusted public health voices within a wider policy environment that supports greenhouse gas reduction behaviour and healthy lifestyles. |
| De Bono, et al. (2010) Risk communication: climate change as a human-health threat, a survey of public perceptions in Malta. European Journal of Public Health. Vol. 22, No. 1, 144–149 | Survey | Malta | Survey using Leiserowitz (2006) survey questions. Results from this study demonstrates that the perception among the Maltese public that climate change poses a risk to one's health (increased disease, water shortages) and general well-being (impact on standard of living) may be the strongest driver behind support for climate change mitigation policy and a willingness to take measures to mitigate climate change. The broad perception that climate change somehow influences health and well-being was a much stronger predictor of support for policy and a willingness to act than a correct knowledge about the human health effects of climate change. As long as climate change was perceived as a threat to public health and general well-being, both locally and abroad, the public demonstrated a stronger willingness to act on the issue. | Re-framing climate change as a threat to human health can be the principal catalyst for people to change their behaviour and increase their support for climate change mitigation (and adaptation) policies. |
| Maibach, E et al. (2010) Reframing climate change as a public health issue: an exploratory study of public reactions. BMC Health, 10: 299 http://www.biomedcentral.com/1471-2458/10/299 | Survey open-ended questions | USA | Authors conducted an exploratory study in the United States of people's reactions to a public health-framed short essay on climate change. Uses a sample from an earlier survey sample stratified by six previously identified audience segments. Results show human health and wellbeing is a widely shared value across all segments. Information about the potential health benefits of specific mitigation-related policy actions appear to be particularly compelling across multiple (American) audiences. Conclusion: Redefining climate change in public health | The public health perspective offers a vision of a better, healthier future - not just a vision of environmental disaster averted. And giving climate change a public health focus brings together the need to both mitigate (i.e. reduce |

| | | | | |
|---|-----------------------|-----|---|---|
| | | | terms should help people make connections to already familiar problems such as asthma, allergies, and infectious diseases experienced in their communities, while shifting the visualisation of the issue away from the usual environmental frame of remote Arctic regions, or distant peoples and animals. | greenhouse gas emissions) and adapt to the problem (i.e. protect communities and people) addressing climate and health at same time. |
| Maibach, E., Kreslake, J., Roser-Renouf, C., Rosenthal, S., Feinberg, G. & Leiserowitz, A. (2015) Do Americans understand that global warming is harmful to human health? Evidence from a national survey. <i>Annals of Global Health</i> , 81, 396-409. DOI: 10.1016/j.aogh.2015.08.010 | Survey | USA | This research reports on a survey of USA adults (N = 1275) Measures included general attitudes and beliefs about global warming, affective assessment of health effects, vulnerable populations and specific health conditions, perceived risk, trust in sources, and support for government responses. Results/conclusions: Most Americans report a general sense that global warming can be harmful to health, but relatively few understand the types of harm it causes or who is most likely to be affected. Respondents said their primary care physician is their most trusted source of information on this topic, followed by the Center [sic] for Disease Control and Prevention, the World Health Organization, and their local public health department. | Results showed that there is a general sense that global warming can be harmful to health, but that relatively few understand the types of harm it causes. Primary care physicians and public health officials are trusted messengers and are well positioned to educate the public about the health relevance of climate change. |
| Kreslake, J Price, K and Sarfaty, M (2016) Developing effective communication materials on the health effects of climate change for vulnerable groups: a mixed methods study. <i>BMC Public Health</i> (2016) 16:946 DOI 10.1186/s12889-016-3546-3 | Survey and interviews | USA | Mixed method study using survey and thematic analysis. 5 themes: Theme 1: Little differentiation between climate change and weather - Most respondents had a superficial understanding of climate change. Theme 2: Emphasis on immediate-term health management: Respondents regarded the posters primarily as straightforward instructions for what to do to protect themselves from weather and/or environmental triggers. Respondents focused mainly on the health management aspect of the posters, citing the "health tips" as the most useful component of the posters. Theme 3: Disconnected from collective action on climate change. Theme 4: Real people experiencing health effects: Participants repeatedly emphasized the need for photographs of real human beings, as opposed to illustrated human figure icons or cartoons. Theme 5: Reaching target audiences. This study found that viewing concise, targeted messages about the health impacts of climate change significantly increases knowledge and beliefs about the relationship between climate change and health among chronically ill, low-SES populations. Another major finding was that greater knowledge of vulnerabilities and triggers is associated with these populations having greater intentions to practice recommended behaviours for climate change adaptation and mitigation. | Individuals who are vulnerable to the health effects of climate change benefit from communication materials that explain, using graphics and concise language, how climate change affects health conditions and how to engage in protective adaptation behaviours. The 'Health tips' message in how to protect themselves in the immediate term outlined in the posters were seen as most useful. The use photographs of 'real human beings' i.e. real people experiencing health effects, as opposed to illustrated human figure icons or cartoons resonated with participants. |
| Kotcher, J., Maibach, E., Montoro, M., & Hassol, S. J. (2018). How Americans respond to information about global warming's health impacts: Evidence from a national survey experiment. <i>GeoHealth</i> , 2, 262–275. https://doi.org/10.1029/2018GH000154 | Survey | USA | This longitudinal study examined how Americans react to information about eight specific categories of health impacts from global warming (n = 2,254). Participants were randomly assigned to a group that had eight brief essays about different categories of health impacts from global warming or to a control group who received no information. Researchers found that informing people about the health implications of global warming increased public engagement with the issue and reduced differences in opinion across political lines and information about illnesses from health impacts from global warming such as contaminated food and water, and disease-carrying organisms were seen as more worrisome. Participants with a chronic condition tended to see information about each of the impacts as more personally relevant. But some topic areas seem easier to understand extreme heat, poor air quality, and contaminated water were all viewed as easier to understand than contaminated food, hunger and malnutrition, and mental health problems. The concept of purity (or rather the threat of having not pure water) activated moral concerns about purity, which are strongly associated with the emotion of disgust. | Informing people about the health implications of global warming can increase public engagement with the issue and reduce differences in opinion across political lines. Information about contaminated food and water and vector-borne illness—generated more negative emotional responses than other categories of health impacts. |
| Kotcher, J Maibach, E and Choi, WT (2019) Fossil fuels are harming our brains: identifying key messages about the | Survey | USA | Researchers' hypothesis is that reading statements about health implications of air pollution from fossil fuels would influence people's attitudes and behavioural intentions and move them to be supportive of a transition to cleaner sources of energy. Researchers assessed the cumulative | Key findings: There is a need to communicate the neurological effects of air pollution from fossil fuels, especially the |

| | | | | |
|--|------------------------------------|-----------|---|---|
| health effects of air pollution from fossil fuels. BMC Public Health (2019) 19:1079 https://doi.org/10.1186/s12889-019-7373-1 pp | | | impact of reading the ten evidence based statements by measuring participants' attitudes both before and after the ranking task. Sample came from U.S. adults (n = 1644) from a non-probability internet panel. Results: researchers found that participants were most concerned by a message about the neurological impacts of air pollution on babies and children. After the ranking exercise, participants expressed increases in perceived health harm of air pollution and fossil fuels, a desire for more clean energy, and intention to engage in consumer advocacy to support clean energy. | neuro-developmental effects on babies and children. Using health risk communication can help motivate people to take protective action. This approach helped audiences understand both the severity of a threat and their susceptibility to it. |
| Sustainability Victoria (2020). Linking climate change and health impacts -Research snapshot. (Available from sustainability.vic.gov.au) | Survey | Australia | Sustainability Victoria undertook a state-wide survey to investigate awareness of the link between health and climate change. A secondary analysis of the survey looked at responses from 700 health professionals. Key findings: High level of awareness of climate change but only 18% feel confident in their level of knowledge on the health impacts of climate change. Overall, the public do not link health and climate change. 80% Health professionals reported that climate change is already harming public health. The public's view of health conditions that could become more common due to climate change, differs significantly from the views of health care professionals. Community spaces can be places of refuge in heat / cold, housing quality and thermal comfort rated as a key issue that must be addressed. 77% said they want to know more about climate change and health and how to reduce emissions and help stop climate change getting worse; 78% wanted to know what behaviours will benefit health and also mitigate against climate change. | This document is useful in communicating the Australian context and providing guidance to where communication efforts need to be developed and targeted. It supports other research findings from the USA that there is a low level of awareness of health impacts in the general public about impacts of climate change on our health. This survey also brings in the concept of health inequities and inequality e.g. from those living in poor housing conditions. |
| Commentaries | | | | |
| Myers, T Nisbet, M Maibach, E Leiserowitz, A (2012) A public health frame arouses hopeful emotions about climate change. A letter. Climatic Change (2012) 13:1105–1112 DOI 10.1007/s10584-012-0513-6 | A letter in Climate change Journal | USA | This letter describes results from previous research of a survey of U.S. residents (N=1,127) undertaken in 2010 (the Global Warming's Six Americas" Maibach et al. 2010) where respondents were asked to read uniquely framed news articles about climate change emphasizing either the risks to the environment, public health, or national security and the benefits of mitigation and adaptation-related actions. Results from the survey revealed that across audience segments, the public health focus was the most likely to elicit emotional reactions consistent with support for climate change mitigation and adaptation. The national security frame may 'boomerang' among audience segments already doubtful or dismissive of the issue, eliciting unintended feelings of anger. The health frame was the most likely to generate feelings of hope, followed by the environment frame, and then the national security frame. Authors discuss that outside the experiment other factors need to be considered such as: <ul style="list-style-type: none"> - the messenger, specifically the congruence between the messenger and the frame. - how the message is delivered and whether it is delivered by the media or face-to-face, - the nature of any policy actions proposed to address the problem, - the salience of other linked trends, competing frames or arguments —particularly those involving the economy and/or political polarization more generally. | Across audience segments, the public health focus is the most likely to elicit support for climate change mitigation and adaptation. A key point in this paper is that outside the experiment there needs to be congruence between the messenger and the frame. |
| Koh, H (2016) Communicating the Health Effects of Climate Change JAMA January 19, Volume 315, Number 3 | Commentary medical journal | USA | This paper provides an outline of the health impacts from human-generated greenhouse gas emissions (carbon dioxide, methane, nitrous oxide) related to the burning of fossil fuels. Draws on evidence outlined in the IPCC report (2015). Lists adverse health outcomes heat- and extreme weather-related conditions, infections, respiratory conditions and allergies, and mental health conditions. Discusses that in their day to day roles clinicians can act on climate change and "have a powerful and unique opportunity to engage the nation by framing the crisis as a health imperative". Medical professionals / clinicians can also raise awareness through educating patients about | This paper in a prominent medical journal is a good example of how climate change and health impacts can be communicated to a targeted audience (in this example a prominent medical journal) using the language and style that resonates with them. |

| | | | | |
|--|------------------------|-------------------------------------|--|--|
| | | | their risks and the risks in general and integrate advice as part of their clinical care and self-management support strategies, by participating in policy development, and joining forces to be a collective and trusted voice on the topic. | |
| Depoux, A Hemono, M Puig-Malet, S Pedron, R & Flahault, A. (2017) Communicating climate change and health in the media. <i>Public Health Reviews</i> , 38(7). Doi:10.1186/s40985-016-0044-1 | Commentary | France | Peer reviewed article looking at two media impact studies, one French newspaper Le Monde and Twitter. Commentary discusses the need to better inform the public on the health threats associated with climate change through the media and draws on the work of Maibach et al. (2008). Article highlights the health risks associated with climate change messages have increased over time but still not enough although there is a spike in social media (Twitter) around the time of the Paris agreement. Authors reiterate Maibach et al by stating promoting climate change health impacts is an ineffective communication method and can be facilitated by the media. However, messages must be accompanied by relevant information with potential solutions. | There is a need to inform the media more about health and climate change risk but must offer solutions with health risk messaging. |
| Maibach,E & Kotcher, J (2018) It's time for a focused climate change public engagement strategy : "It's about health stupid" Aug 2018 Global Climate Action Summit. | Commentary | USA | Commentary outlining the need to communicate the health risks from climate change. Outlines that climate change is not solely an environmental issue that is distant in time, space and species. It is causing us harm now, here and worldwide and impacting on us. People understand that climate change is making the weather more dangerous, threatens food and water and damaging infrastructure and communities. Authors contend that the most important public education needs to focus on climate change and harmful effects to our health and in promoting the co-benefits of clean energy. The paper gives examples of air pollution effects on children's brain development and other health impacts on heart disease, asthma and cancer. Authors also contend that health. professionals and health organisations have a key and important role to play in communicating about these harmful effects. As trusted voices they have the potential to get policy makers and the public to understand the issues. | Aligns with other research that climate change is not a distant issue in time or space impacting on others and other species. It is causing us harm now, here and to us. Health professionals and health organisations are the "ideal messengers". Paper also highlights the need to raise awareness of how carbon pollution causes neurological health. |
| Maibach EW, Sarfaty M, Mitchell M, Gould R (2019) Limiting global warming to 1.5 to 2.0°C—A unique and necessary role for health professionals. <i>PLoS Med</i> 16(5): e1002804. https://doi.org/10.1371/journal.pmed.1002804 https://doi.org/10.1371/journal.pmed.1002804 | Editorial / commentary | USA General Health professionals | A call to action to the health professions. Health professionals can make a critical difference in advocating, educating and problem solving climate change and health risks. Authors press that there is an urgent need for global action to create a clean energy economy, drawing down excess atmospheric carbon, and preparing for and adapting to health impacts. Authors highlight that those with strong vested interests in the fossil fuel economy have a view that "health professionals should 'stick to our own lane', and stay out of complicated policy dialogues that we are ill-prepared to understand, much less advance". But authors outline how climate change is a health issue and therefore is very much in "our lane". And that it would be irresponsible not to take actions to protect the health and well-being of people. But to do this, health professionals do need to become experts in areas of policy outside 'our lane', i.e. climate science. | Health professionals can make a critical difference and is imperative Need to become experts outside our lane Health professionals are among the people best positioned to make sure that the public and policy makers understand this and final message "Carpe diem". |
| Literature Reviews | | | | |
| van den Bergh, J (2016) Human health impacts of climate change as a catalyst for public engagement Combining medical, economic and behavioural insights. <i>IJCCSM</i> . Vol 8 , no 6 pp.578-596 | Literature review | Spain/ Multi-national | This review looked at climate change induced health impacts and their economic costs. The review covers a typology of health impacts, a review of economic studies looking at health costs from global warming, co-benefits of mitigation policy and behavioural studies and communication strategies. | A key point from this study is the need for Climate health impacts and their economic costs to be prioritised in mitigation policy activities. The study also provides an interesting overview of economic literature that health professionals would not as a general rule look at or seek out. |
| Hathaway, J., & Maibach, E. W. (2018). Health implications of climate change: a review of the literature about the perception of the | Literature Review | USA | Authors found 12 studies that looked at health professionals' perceptions of climate change. Only one of these studies was Australian. Results from the review showed that most public health organisations had an awareness of climate change and its health impacts. Specific areas of concern are heat, disruption to health | This review complements the Sustainability Victoria survey results in that health professionals are aware of climate change |

| | | | | |
|--|-----------------------------------|--------|--|--|
| public and health professionals. Current Environmental Health Reports, 5, 197-204. Doi:10.1007/s40572-018-0190-3 | | | infrastructure from storms, vector borne illness, air pollution, and impacts on mental health. However, few health departments/ organisations have developed any strategies to address these risks. Health professionals also want to learn more about climate change and how it impacts on health as part of their own education. This review also included a reference from a study undertaken with Inuit elders in Canada. This is of relevance as there are few studies in this review that have included any reference to indigenous cultures. This review also reiterates that the general public have a low level of awareness of climate change and its impacts on health. And the need for investment in expertise, finance and personnel to effectively communicate about these issues. | health impacts and want to know more. This study also highlights that there is a need to communicate how health professionals can develop and implement mitigation and adaptation strategies as well as continuing to raise awareness of climate change and health impacts. |
| MacIntyre et al (2019) Evaluating risk communication during extreme weather and climate change: a scoping review. Health Promotion and Chronic Disease in Canada Research Policy and Practice. vol 39 , no 4 April 2019. pp142- 156 | Scoping review | Canada | This literature review looked at how risk communication is used in climate change, flooding, hurricane events, extreme heat and wildfires to inform local public health messaging and meet Ontario Public Health Standards. Papers reviewed were predominantly from the USA, Europe and Canada. Authors describe risk communication efforts as evidence based approach to communicating with the public as a short term messaging strategy focused on hazards and protective actions. Risk communications appear to be more effective than efforts to communicate risk around climate change that are usually focused on motivating longer term proactive adaptation strategies. Authors identified 7 risk communications processes and 3 main thematic areas: risk perception, vulnerable populations, and community-based strategies. | Risk communication strategies that have short term health protective messages that outline the hazards and what individuals and organisations can do to protect themselves from the risk. This risk communication approach appears to be more effective than using long term strategies seeking to motivate change for climate change adaptation. This review also frames the literature search in terms of meeting public health quality standards. |
| Karlsson, M Alfredsson, E and Westling, N (2020) Climate policy co-benefits: a review. <i>Climate Policy</i> . Vol. 20, NO. 3, 292–316 https://doi.org/10.1080/14693062.2020.1724070 | Literature review | Sweden | This multi-national review looked at how co-benefits are included in climate policy. Researchers divided climate policy co-benefits into 3 types: 1. Air quality and biodiversity; 2 co-benefits from other policy areas (e.g. reducing greenhouse gas emission from changes in traffic congestion) and 3. Synergies of policies with multiple objectives. Authors reported that co-benefits are well-researched in areas of air quality and health. The health studies are mostly reported in terms of deaths avoided e.g. particle related deaths that may have occurred due to greenhouse gas emissions. The co-benefits in these areas are reported to be large, “often equalling or exceeding mitigation costs”. Authors also found studies showing co-benefits for diet and physical activity, soil and water quality, biodiversity, economic and organisational performance, and energy security. But, despite their significance, co-benefits are seldom considered in decision-making, leading to biased policies and goal failures. And in several areas, such as diet, economic performance and energy security, co-benefits are sparsely researched, but there is emerging evidence from the few studies in this review that are pointing to high values. The authors conclude that more research is needed, including on how to describe the total value of different co-benefits. But that where the evidence exists it should be more widely used to inform policy decisions. | A key strategy for communicating climate change and health is to emphasise the economic co-benefits. However, there is not enough research on co-benefits (with comparable quantitative and monetised data) but where it does exist e.g. air quality /air pollution it should be used more widely to give a more comprehensive picture of what is at stake. This review includes some Australia research for example in soil and water, diet and physical activity that could be used to inform Australian policy. |
| Qualitative studies | | | | |
| Malena-Chan,R (2016) A narrative model for exploring climate change engagement among young community leaders. Health Promotion and Chronic Disease Prevention in Canada. | Qualitative Narrative methodology | Canada | This qualitative study explored the experience of community leaders in responding to climate change in Saskatoon, Saskatchewan, Canada, age 20-40 (n = 10). Climate change narratives were explored both structurally and thematically using a narrative methodology. Structural interpretations included sufficient knowledge and an agency to do something about it, a sense of agency and a sense of responsibility, a sense of responsibility and a sense of capacity to achieve a desired future and a sense of capacity and a sense of capacity activation; and a sense of activation in everyday life leading to meaningful | This research provides a framework using narrative methods (narrative dissonance, mobilising moments and narrative fidelity) to explore people’s stories. These methods could be useful in gaining a deeper understanding of barriers to moving people to take |

| | | | | |
|--|---|------------|--|--|
| | | | <p>mobilisation. Thematic interpretation included: narrative dissonance, mobilizing moments and narrative fidelity. Narrative fidelity is a term used to describe alternative interpretations of an issue and dissonance can be reframed. Researchers found that even though participants know about and have personal motivation to act on climate change this did not prevent 'narrative dissonance' from occurring. Narrative dissonance is a structural breakdown of a narrative because of emotional moral or conceptual contradictions within the story itself. This can lead to feelings of inertia, apathy, fear, self-doubt and isolation. Therefore, simply giving people information about climate change is not enough but sharing stories about climate change with others could help move people from feeling overwhelmed to gaining a sense of solidarity and group problem solving.</p> | <p>actions on climate change and overcoming narrative dissonance.</p> |
| <p>Lundgren L et al (2019) Panel based exhibit using participatory design elements may motivate behavior change. <i>Journal Science Communication</i> 18 (2) https://doi.org/10.22323/2.18020203</p> | <p>Participatory and community engagement</p> | <p>USA</p> | <p>This pilot study was a qualitative exercise that sought to engage a museum audience in a Science Café style format in the designing of a climate change and health exhibit. The researchers used participatory strategies to enable a two-way science communication. Feedback from participants showed that water quality and air quality were main issues raised. But participants also wanted to understand broad and general information about climate change and health as one participant said, "everything I should know to protect my family". Actions to address litter or pollution were most frequently reported. As a way of getting the museum visitors engaged the researchers used several strategies such as interactive air quality maps, intercept interviews, developing the 'our community action plan' and the use of visitor comment cards. The 'our community action plan' feedback card had 3 components to it: we want to protect (insert the issue); by (insert the action) and with (insert who will do the action). One example of a community card included in the paper said this: We want to protect drinking water By: starting a carpool With: Our neighbours The feedback cards were displayed as part of the exhibit. Researchers concluded that meaningful science engagement can be achieved by engaging the public in co-designing panel-based exhibits in museums about civic issues.</p> | <p>Museums can facilitate conversations about civic issues such as climate change and health impacts in a unique way that is not in the usual format the community would usually be exposed to this information. The researchers believe that the mix of Science Café style with the use of other participatory strategies was a good way to engage the community on climate and health issues.</p> |
| <p>Matlock, M Hopfer, S Ogunseitun, O (2019) Communicating Risk for a Climate-Sensitive Disease: A Case Study of Valley Fever in Central California. <i>International Journal Environmental Research and Public Health</i>, 16,3254</p> | <p>Qualitative study</p> | <p>USA</p> | <p>Five governmental public health agencies from regions in Central California participated in semi structured interviews on how these agencies communicate to their communities about the climate sensitive disease, Valley Fever. Results showed that the public health agencies deliberately omitted climate change information when communicating risk messages with the public for political reasons. The fact that the disease is still being researched also complicates the issue. However, the agencies indicated that when they are discussing poor air quality days and influenza virus season in future communications the agencies plan to use risk messaging methods the kind they usually use when communicating health risk factors. Authors note that when using risk communication itself, it is important to show the 'risk audience' how they might benefit from an activity that might affect them giving them behaviour adaptation strategies rather than behaviour avoidance. Risk communication should focus on process, presentation and comparing risks i.e. Public health agencies need to simplify the language but not the content; there is a need for consistent communication strategies on climate sensitive disease; and messages need to include a comparison of risks through the use of analogies, ranges, and traits.</p> | <p>In this study the results showed that public health agencies feel political pressure not to discuss climate change. However, they may be more comfortable to discuss climate change by framing it in terms of risk messaging. Using this risk communication approach enables them to discuss climate sensitive conditions in the same way they would communicate about other health risk factors such as tobacco smoking.</p> |

The search identified five key themes that were: climate change- health risk framing, building capacity of trusted voices to deliver climate and health messages, communication

strategising and planning, vulnerability factors and co-benefits. The themes are discussed further below.

Theme 1- Climate Change-Health Risk Framing

A dominant theme in this scoping study is that framing climate change as an issue that affects health and wellbeing has potential to engage a broader cross-section of the public on climate change issues that had not previously been engaged in the topic (Maibach et al 2011). Framing is a communication theory and process used by communicators to link messages to an audience's values and beliefs (Maibach et al 2011). Framing is an effective interpretive storyline that "set a specific train of thought in motion, communicating why an issue might be a problem, who or what might be responsible for it, and what should be done about it"(Rudolph et al 2018). The frame used suggests both the diagnosis of the problem as well as actions to be taken (Myers et al 2012). In this case linking climate change and threats to health and wellbeing. Framing the message that climate change is a major threat to people's health and well-being (Maibach et al 2011) is also in contrast to how climate change has historically been framed: as an environmental problem with polar bears on melting ice caps in a distant place. Instead, climate change could be framed as a health (Koh 2016, Maibach & Kotcher 2018), political (Myers et al 2012), economic or scientific, national security, or preparedness problem. This latter framing can lead to polarisation (Weathers et al 2017) and lead to a sense that climate change is distant from everyday experiences (Kotcher et al 2018).

However, other authors support that the climate change-health frame helps people connect this complex and poorly understood issue to risks people understand, particularly when the message is localised (Weathers et al 2017) and it facilitates connections with existing beliefs, values, and concerns (Akerlof et al 2020). Surveys and experiments that use the health frame have been shown to engage diverse groups of people and motivate them to take action to mitigate or adapt to climate change (Maibach et al 2010). Climate change health framing also assisted people to more easily understand extreme heat, poor air quality, and contaminated water (Kotcher et al 2018). The majority of articles discuss a large number of health impacts (see Table 2 for a list of climate health issues raised in the scoping study), with vector borne disease, heat impacts, air quality and food or nutrition issues being mentioned the most.

However, what is also embedded within this frame is the concept of risk or threat. The risk frame process identifies the risk or threat, describes the harm it will cause (to health and wellbeing) and what action needs to be taken. The risk frame has three dimensions: 1) risk

perception (Akerlof et al 2016, MacIntyre et al 2019); 2) risk communication (MacIntyre et al 2019); and, 3) risk management (Karlsson et al 2020).

Table 2 Climate health risks identified in the scoping study literature

| Climate health risks identified | Number of articles | Author/s |
|--|--------------------|--|
| Infectious disease (Vectors) | 15 | Akerlof et al 2010, De Bono et al 2010, Maibach et al 2011, Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Koh 2016, Depoux et al 2017, Weathers et al 2017, Hathaway & Maibach 2018, Maibach et al 2018, Kotcher et al 2019 Maibach et al 2019, Matlock et al 2019, Karlsson et al 2020 |
| Heat/ heat-related impacts | 13 | Akerlof et al 2010, De Bono et al 2010, Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Koh 2016, Kreslake et al 2016, Weathers et al 2017, Hathaway & Maibach 2018, Rudolph et al 2018, Matlock et al 2019, Corners et al 2020, Sustainability Victoria 2020 |
| Air pollution/ air quality | 10 | De Bono et al 2010, EcoAmerica 2016, Koh Kotcher et al 2018, Maibach & Kotcher 2018, Lundgren et al 2019, Matlock et al 2019, Corners et al 2020, Maibach et al 2020, Karlsson et al 2020 |
| Food/ food security/ malnutrition | 10 | Akerlof et al 2010, Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Koh 2016, Depoux et al 2017, Weathers et al 2017, Maibach & Kotcher 2018, Maibach et al 2019, Sustainability Victoria 2020 |
| Respiratory conditions (general) | 9 | Maibach et al 2015, Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Koh 2016, Kreslake et al 2016, Depoux et al 2017, Kotcher et al 2019 Sustainability Victoria 2020 |
| Asthma | 8 | Maibach et al 2015, EcoAmerica 2016, Kreslake et al 2016, Matlock et al 2019, Lundgren et al 2019, Hathaway & Maibach 2018, Maibach & Kotcher 2018, Kotcher et al 2018 |
| Infections general (including water and food borne illness) | 7 | Maibach et al 2011, Van den Bergh & Pillay 2015, Chadwick 2016, Koh 2016, Hathaway & Maibach 2018, Maibach & Kotcher 2018, Maibach et al 2019 |
| Injury | 7 | Maibach et al 2015, Van den Bergh & Pillay 2015, EcoAmerica 2016, Kreslake et al 2016, Kotcher et al 2018, Rudolph et al 2018, Maibach et al 2019 |
| Allergens | 6 | Van den Bergh & Pillay 2015, EcoAmerica 2016, Koh 2016, Kreslake et al 2016, Weathers et al 2017, Kotcher et al 2018 |
| Mental health | 6 | Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Koh 2016, Maibach & Kotcher 2018, Maibach et al 2019 |
| Obesity | 5 | De Bono et al 2010, Maibach et al 2011, Kreslake et al 2016 Weathers et al 2017 Hathaway & Maibach et al 2018 |
| Cancer | 3 | Van den Bergh & Pillay 2015, Maibach & Kotcher 2018, Karlsson et al 2020 |
| Cardiovascular disease | 3 | Kreslake et al 2016, Hathaway & Maibach 2018, Karlsson et al 2020 |
| Social displacement | 3 | EcoAmerica 2016, Weathers et al 2017, Rudolph et al 2018 |
| Water (challenges posed by the lack of sanitation and clean water) | 3 | De Bono et al 2010, Koh 2016, Sustainability Victoria 2020 |
| Diseases - Climate sensitive | 2 | Weathers et al 2017, Matlock et al 2019 |
| Neurological impacts e.g. Child development, Alzheimer's disease | 2 | Maibach & Kotcher 2018, Kotcher et al 2019 |
| Illness (general) | 2 | Maibach et al 2019, Karlsson et al 2020 |
| Chronic lung disease | 1 | EcoAmerica 2016, Rudolph et al 2018 |
| Environmental 'Bio perverse impacts' | 1 | Karlsson et al 2020 |
| Lifestyle | 1 | Van den Bergh & Pillay 2015 |
| Shelter | 1 | Koh 2016 |
| Wildfire Smoke exposure/ injury | 1 | Weathers et al 2017 |

Risk perception is how audiences evaluate information about specific categories, for example health impacts from global warming (Kotcher et al 2018). There are many factors that influence a person's risk perception. These include efficacy, political ideology, knowledge and experience with the hazard, socioeconomic status, emotions/ psychological impacts, duration of residence in the area, information preferences, trust in the information provider, and perceived efficacy and cost of mitigation (MacIntyre et al 2019). Risk efficacy is an important factor to consider, as efficacy (self-efficacy and collective efficacy) needs to be high before people can engage with the threatening details of the risk information (Akerlof et al 2020). Individual perception of personal risk has been shown to be a powerful behaviour change motivator and people are more likely to recognise and act on risks that are perceived to be close to home (Maibach et al 2011) in time and place.

Risk communication is an evidence-based approach to communicating with the public and is usually in the form of short-term messaging, focused on immediate hazards and protective actions (Macintyre et al 2019). Risk communication's short-term protective actions are tailored for specific at-risk audiences (Matlock et al 2019) and appear to be more effective in initiating behaviour change than communicating longer-term proactive climate change adaptation strategies (MacIntyre et al 2019). It also appears that public health agencies may prefer using risk messaging methods as this aligns with traditional public health communication strategies that are commonly used for communicating risk factors for preventing and managing chronic illness (Matlock et al 2019). However, risk communication is an ongoing effort and public health organisations may struggle to maintain the level of effort required and the appropriate resources and funding needed (Matlock et al 2019).

Risk management in this scoping study relates to mitigation and adaptation to climate change. This includes: identifying the risk by following a risk assessment process; identifying who or what is most vulnerable from the risk; and, what actions need to be put in place to mitigate (stabilise, or reverse) the risk and/ or adapt to the risk by preparing for anticipated effects (Chadwick 2016). Risk management is also a process used in disaster management and includes disaster preparedness, health adaptation planning and community engagement (MacIntyre et al 2019).

In terms of climate risks, the most often referred risks reported in the scoping study are environmental (as opposed to social, political, or behaviour risks) and include extreme weather events, risks to infrastructure, floods and risks to food supply and agricultural production, as per Table 3.

In this scoping study there is no set sequence prescribed for how risk messages are designed but Rudolph et al (2018) summarise their process as: Environmental Trigger +

Solution + Values + Scientists Agree = Climate and Health Message. The term ‘environmental trigger’ here requires some clarification. The environmental trigger is the climate change risk that poses harm to human health because of extreme heat or flood, and not the risk it has for nonhuman life (e.g., plants and animals) (Weathers et al 2017). The climate change health risk frame is therefore specifically about the harms to *human and social health*. This was reinforced in the messaging guide by EcoAmerica (2016) in step 1 that states, “start with people, stay with people”. It is also a reminder that “climate change is not a distant issue in time or space impacting on others and other species. It is causing us harm now, here and to us” (Maibach et al 2018).

Table 3 Climate risk identified in the scoping study literature

| Type of Climate Risk | Number of articles | Authors |
|---|--------------------|--|
| Social, economic, political, and behavioural risks | | |
| Economic risk | 3 | Maibach et al 2011, Van den Bergh & Pillay 2015, Karlsson et al 2020 |
| Political risk | 2 | Weathers et al 2017, Matlock et al 2019 |
| Social risk | 4 | Koh 2016, Weathers et al 2017, Rudolph et al 2018, Corners et al 2020 |
| Behavioural risk | 1 | Matlock et al 2019 |
| Environmental risks | | |
| Extreme weather | 10 | Maibach et al 2011, Maibach et al 2015, Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Hathaway & Maibach 2018, Rudolph et al 2018, MacIntyre et al 2019, Akerlof et al 2020 |
| Infrastructure damage Transport systems health infrastructure | 8 | DeBono et al 2010, Chadwick 2016, Maibach & Kotcher 2018, Hathaway & Maibach 2018, Rudolph et al 2018, Lundgren et al 2019, Akerlof 2020, Corners et al 2020, Karlsson et al 2020 |
| Floods | 8 | Van den Bergh & Pillay 2015, Chadwick 2016, Koh 2016, Lundgren et al 2019, Maibach et al 2019, Corners et al 2020, Sustainability Victoria 2020 |
| Agriculture / food production/ supply | 7 | Van Den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Koh 2016, Rudolph et al 2018, Lundgren et al 2019, Akerlof et al 2020 |
| Extreme heat Heatwave | 6 | Koh 2016, EcoAmerica 2016, Maibach et al 2019, Akerlof et al 2020, Sustainability Victoria 2020 |
| Droughts | 6 | Maibach et al 2010, Maibach et al 2011, Van den Bergh & Pillay 2015, Chadwick 2016, Lundgren et al 2019 |
| Sea level rise | 3 | EcoAmerica 2016, Koh 2016, Akerlof et al 2020 |
| precipitation | 5 | Van den Bergh & Pillay 2015, EcoAmerica 2016, Weathers et al 2017, Maibach et al 2019 |
| Wildfire/ bushfire | 3 | Koh 2016, Rudolph et al 2018, Sustainability Victoria 2020 |
| Water | 2 | De Bono et al 2010, Van den Bergh & Pillay 2015 |
| Carbon pollution | 2 | Maibach et al 2019 |

Finally, framing is not as simple as applying a climate change- health risk label to a message. The message needs to be tested and tailored to context and geographical location. For example, although many articles support the climate- health risk frame approach in this scoping study, Kary et al found that lay people accepted scientific climate evidence comparing distant geographical locations (e.g. Australia and the UK) over geographically nearby locations such as (Australia and New Zealand). But, in terms of scientific health evidence, participants were not influenced if evidence came from socio-culturally similar populations or dissimilar populations (Australia and Papua New Guinea). Therefore, the health frame component did not require diverse comparison frames, but the climate change component did, separating the types of information required for two frames. Also, the type of evidence required and how it is presented might differ depending

on audience preferences. For example, Perlata (2017) et al found in their experimental study that the balance of numerical and narrative evidence might be different for different audience types, with one group preferring more numerical climate science data but more narrative (non numerical) evidence for health. Akerlof et al (2020) also suggest caution is required if recommending specific frames, as in their study they found no differences in framing effects. However, what they did find was that risk messages needed to be accompanied by efficacy / solution messages regardless of the frame.

Theme 2 - Building capacity of trusted voices to deliver climate and health messages

This second theme is embedded throughout the scoping study and has two sub themes: 1) That health professionals are amongst the most trusted people and as such are a 'trusted voice'; and, 2) That health professionals need to be empowered and have the capacity to use this trusted voice.

Trusted voices

Throughout this scoping study health professionals are understood to be a trusted voice and are seen to be uniquely placed to deliver key messages about climate change and health. Health professionals and health organizations, health communicators and researchers (Chadwick 2016) are perceived to be the ideal messengers to be leading public engagement efforts. This is because doctors, nurses, pharmacists and other professionals are among the most trusted members of every society (Maibach & Kotcher 2018). Health professionals are perceived to have scientific, ethical and moral authority (Maibach et al 2020) that enables them to reach and motivate a vast and diverse population (EcoAmerica 2016). Additionally, health professionals have the scientific knowledge, supported by public health tools and approaches that are underpinned by a strong values base, such as addressing inequity, to help them address the problem (Rudolph et al 2018). However, as Table 4 shows, health professionals are not the only groups considered to be a 'trusted voice'.

Alongside the message of health professionals being the trusted voice, one might say there is a sense of frustration from some authors, who have a view that despite the climate change and health risk being known, health professionals are not using their trusted place in society to promote the links to climate change and health to the public as much as they could/ should, and essentially, aside from a few, have been silent on this issue (Maibach et al 2020).

Table 4 Trusted Voices identified in the scoping study literature

| Category of trusted voice | Number of articles | Authors |
|--|--------------------|--|
| Health professionals/ Practitioners | 11 | Chadwick 2016, Connor et al 2016, Depoux et al 2017, Weathers et al 2017, Hathaway & Maibach 2018, Maibach et al 2018, Maibach et al 2019, Corner et al 2020, Maibach et al 2020, Sustainability Victoria 2020 |
| (Public) Health organisations | 6 | Maibach et al 2015, Akerlof et al 2016, EcoAmerica 2016, Rudolph et al 2018, MacIntyre et al. 2019, Matlock et al 2019 |
| Scientists | 6 | Connor et al 2016, Kreslake et al 2016, Lundgren et al 2019, Akerlof et al 2020 Kary et al 2020, Sustainability Victoria (Climate), (Natural), |
| Medical professionals Primary Care Physicians / GPs | 5 | Maibach et al 2015, Van den Bergh & Pillay 2015, EcoAmerica 2016, Koh 2016, Sustainability Victoria 2020 |
| Health communicators | 3 | Maibach et al 2011, Chadwick 2016, Corner et al 2020 |
| Community | 3 | Rudolph et al 2018, Matlock et al 2019, Lundgren et al 2019, Akerlof et al 2020, |
| Community leaders/ elders | 2 | Malena-Chan 2016, , Rudolph et al 2018, Matlock et al 2019 |
| Government | 2 | MacIntyre et al 2019, Akerlof et al 2020 |
| World Health Organization (WHO) | 2 | Maibach et al 2015, EcoAmerica 2016 |
| Center for Disease Control (CDC) | 2 | Maibach et al 2015, EcoAmerica 2016 |
| News media | | Hathaway & Maibach 2018, Matlock et al 2019 |
| Economists | 2 | Van den Bergh & Pillay 2015, Karlsson et al 2020 |
| Real people | 1 | Kreslake et al 2016 |
| Emergency Services | 1 | Sustainability Victoria 2020 |
| Health service providers | 1 | Kreslake et al 2016 |
| American Lung Association | 1 | EcoAmerica 2016 |
| Teachers | 1 | Rudolph et al 2018 |
| Academics | 1 | MacIntyre et al 2019 |
| Museums | 1 | Lundgren et al 2019 |
| Youth | 1 | Rudolph et al 2018 |
| Weather forecasters | 1 | Rudolph et al 2018 |

In conjunction with this, is the understanding that health harms of climate change are no longer a future threat, they are a current reality (Maibach et al 2019), a fact that the public is largely unaware of (Maibach et al 2011, Sustainability Victoria 2020). As health professionals have this authoritative power and immense trust, they have a responsibility to play a lead role in getting the message out about climate health risks. Health professionals should take action to prevent and manage risks and provide information to educate, advocate, and collaborate with individuals, communities, governments, and with climate health advocates globally (Koh 2016, Weathers et al 2017, Maibach et al 2020). There is also a sense that if these powerful health voices are absent, those who are most loudly heard are major corporations and fossil fuel companies who are contributing the most to climate change and health harms (Maibach et al 2019). Table 5 shows examples of how health professionals are seen to be trusted voices as described in the scoping study literature.

For communication to be effective, a messenger that has congruence with the selected frame is required. (Akerlof et al 2020). In the case of the climate change- health risk frame, the trusted voices that are credible to the audience in delivering the message are health professionals. What is needed is for health professionals to accept the clarion call (Maibach et al 2020).

Table 5 Examples of how health professionals are described as a trusted voice in the scoping study literature

| Author | Trusted voice reference |
|---|---|
| Maibach et al 2010 | Information about the potential health benefits of specific mitigation-related policy actions appears to be particularly compelling. We believe that the public health community has an important perspective to share about climate change, a perspective that makes the problem more personally relevant, significant, and understandable to members of the public |
| Maibach et al 2011 | As public health professionals, we are uniquely well positioned to explain how the rapidly emerging threats associated with climate change are connected with individual and community health and wellbeing. By communicating the potential of global climate change to harm human health, and by conveying the potential to improve human health through actions that limit climate change, we can enhance public understanding of the full scope of the problem, and help enable appropriate responses by individuals and communities. |
| Maibach et al 2015 | Primary care physicians and public health officials appear well positioned to educate the public about the health relevance of climate change. |
| Chadwick 2016 | Health communication theorists, researchers, and practitioners are well positioned to aid in the mitigation of and response to climate change and its health effects. |
| EcoAmerica 2016 | Americans trust their doctors and other health professionals as sources of credible information on climate change. Health care providers and public health officials have the potential to reach and motivate a vast and diverse population of Americans to protect their health. |
| EcoAmerica 2016 | The combination of trust and reach, whether it's public health officials engaging communities or the doctor–patient relationship, presents a unique opportunity for health professionals to leverage their leadership and educate the public about climate change and health. |
| Koh 2016 | Clinicians have a powerful and unique opportunity to engage the nation by framing the crisis as a health imperative. |
| Depoux et al 2017 | Information regarding health risks associated with climate change should be framed as a public health threat and supplemented with recommendations and action items provided by experts. |
| Weathers et al 2017 (health frame) | people's health is already being harmed by climate change, and the magnitude of this harm is almost certain to get much worse if effective actions are not soon taken to limit climate change and to help communities successfully adapt to unavoidable changes in their climate. Therefore, public health organizations and professionals have a responsibility to inform communities about these risks and how they can be averted. |
| Weathers et al 2017 (risk / threat frame) | Public health professionals are uniquely positioned to explain how the rapidly emerging threats associated with climate change are connected with individual and community health. By communicating the potential of global climate change to harm human health—locally and elsewhere—and by conveying the potential to improve human health through actions that limit climate change and prevent human harm, health professionals can enhance public understanding of the full scope of the problem and help enable appropriate responses by individuals and communities. |
| Maibach & Kotcher 2018 | Health professionals and health organizations are the ideal messengers to be leading these public engagement efforts because doctors, nurses, pharmacists and other professionals are among the most trusted members of every community. |
| Maibach & Kotcher 2018 | Health messages about air pollution, climate change and fossil fuels—delivered repeatedly in clear terms by a variety of trusted health professionals—have great potential to help the public and policy makers understand what's really at stake. |
| Rudolph et al 2018 | Local Health Department (LHDs) have a professional and ethical responsibility to address the climate crisis. The role of LHDs is to apply the same foundational public health tools and approaches that are used to address any emergent health crisis, grounded in core public health values such as equity, prevention, and preparedness. |
| Maibach et al 2019 | Health professionals are among the people best positioned to make sure that the public and policy makers understand this. Carpe diem. |
| MacIntyre et al 2019 | Public health practitioners and decision makers are important intermediaries in Extreme Weather and Climate Change (EWCC) risk communications and provide necessary knowledge to motivate a healthy response to evidence of accumulating EWCC risks. |
| Maibach et al 2020 | If not us (health professionals), who? If not now, when? We are among the most trusted members of every society worldwide |

The need for building capacity

The scoping study found that health professionals are trusted voices to deliver climate change and health risk messages as discussed above. However, as one article asks, “Do they have the necessary knowledge, concern, and motivation?” (EcoAmerica 2016). The

scoping study identified that health professionals are aware of climate change (Maibach et al 2015, EcoAmerica 2016, Weathers et al 2017, Sustainability Victoria 2020), and some are reporting that they are already seeing climate health impacts in their practice and in their communities (Sustainability Victoria 2020). However, in the survey undertaken by Sustainability Victoria, only 30% indicated they were comfortable communicating about the health impacts of climate change or think they are sufficiently informed about the health impacts of climate change. Additionally, over 80% health professionals feel they need more information and training (Sustainability Victoria 2020).

The scoping study also shows that the general public do not link health and climate change (Akerlof 2010, De Bono et al 2010, Maibach et al 2015, Hathaway & Maibach 2018). Yet, they indicate they would like to know more about health impacts (Maibach et al 2010, Sustainability Victoria 2020), and the behaviours that will benefit health and also mitigate against climate change (Sustainability Victoria 2020).

The acknowledgement that there is a lack of knowledge from both health professionals and the community indicate that there is a need for better ways to educate, engage, communicate, and collaborate with health professionals and communities on climate change and health issues. However, to effectively communicate about climate change and health and disseminate their knowledge to other health professionals, communities, and policy makers, health professionals also need to build their capacity to do so and learn communication techniques and skills (Chadwick 2016, Maibach et al 2011).

Theme 3 - Communication Strategising and Planning

The third theme, communication strategising and planning, includes two sub themes: 1) understanding how to develop the message; and, 2) communication methods and tools. So far, the scoping study shows us that there is agreement in the literature that the starting point for climate and health messages is to use the climate change- health risk frame delivered by the trusted voice of health professionals, as this is more likely to reach and engage broader audiences than using others frames delivered by politicians, economists or scientists (Weathers et al 2017). However, there is diversity in the literature in how to design a message. A broad range of theories that can be used to underpin or test the design, and many different modes to deliver it. There is however an implicit agreement that creating the messages requires some strategising and planning. Fourteen articles describe communication strategies, engagement, or 'exposure' plans (Myers et al 2012, Chadwick 2016, EcoAmerica 2016, Koh 2016, Maibach et al 2016, Rudolph et al 2016, Depoux et al 2017, Weathers et al 2017, Hathaway & Maibach 2018, Maibach et al 2018, MacIntyre et al 2019, Maibach et al 2019 Matlock et al 2019, Corners et al 2020).

Understanding how to develop the message

This scoping study included seven guidelines and education resources that introduce climate change, discuss health impacts and provides a range of communication strategies, tips, and techniques. The guidelines vary from including a brief introduction to climate change and common vocabulary used (Chadwick 2016), to providing detailed outlines of communication strategies around individual climate change risks. For example, how to communicate with communities during bushfires (Rudolph et al 2018). Table 6 provides a summary of some of the recommendations discussed in the education resources and guidelines.

Table 6 A summary of recommendations outlined in the scoping study literature education resources and guidelines

| Author | Key steps outlined in the guideline/ education resource |
|---------------------|--|
| Chadwick 2016 | <p>5 roles for Health communicators in communicating climate change and health:</p> <ol style="list-style-type: none"> 1. Understanding communicative processes that lead to change and resistance to change, such as responses to media coverage and frames including risk perceptions, predictors of information seeking, drivers of information sharing and predictors of behaviour. 2. Identify and apply the most effective messages strategies (e.g., types of appeals, visuals, channels, sources, etc.) for target audiences 3. Assist in the preparedness of health systems to respond to climate change effects 4. Play a role in the translation of communication and physical sciences to public health and government decision makers, practitioners, and lay audiences 5. Apply intergroup, intercultural, and organizational theories to deliberations and decision making at many levels that focus on climate change and its health effects. |
| Corner et al 2020 | <p>Seven recommendations for communicators and practitioners working to engage the public on climate risks and adaptation:</p> <ol style="list-style-type: none"> 1. Climate change concern is at an all-time high, and adaptation policies are supported across the political spectrum these are important starting points for public engagement 2. Climate impacts are increasingly salient, with a surge in concern around extreme heat - this opens up a new front for public engagement 3. Climate change is getting 'closer to home' - show how climate risks are relevant to people's lives by relating them to widely-shared values, and build efficacy by making the link to constructive solutions 4. Framing messages - concerns about mitigation and adaptation reinforce each other and are perceived as two sides of the same coin 5. Health risks, wellbeing and adaptation - make the connection and frame messages in this way, but don't assume much existing knowledge 6. Climate conversations need to go beyond discussions of emissions targets - a 'just transition' applies to adaptation as well 7. From concern to commitment - deepening public engagement on climate change is the challenge ahead |
| ecoAmerica: (2016). | <p>•15 steps: how to create your own message</p> <ol style="list-style-type: none"> 1. Start with people, stay with people: 2. Connect to common values 3. Acknowledge ambivalence- Respect their viewpoint and allow them their own space 4. Make it real 5. Emphasise solutions 6. Inspire and empower 7. Focus on personal benefit 8. End with your ask- 9. Sequence matters |

| | |
|---------------------|---|
| | <ul style="list-style-type: none"> 10. Describe, don't label 11. Have at least 1 powerful fact from a trusted messenger 12. Ditch doom and gloom 13. Use stories to strengthen engagement 14. Stay above the fray 15. Message discipline is critical |
| Maibach et al 2011 | <p>Four key points:</p> <ul style="list-style-type: none"> 1. Climate change is real, and human caused. 2. Climate change is bad for us and for our community in a number of ways. 3. We need to start taking action now to protect the health of our community's most vulnerable members — including our children, our seniors, people with chronic illnesses, and the poor — because our climate is already changing and people are already being harmed. [Our top priorities for protecting people's health from our changing climate are (here you list your organization's top three priorities). 4. Taking action creates a "win-win" situation for us because, in addition to dealing with climate change, most of these actions will benefit our health too. |
| Maibach et al 2020 | <p>Five key messages:</p> <ul style="list-style-type: none"> 1. The health harms of climate change and air pollution are happening now. 2. We must take immediate action to protect our communities. 3. Prevention offers the most powerful protection against future harms. 4. Preventive actions will create immediate health and economic benefits. 5. We must double our commitment to reducing carbon pollution—and then live up to it. |
| Rudolph et al 2016 | <p>Climate and health messages: <i>Environmental Trigger + Solution + Values + Scientists Agree = Climate and Health Message</i></p> <ul style="list-style-type: none"> 1. Establish or trigger an "environmental frame" to remind people that our health and well-being depend on clean air and water, healthy food, and a stable climate. 2. State your values to allow people to connect your message with shared values such as fairness, opportunity, protection, preparedness, equality, responsibility, leaving the world a better place for our children. 3. State the problem and solution clearly so that your audience understands the need for unified societal action, and specifically what you want them to do and when you want them to do it. 4. Affirm that scientists agree that climate change is real, human caused, harmful, and solvable. |
| Weathers et al 2017 | <p>3 Simple messages:</p> <ul style="list-style-type: none"> 1. There is scientific consensus about human-caused climate change 2. Climate change is harming people's health everywhere 3. Actions will limit climate change and make communities healthier |

The guidelines build on the work of Anthony Leiserowitz and agree on core elements as per Leiserowitz: "It's real. It's us. It's bad. Scientists agree. There's hope". (Leiserowitz et al 2015 cited in Rudolph et al 2016). What has now been added to this list are shared values, framing messages around familiar risks, using shared experiences to establish 'common ground' for climate conversations (EcoAmerica 2016, Corner et al 2020), and the essential use of consistent evidence base facts delivered by a trusted voice (EcoAmerica 2016) that are repeated often (EcoAmerica 2016, Maibach & Kotcher 2018, Rudolph et al 2018, Corner et al 2020). The concept of hope, or providing a solution, and ditching the doom and gloom (EcoAmerica 2016) also aligns with the concept of building efficacy by making the links to constructive solutions (Corner et al 2020). The concept of solutions also links with co-benefits and this is discussed further in Theme 5. As there are many other competing message priorities in the news or in politics (Corner et al. 2020), the timing of the message needs to be carefully considered. Corner et al (2020) observe that in the UK there is a

heightened awareness of climate risk at the moment, presenting an opportunity to draw on a common currency of peoples' experiences of heatwaves or floods.

Communication methods and tools

In their study evaluating risk communication, MacIntyre et al (2019) found eight risk communication practices. These practices were also found in this scoping study with most alignment for: community based scenarios participation (n=11), print material (n=11), social media (n=10), and participatory management strategies (n=7). In addition to the original eight communication practices identified by MacIntyre et al, this scoping study found an additional four types of communication practices that may be specifically useful for climate change and health risk messaging. These include the trusted voice (n=20) (as previously discussed in Theme 1), theory informed practices (n=21), narratives and storytelling with real peoples' stories and experience (n=10) and visual tools such as imagery, video, posters, interactive exhibits, numerical charts (n=10).

Communication platforms and tools- What is clear from this scoping study is that communicating about climate change and health requires a pluralist approach as no single communication strategy or message can incorporate all of the information about climate change or its health impacts (Rudolph et al 2018). This means for effective communication, this requires a multidimensional approach, that uses multiple platforms to deliver the message, and draws on knowledge that is interdisciplinary, intersectoral and community informed (Rudolph et al 2018). There is consensus in the literature that a multidimensional approach with multiple- platforms are part and parcel of the communication delivery process and include print material, radio, television, social media, community events and meetings, worship services, and other venues (Chadwick 2016, Rudolph et al 2018, MacIntyre et al 2019).

Despite the fact that we are living in the digital age, only ten articles mention social media platforms. Of these, three mention social media in general terms (EcoAmerica 2016, Weathers et al 2018, MacIntyre et al 2019), two mention social media in terms of the value it has when providing visual content (Kotcher et al 2019 and Corners et al 2020), and two provide examples of how social media can be used (Maibach et al 2011 and Rudolph et al 2018). For example, an alert system to send out text messages in multiple languages for flood warnings, heat waves or high pollen days (Rudolph 2016). In terms of social media platforms, only three mention Twitter (Maibach et al 2011, Myers et al 2012, Depoux et al 2017), and two mention Facebook (Maibach et al 2011, Connors et al 2020). Even though the scoping study found eight education guideline resources, none of the resources provide guidance on how to write risk messages for use on social media.

Narratives and storytelling - Surveys have been used to test out communication theories and hypotheses and this scoping study included eight articles using surveys. However, what is emerging is that alongside the surveys, people's interpretations of their experiences and their real life story need to be captured and communicated to make the issue real, and resonate with people's values, cultural differences, and local or regional climate conditions (Akerlof et al 2010). Storytelling includes "stories of self", and the "stories of us and now" drawing on shared values and experiences, (Malena-Chan 2016) creating empathy and opening people to new perspectives (EcoAmerica 2016). This storytelling approach makes a connection with audiences on a personal level making it easier to understand (Matlock et al 2019). Personal experience seems to be a key factor in elevating risk perceptions about climate health risks, such as heat events (Corners et al 2020). Additionally, when people see climate change as a local issue, they are more likely to describe it as a personal issue (Rudolph et al 2018). Another form of storytelling outlined in the scoping study is the use of essays as part of experimental research when testing a communication hypothesis. Typically, a story about a climate change issue is put into a short essay format and research participants are then asked questions either by survey or interview about the content. Using this approach, researchers found more interest in less familiar and more emotionally engaging issues, such as food-, water-, and vector-borne illnesses (Kotcher et al 2018). See example of an essay used by Maibach et al (2011) in Box 3.

Visual tools: In addition to the public media (public media, television, web-based) or print material (facts sheets and brochures) as listed in McIntyre et al (2019), this scoping study found that visual tools provided an additional unique opportunity to communicate climate health risk messages.

Using visual language enables the audience to see themselves in the solutions (EcoAmerica 2016), and help people join the dots visually for issues that are not yet salient in the public mind (Corner et al 2016). Visual tools included the use of 'real people' (Kreslake et al 2016, Rudolph et al 2018, Matlock et al 2019, Corner et al 2020) in fact sheets (Matlock) posters (Kreslake et al 2016) and positive images of people in the community demonstrating solutions in action (Rudolph et al 2018), or real people that have been affected by droughts, floods, wildfires, and storms (Rudolph et al 2018, Corner et al 2020). In developing other types of visual resources (e.g. slides, social media content). Corner et al's (2020) advice is to be careful to avoid 'classic' heatwave imagery where everyone looks like they are having fun in the sun. They advise to seek out images that show the human impacts of heat-stress and drought. Akerlof et al (2020) also found that public health videos made by government agencies to raise awareness of climate and health issues moved people from fear to efficacy. Kotcher et al (2018) suggest using episodic frames (e.g., focusing on concrete events or individuals) and 'visual stimuli' to increase the

strength and durability of framing effects. Other forms of visual tools included a mix of narrative and numerical data (in the form of graphs or charts) are useful to provide balanced climate evidence (Perlata et al 2017).

Perhaps the most unique visual communication tool identified in this scoping study are the strategies used in Lundgren et al's (2019) participatory study. This pilot study was a qualitative exercise that sought to engage a museum audience in a Science Café style format in the designing of a climate change and health exhibit at the museum. The researchers used different types of visual aids to encourage participation and these included interactive air quality maps, developing the 'our community action plan' and the use of visitor comment cards. The 'our community action plan, 'feedback card had 3 components to it: We want to protect (insert the issue); By (insert the action) and With (insert who will do the action). One example of a community card included in the paper said this: We want to protect: our drinking water. By: starting a carpool. With: Our neighbours. The feedback cards were displayed as part of the exhibit.

Box SEQ Box 1 ARABIC 3 Essay example provided by Maibach et al 2011*

Essay Example: Explanation of the Public Relevance of Climate Change

Global Warming is a Threat to Peoples' Health & Wellbeing

Most people agree with the sentiment that "good health is a great blessing." Although not yet widely known, global warming poses a very real threat to the health and wellbeing of Americans and other people around the world. Experts at the World Health Organization say that global warming is already leading to an increase in the rate of some diseases and is causing many **deaths**. **If our government and other governments around the world do not soon take steps to limit global warming, a growing number of people in the United States will likely be harmed and killed.** Conversely, if our government does take steps to limit global warming, our health and wellbeing will likely improve in a number of important ways.

Our health will suffer if we don't take action. Global warming can harm people both directly and indirectly. Directly, global warming causes more extreme weather patterns including more frequent heat waves, more violent storms, and rising sea-levels — all of which can lead to people being harmed or killed. Indirectly, global warming harms the quality of our water, air and food, and our ecosystems, all of which can lead to increasing rates of disease and death. If we do not act now to limit global warming, experts at the U.S. Centers for Disease Control and Prevention say that global warming will harm people in every region of the United States. As a result of the poor air quality caused by global warming, children will become more likely to develop asthma, and the asthma they suffer from will be more severe; adults who have heart and lung diseases will become more likely to be hospitalized or die from their illness. An increasing number of extreme heat waves, floods, storms, fires and droughts caused by the changes in our climate will lead to more people being injured or killed. New infectious diseases (such as West Nile Virus) and old infectious diseases that we had previously eradicated from the United States (such as malaria and Dengue Fever) are likely to become an increasing problem for us as our climate warms.

Our health will benefit if we do take action. According to a recent study published in the medical journal *Lancet*, taking actions to limit global warming — by making our energy sources cleaner and our cars and appliances more efficient, by making our cities and towns friendlier to trains, buses, and bikers and walkers, and by improving the quality and safety of our food — will improve the health of almost every American. Cleaner energy sources and more efficient use of energy will lead to healthier air for children and adults to breathe. Improving the design of our cities and towns in ways that make it easier and safer to get around on foot, by bike, and on mass transit will reduce the number of cars on our roads and will help people become more physically active and lose weight. Increasing our consumption of fruits and vegetables, and reducing our intake of meat — especially beef — will help people maintain a healthy weight, will help prevent heart disease and cancer, and will play an important role in limiting global warming.

Theory informed communication practices- Whilst analysing the articles and looking for common themes, the use of theoretical frameworks, perspectives and models emerged. MacIntyre et al (2019) identified in their research that there is a lack of theoretical perspectives to underpin risk communication evaluation. Just over a third of the articles included in this scoping study refer to a theoretical framework of some kind, the most common being framing theory, (as previously been discussed in Theme 1) (Akerlof et al 2010, De Bono 2010, Maibach et al 2010 Maibach, Myers et al 2012, Chadwick 2016, Kreslake et al 2016, Rudolph et al 2016, Weathers et al 2017, Kotcher et al 2019, Malena-Chan 2019, Corner et al 2020) followed by audience segmentation (Akerlof et al 2010, Maibach et al 2010, Myers et al 2012, Van den Bergh & Pillay 2015, Chadwick 2016, Weathers et al 2017, Kotcher et al 2019). Other theories include: the loss/gain frame (Connor et al 2016), diversity effects (Kary et al 2018), Motivated Reasoning Theory (Perlata et al 2017), Behaviour Adaptation Model (Matlock et al 2019) Narrative Methodology (Malena-Chan 2016), Cost benefit (Karlsson et al 2020) and Participatory theory (Lundgren et al 2019).

Community engagement and participation: The scoping study found agreement in the literature about the integral role that community engagement and participation has in communicating about climate change and health risks. As Chadwick (2016) identifies, the communication process goes beyond thinking about the media and involves active participation strategies with the community and key stakeholders. As Rudolph et al (2018) point out, the central tenet of patient-centred health care is “nothing about me without me,” and in public health, “community residents must be included in decisions that affect community health”.

Engagement and participation is a two way process (Maibach et al 2010, Peralta et al 2017, Weathers et al 2017, Lundgren et al 2019, Matlock et al 2019), and is particularly important for sharing risk communication, identifying mitigation and adaptation barriers and enablers (Chadwick 2016). Community engagement in identifying hazard maps around specific threats as part of community climate change scenario planning has also been found to be an effective method of raising public awareness while fostering the active participation of the community, collaboration among key actors, and enhancing self-efficacy (MacIntyre et al 2019). Other engagement strategies include using qualitative methods (e.g., surveys, interviews, focus groups) (Rudolph et al 2018) or partnering with civic organizations in communication research and testing out messages to help evaluate their ecological validity (Kotcher et al 2019). Community participatory planning processes that also use storytelling networks are also useful ways to include the community in climate risk mitigation and adaptation planning (MacIntyre et al 2019), and can also assist with the identification of

indicators for climate and health vulnerability assessments and in data collection and interpretation (Rudolph et al 2018).

In line with the communication practices identified by MacIntyre et al (2019) participation activities also included public events, forums, presentations or workshops (Maibach et al 2011, Rudolph et al 2018, Lundgren et al 2019, Matlock et al 2019, Corner et al 2020), hazard mapping (Rudolph et al 2018, MacIntyre et al 2019), and community based scenarios (Maibach et al 2010, Maibach et al 2011, Myers et al 2012, Weathers et al 2017, Hathaway & Maibach 2018, Kotcher et al 2018).

Additional community engagement and participation strategies that are structured participatory activities include community science/ citizen science projects (Rudolph et al 2018), citizen assemblies (Corner et al 2020), community dialogues (Corner et al 2020), community deliberation and democratic dialogue (MacIntyre et al 2019), and social movements such as Extinction Rebellion and Fridays for Future (Corners et al 2020). Chadwick (2016) also includes incorporating intergroup, intercultural, and organisational theories as part of the deliberation and decision making process so that climate change and its health effects can be understood from many levels.

Theme 4: Vulnerability factors

This fourth theme describes vulnerability factors and provides a definition of vulnerability, identifies who or what is vulnerable, and suggests in the literature how to address communication strategies for vulnerable factors including the concept of equity, justice and fairness. For effective risk communication, vulnerability factors must be considered (MacIntyre et al 2019). In this scoping study, one article (Chadwick 2016) provides a definition of vulnerability as per the IPCC's definition of vulnerability to climate change which is the:

“propensity or predisposition to be adversely affected” and includes sensitivity or susceptibility to harm as well as inability to cope with and adapt to hazards (IPCC, 2014a, p.1775).

Chadwick summarises vulnerability as a combination of vulnerability and exposure to hazards (Chadwick 2016).

Although it is recognised in the scoping study that everyone is vulnerable to, and will be impacted by, climate change (Koh 2016, Rudolph et al 2018), it is also recognised that there are certain people, places and systems that are more exposed to risk or have limited capacity or resilience to address the risk (Chadwick 2016, EcoAmerica 2016). Vulnerability factors also bring in concepts of fairness (Corner et al 2020) and justice (Malena-Chan 2016, Rudolph et al 2018, Corners et al 2020) and equity (Rudolph et al 2018). It is the most

vulnerable, predominantly from the most socially disadvantaged groups, that tend to have a lower socioeconomic status, poor housing and poor living conditions and lower education levels, that will be most impacted by climate change (Van den Bergh & Pillay 2015). The climate change health at-risk population can have co-occurring vulnerability factors that increase their risk for illness, injury or death from environmental conditions such as extreme heat, air pollution, and stress (Koh 2016) particularly if they lack financial, social or community support (Kreslake et al 2016). Therefore, climate change exacerbates local and global inequities and this requires community engagement that is inclusive, transparent, and accountable (Rudolph et al 2018) to ensure there is a 'just transition' and 'just adaptation' (Corners et al 2020) for everyone.

As discussed previously, community participation and engagement is a key part of communicating about climate change- health risks. However, despite people from low income communities or communities of colour [sic] being in the at-risk groups, they are under-represented in decision making that impacts their health and climate resilience (Rudolph et al 2018). Therefore community participation events that include these vulnerable groups need to be carefully managed with a recognition of the power dynamics between community members and government employees, people of colour [sic] and White people, and people with different educational and socioeconomic backgrounds (Rudolph et al 2018). Rudolph et al (2018) suggest using localised vulnerability assessments that include both health and social inequities to determine the impact, vulnerability, adaptive capacity measures to recover after a climate-related event. Adaptive capacity measures might include the ability to cope, mitigation activity required, or adaptation activity (Rudolph et al 2018).

When using risk communication itself, it is important to show the 'risk audience' how they might benefit from an activity that might affect them, giving them behaviour adaptation strategies (Matlock et al 2019), and building self-efficacy and a sense of danger control (Kreslake et al 2016). The messages need to be culturally appropriate, available in multiple languages and in low literacy formats (Rudolph et al 2018). Giving positive solutions as part of the message is what Kreslake et al (2016) suggest is the key factor in risk communication and people need a sense of efficacy (individual or collective) as the basis for them to be open to messages about the climate change health risk threat (Kreslake et al 2016).

Vulnerability factors are highly contextual with environmental, social, and geographical variables for example, where you live and the pre-existing burden of disease, increases the vulnerability factors (Rudolph et al 2018). For example, farmers, migrant outdoor workers, and prison populations are more vulnerable than others to seasonal climate sensitive diseases, such as Valley Fever (or Coccidioidomycosis), a fungal respiratory disease, in the Southwestern United States (Matlock et al 2019). City residents and city infrastructure also

have their own unique climate change vulnerabilities to extreme heat due to the heat island effect (Maibach et al 2011; Chadwick 2016, Hathaway & Maibach 2018). In this scoping study the top four vulnerable groups are children, the elderly, the poor /people living on low incomes, and the sick or chronically ill. Table 7 provides a list of vulnerability factors identified in the scoping study.

Table 7 Vulnerability factors identified in the scoping study literature

| Vulnerability factor | Number of articles | Authors |
|--|---------------------------|---|
| Elderly | 15 | Akerlof et al 2010, Maibach et al 2011, Maibach et al 2015 Van Den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Kreslake et al 2016, Weathers et al 2017, Kotcher et al 2018, Hathaway & Maibach 2018, Maibach & Kotcher 2018, Rudolph et al 2018, Kotcher et al 2019, Corners et al 2020, Maibach et al 2020 |
| Children | 15 | Akerlof et al 2010, Maibach et al 2011, Van den Bergh & Pillay 2015, Maibach et al 2015, EcoAmerica 2016, Kreslake et al 2016 Chadwick 2016, Weathers et al 2017, Hathaway & Maibach 2018, Maibach & Kotcher 2018, Rudolph et al 2018, Kotcher et al 2018, Kotcher et al 2019, Corners et al 2020, Maibach et al 2020. |
| Poor/ low income | 15 | Maibach et al 2010 Maibach et al 2011, Maibach et al 2015, EcoAmerica 2016, Kreslake et al 2016, Weathers et al 2017, Hathaway & Maibach 2018 Kotcher et al 2018, Maibach & Kotcher 2018, Rudolph et al 2018, Kotcher et al 2019, MacIntyre et al 2019, Corners et al 2020, Maibach et al 2020 |
| Poor health / chronically ill / pre-existing health conditions | 13 | Akerlof et al 2010, Maibach et al 2011, Maibach et al 2015, Van den Bergh & Pillay 2015, Chadwick 2016, EcoAmerica 2016, Kreslake et al 2016, Hathaway & Maibach 2018, Kotcher et al. 2018, Rudolph et al 2018, Kotcher et al 2019, Maibach et al 2020 |
| People with disabilities | 4 | Maibach et al 2011, Hathaway & Maibach 2018, Rudolph et al 2018, MacIntyre et al 2019 |
| Outdoor workers | 4 | Chadwick 2016, Hathaway & Maibach 2018, Rudolph et al 2018, Matlock et al 2019 |
| Racial/ ethnic / | 4 | Maibach et al 2010, Kreslake et al 2016, Rudolph et al 2018, MacIntyre et al 2019 |
| Poor Housing / poor living conditions | 4 | Maibach et al 2010, Van den Bergh & Pillay 2015, Rudolph et al 2018 Sustainability Victoria 2020 |
| Urban environments / cities | 4 | Maibach et al 2011, Chadwick 2016, Rudolph et al 2018, Karlsson et al 2020 |
| Farmers | 3 | Rudolph et al 2018, Matlock et al 2019, MacIntyre et al 2019 |
| Geography (low lying coastal wildland-urban interface/coastal communities/ flood Prone areas | 3 | Van Den Bergh & Pillay 2015, EcoAmerica 2016, Rudolph et al 2018, |
| Indigenous/ Tribal communities | 3 | Maibach et al 2010, Van den Bergh & Pillay 2015, Rudolph et al 2018 |
| People of colour | 3 | Maibach et al 2015, EcoAmerica 2016, Maibach et al 2019 |
| Women / Pregnant women | 3 | Van den Bergh & Pillay 2015, Hathaway & Maibach 2018, Rudolph et al 2018 |
| Health care system | 2 | Rudolph et al 2018, Akerlof et al 2020 |
| Gender | 2 | DeBono et al 2010, Kreslake et al 2020 |
| Immunosuppression | 2 | Van den Bergh & Pillay 2015, Rudolph et al 2018 |
| Migrant workers | 2 | Rudolph et al 2018, Matlock et al 2019 |
| Infrastructure | 2 | Rudolph et al 2018, Karlsson et al 2020 |
| Poor countries / regions | 2 | Van den Bergh & Pillay 2015, Hathaway & Maibach 2018 |
| Rural remote | 2 | Rudolph et al 2018, MacIntyre et al 2019 |
| Young people | 2 | Rudolph et al 2018, Sustainability Victoria 2020 |
| First responders | 1 | Rudolph et al 2018 |
| Homelessness | 1 | Rudolph et al 2018 |
| Living alone | 1 | Maibach Nisbet and Baldwin |
| Prisoner populations | 1 | Matlock et al 2019 |

Co-benefits

The last theme, co-benefits, is about the need to provide solutions and the win-win scenarios. Maibach et al (2011) indicate that when undertaking health risk messaging, solutions must be provided, and this makes co-benefits an integral component of the climate change-health risk communication. Using health risks and wellbeing frames with mitigation and adaptation co-benefits are also useful in helping people make the connection that to address one is to address the other, two sides of the same coin (Corner et al 2020).

Although co-benefits are a dominant theme in this scoping study, only one article (Chadwick 2016) provides a definition. Chadwick (2016) describes co-benefits as “positive effects an action aimed at one objective (e.g. decreasing greenhouse gas emissions) has for other objectives (e.g., reducing health risks)” (Chadwick 2016). Essentially co-benefits create a “win-win” situation because, in addition to dealing with climate change, most of the actions benefit health too (Maibach et 2011, Rudolph et al 2018) resulting in the double dividend, ancillary benefits or co-impacts (Karlsson et al 2020). Co-benefits for health are the prevention of illness, protection against injury, illness and death, and building resilience and social capital (Maibach et al 2011, Rudolph 2018).

Karlsson et al (2020) also refers to co-benefits as the ‘triple win’. For example, a ‘triple-win’ is gained by replacing car trips with biking or walking, that enhances personal fitness and improves air quality in addition to reducing GHG emissions (Karlsson et al 2020). Therefore, using cleaner renewable energy sources, with improved urban designs can facilitate safe public and active transport and this simultaneously addresses climate change risk and health risks such as obesity, physical inactivity, heart disease and transportation-related injuries and death (Maibach et al 2010, Maibach et al 2011). Mitigation strategies to reduce greenhouse gas emissions also reduce energy consumption at work and home, decrease reliance on carbon intensive fuels, and improve fuel economy (Koh 2016). Essentially this translates to “Climate solutions are health solutions, and health solutions are economic solutions” (Maibach et al 2020).

Connors et al (2016) examined which climate change and health messages are shared in social media networks. They found that messages about gains (the benefits) from mitigation survived more than the loss frames (the costs of non-mitigation) in initial communications. However, the loss frame messages survived more later in communication chains (Connor et al 2016). This suggests that a mix of gain and loss frames are needed for the message to first penetrate the social media network, and then for it to last, followed up with a loss frame presenting the other side of the argument, the cost of inaction.

With regards to using quantified facts on co-benefits for climate change – health risk messages, Karlsson et al (2020) discovered in their literature review exploring co-benefits

research in policy, that co-benefits are well-researched in areas of air quality and health. The health studies are mostly reported in terms of deaths avoided e.g. particle related deaths that may have occurred due to greenhouse gas emissions. However, as Karlsson et al report, despite the evidence of co-benefits in these areas being found to be substantial, “often equalling or exceeding mitigation costs”, the authors found that co-benefits are seldom considered in policy decision-making. Van den Bergh and Pillay (2015) support this and also report that the true health costs/ damages are not taken into account in most climate change cost modelling studies. Therefore, the indirect impacts of climate change on labour productivity and demand for health care are not specifically measured or addressed and as a result health costs are underestimated (Van der Bergh & Pillay 2015). Karlsson et al also found that in several areas, such as diet, economic performance and energy security, co-benefits are sparsely researched. However, articles in the topic areas they did find suggested that the results were promising and are pointing to ‘high values’ (Karlsson et al 2020).

The Karlsson et al (2020) report quantified co-benefits for a broad range of climate -health issues that can be used to emphasise the ‘win- wins’. Some of their findings include: implementing climate mitigation packages / policy reduces costs (e.g. EUR 250 billion annually by 2050); green buildings reduce air pollution and create energy savings (an estimated USD 13.3 billion); GDP effects on carbon tax enhances welfare; wind power and solar energy investments can increase GDP (example given are the estimated air quality co-benefits of wind power alone are worth 0.46% of GDP in Northwest China); and, health co-benefits and air quality and dietary changes decrease health care expenditure (Karlsson et al 2020). Other examples include the fact that improving air quality results in more deaths avoided (estimates from .64-4.92 million), a decreased health burden from respiratory diseases (asthma, allergens), and increased days at work from health improvements. Karlsson et al’s study found that co-benefits are not measured in a consistent way, some measure Years of Life Lost, Lives saved, deaths avoided, or Disability Adjusted Life Years (DALYS); cost savings, GDP effects, modelling scenarios using different measures of greenhouse gas emissions or survey data. Each approach yields different results that can add to the strength of co-benefits but does limit comparisons. It is Karlsson et al’s view that articles that compare monetary valuations of co-benefits to mitigation costs, as percentage of mitigation costs or USD/tCO_{2e} are easier to compare across policy fields and geographies (Karlsson et al 2020).

Karlsson et al (2020) categorised the co- benefits in their study as co-benefits for diet and physical activity, soil and water quality, biodiversity, economic and organisational performance, and energy security. In this scoping study, though not quantified, an additional

fourteen co-benefits are referred to in the included literature (see Table 8). Examples include co-benefits for cleaner and safer energy (Maibach et al 2011, Koh 2016, Weathers et al 2017, Rudolph et al 2018, Hathaway & Maibach 2018, Lundgren et al, 2019 Matlock et 2019, Akerlof et al 2020, Karlsson et al 2020 Maibach et al 2020), and sustainable clean energy will create new employment, traineeships and business opportunities (Rudolph et al 2018, Karlsson et al 2020), society benefits with reduced social dysfunction, more social capital and social stability, (Malena-Chan 2016, Weathers et al 2017, Hathaway & Maibach 2018, Rudolph et al 2018, MacIntyre et al 2019, Matlock et al 2019, Corner et al 2020) and cleaner air (Maibach et al 2011, Koh 2016, Weathers et al 2017, Rudolph et al 2018, Hathaway & Maibach 2018, Lundgren et al, 2019 Matlock et 2019, Akerlof et al 2020, Karlsson et al 2020 Maibach et al 2020) and water (De Bono et al 2010, Maibach et al 2011, Van den Bergh & Pillay 2015, Weathers et al 2017, Hathaway and Maibach 2018, Kotcher et al 2018, Lundgren et al 2019, Karlsson et al 2020).

Table 8 Co-benefits identified in the scoping study literature

| Co- Benefit measures | Number of articles | Author/s |
|--|---------------------------|--|
| Air Quality/ cleaner air | 10 | Maibach et al 2011, Koh 2016, Weathers et al 2017, Rudolph et al 2018, Hathaway & Maibach 2018, Lundgren et al, 2019 Matlock et 2019, Akerlof et al 2020, Karlsson et al 2020 Maibach et al 2020 |
| Cleaner Energy /Safer Energy | 9 | Maibach et al 2011, Van den Bergh & Pillay 2015, Weathers et al 2017 Hathaway & Maibach 2018, Kotcher et al 2018, Maibach &Kotcher 2018, Kotcher et al 2019, Maibach et al 2019, Karlsson et al 2020 |
| Water quality | 8 | De Bono et al 2010, Maibach et al 2011, Van den Bergh & Pillay 2015, Weathers et al 2017, Hathaway and Maibach 2018, Kotcher et al 2018, Lundgren et al 2019, Karlsson et al 2020 |
| Societal benefits | 7 | Malena-Chan 2016, Weathers et al 2017, Hathaway & Maibach 2018, Rudolph et al 2018, MacIntyre et al 2019, Matlock et al 2019, Corner et al 2020 |
| Diet, healthier food, food security | 7 | Maibach et al 2011, Van den Bergh & Pillay 2015, Weathers et al 2017 Maibach & Kotcher 2018, Rudolph et al 2018, Akerlof et al 2020, Karlsson et al 2020 |
| Physical activity | 6 | Maibach et al 2011, Weathers et al 2017, Rudolph et al 2018, Lundgren et al 2019, Akerlof et al 2020, Karlsson et al 2020 |
| Injury prevention / less accidents/ safety | 5 | Maibach et al 2011 Van Den Bergh & Pillay, Weathers et al 2017 Lundgren et al 2019, Karlsson et al 2020 |
| Urban design | 5 | Maibach et al 2011, Weathers et al 2017, Rudolph et al 2018, Akerlof et al 2020, Karlsson et al 2020 |
| Biodiversity | 4 | Maibach et al 2011, Weathers et al 2017, Rudolph et al 2018 Karlsson et al 2020 |
| Energy security | 4 | De Bono et al 2010, Maibach et al 2011, Van den Bergh & Pillay 2015, Karlsson et al 2020 |
| Better health / wellbeing | 4 | Maibach et al 2011, Van den Bergh & Pillay 2015, Weathers et al 2017, Rudolph et al 2018 |
| Mental health / wellbeing | 3 | Weathers et al 2017, Rudolph et al 2018, Karlsson et al 2020 |
| Economic | 3 | Maibach et al 2011, Maibach et al 2020, Karlsson et al 2020 |
| Soil quality | 3 | Rudolph et al 2018, Karlsson et al 2020, Maibach et al 2020 |
| Health care costs | 3 | Weathers et al Kotcher et al 2018 Karlsson et al 2020 |
| Community resilience | 3 | Weathers et al 2017, Rudolph et al 2018, Corners et al 2020 |
| Employment | 2 | Rudolph et al 2018 Karlsson et al 2020 |
| Increase equity | 2 | Weathers et al 2017, Rudolph et al 2018 |
| Improved welfare systems | 1 | Karlsson et al 2020 |

Limitations

The Arskey and O'Malley (2005) scoping study framework suggests having a team of researchers to assist with data collection and analysis. However, due to limited available time and human resources this scoping study had a very small team. Therefore, a pragmatic decision was made to limit the search strategy to a manageable one database. In doing so this limits the amount of literature that could have been reviewed. The use of a qualitative theoretical perspective to identify themes can also produce bias in the analysis process. To triangulate this, the scoping study team will present the preliminary findings from this scoping study to key stakeholders, as per stage 6 of the Arskey and O'Malley framework. Other limitations of this study relate to the limited number of articles generally about evaluating effective climate change and health communication. There is a paucity of Australian based studies and most of the articles in this scoping study are from the USA (and one main research team). Therefore, their work has a heavy influence on the results of this scoping study.

Conclusion

This scoping study sought to answer the research question, 'What does the literature tell us about effective ways to communicate about climate and health?'. Results from this study highlight that an effective way to communicate about climate and health is to use a climate change- health risk frame. Climate change health risk messages need to have a short-term focus that outlines the issue, who is at risk and what they can do for protection, in the same way that risk communication messages are used during extreme weather events. Second, that the climate change- health risk frame is best delivered by the trusted voices of health professionals and health organisations. Messages can be variations of this kind of approach: It's real—i.e., climate change is real. It's us—i.e., climate change is human-caused, Experts agree—i.e., there is consensus among climate scientists that human-caused climate change is happening. It's bad—i.e., climate change is harmful to people. There's hope—i.e., human actions can limit climate change.

However, the scoping study also highlighted that although there is a basic level of awareness of climate change risks amongst health professionals and the public, more education and capacity building is required to enable and empower health professionals to understand and communicate the issues about the health impacts; and for the public to be able to understand and act on the information presented to them.

To be effective climate change health risk messages require some strategising and planning, and this requires a detailed understanding of the climate change and the environmental and human health impacts, the local context, demographic profile, and

political landscape, and vulnerability factors. This scoping study found several education resources and guidelines are available that can assist health professionals to gain an understanding about climate change vocabulary, and provide communication tips and techniques.

To be effective, all climate change health risk messaging must include co-benefit messages that underline the win-wins of taking mitigation and adaptation action and build individual and collective efficacy and emphasise that “Climate solutions are health solutions, and health solutions are economic solutions” (Maibach et al 2020).

Finally, the scoping study also reinforces the need for a pluralistic approach and using a wide range of communication tools and platforms, including social media, print material, community events, presentations, and workshops. Finally, scoping also showed the usefulness of narratives and storytelling, and visual communication tools. This included novel ways to engage the public in interactive activities in museums and purposeful community engagement and participatory strategies such as deliberative dialogues, community or citizen science, and citizen assemblies.

References

- Akerlof, K et al (2010) Public Perceptions of Climate Change as a Human Health Risk: Surveys of the United States, Canada and Malta. *Int. J. Environ. Res. Public Health*, 7, pp-2559-2606; doi:10.3390/ijerph7062559
- Akerlof, K et al (2020) Governmental Communication of Climate Change Risk and Efficacy: Moving Audiences Toward “Danger Control” *Environmental Management*, 65:678–688
- Arksey H, O’Malley L (2005) Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology: Theory & Practice*, vol. 8(1) pp. 19-32
- Chadwick, A (2016) Climate Change, Health, and Communication: A Primer. *Health Communication*. Vol. 31, NO. 6, 782–785 <http://dx.doi.org/10.1080/10410236.2014.1002030>
- Climate Council. What is climate change? Available from: <https://www.climatecouncil.org.au/resources/what-is-climate-change-what-can-we-do/> <accessed 5th May 2020>
- Connor, P et al (2016) Interpersonal communication about climate change: how messages change when communicated through simulated online social networks. *Climate Change* 136: 463-476 DOI 10.1007/s10584-016-1643-z
- Corner, A., Demski, C., Steentjes, K. and Pidgeon, N. (2020) Engaging the public on climate risks and adaptation: A briefing for UK communicators. Oxford: Climate Outreach
- De Bono, et al. (2010) Risk communication: climate change as a human-health threat, a survey of public perceptions in Malta. *European Journal of Public Health*. Vol. 22, No. 1, 144–149
- Depoux, A., Hemono, M., Puig-Malet, S., Pedron, R., & Flahault, A. (2017). Communicating climate change and health in the media. *Public Health Reviews*, 38(7). Doi:10.1186/s40985-016-0044-1
- EcoAmerica: (2016). Let’s Talk Health and Climate: Communication Guidance for Health Professionals, Climate for Health, Washington, D.C.
- Hathaway, J., & Maibach, E. W. (2018). Health implications of climate change: a review of the literature about the perception of the public and health professionals. *Current Environmental Health Reports*, 5, 197-204. Doi:10.1007/s40572-018-0190-3
- Horsburgh, N Armstrong, F and Mulvenna, V (2017) Framework for a National Strategy on Climate, Health and Well-Being For Australia. Climate and Health Alliance. Available from https://d3n8a8pro7vnmx.cloudfront.net/caha/pages/40/attachments/original/1498008324/CAHA_Framework_for_a_National_Strategy_on_Climate_Health_and_Well-being_v05_SCREEN_%28Full_Report%29.pdf?1498008324 <Accessed 5th May 2020>
- Karlsson, M Alfredsson, E and Westling, N (2020) Climate policy co-benefits: a review. *Climate Policy*. Vol. 20, NO. 3, 292–316 <https://doi.org/10.1080/14693062.2020.1724070>
- Kary, A et al (2018) What makes for compelling science? Evidential diversity in the evaluation of scientific arguments. *Global Environmental Change*. 49; 86-196.
- Koh, H (2016) Communicating the Health Effects of Climate Change, *JAMA* January 19, Volume 315, Number 3
- Kotcher, J., Maibach, E., Montoro, M and Hassol, S. J. (2018) How Americans respond to information about global warming’s health impacts: Evidence from a national survey experiment. *GeoHealth*, 2, 262–275. <https://doi.org/10.1029/2018GH000154>
- Kotcher, J Maibach, E and Choi, WT (2019) Fossil fuels are harming our brains: identifying key messages about the health effects of air pollution from fossil fuels. *BMC Public Health* (2019) 19:1079 <https://doi.org/10.1186/s12889-019-7373-1> pp

- Kreslake, J Price, K and Sarfaty, M (2016) Developing effective communication materials on the health effects of climate change for vulnerable groups: a mixed methods study. *BMC Public Health* ,16:946 DOI 10.1186/s12889-016-3546-3
- Levac, D Colquhoun, H O'Brien, K (2010) Scoping studies: advancing the methodology. *Implementation Science*. 5:69 <http://www.implementationscience.com/content/5/1/69>
- Lundgren, L Stofer, K Dunckel, B Krieger, J Lange, M and James, V (2019) Panel based exhibit using participatory design elements may motivate behavior change. *Journal Science Communication* 18 (2) <https://doi.org/10.22323/2.18020203>
- MacIntyre, E Khanna, S Darychuk, A Copes, R Schwartz, B (2019) Evaluating risk communication during extreme weather and climate change: a scoping review. *Health Promotion and Chronic Disease in Canada Research Policy and Practice*. vol 39, no 4 April 2019. pp142- 156
- Maibach, E Nisbet, M Baldwin, P Akerlof, K and Diao, G (2010) Reframing climate change as a public health issue: an exploratory study of public reactions. *BMC Health*, 10: 299 <http://www.biomedcentral.com/1471-2458/10/299>
- Maibach, E Nisbet, M Weathers, M (2011) Conveying the Human Implications of Climate Change: A Climate Change Communication Primer for Public Health Professionals. Fairfax, VA: George Mason University Center for Climate Change Communication.
- Maibach, E., Kreslake, J., Roser-Renouf, C., Rosenthal, S., Feinberg, G. & Leiserowitz, A. (2015) Do Americans understand that global warming is harmful to human health? Evidence from a national survey. *Annals of Global Health*, 81, 396-409.DOI: 10.1016/j.aogh.2015.08.010
- Maibach, E & Kotcher, J (2018) It's time for a focused climate change public engagement strategy: "It's about health stupid" Aug 2018, Global Climate Action Summit.
- Maibach EW, Sarfaty M, Mitchell M, Gould R (2019) Limiting global warming to 1.5 to 2.0°C—A unique and necessary role for health professionals. *PLoS Med* 16(5): e1002804. <https://doi.org/10.1371/journal.pmed.1002804>
- Maibach, E Sarfaty, M Gould, R Damle, N and Armstrong, F (2020) A call to action by health professionals in W. K. Al-Delaimy, V. Ramanathan, M. Sánchez Sorondo (eds.), *Health of People, Health of Planet and Our Responsibility*, https://doi.org/10.1007/978-3-030-31125-4_33 pp397-
- Malena-Chan, R (2016) A narrative model for exploring climate change engagement among young community leaders. *Health Promotion and Chronic Disease Prevention in Canada*. Vol 39, No 4 pp.157-166.
- Masson-Delmotte V, Zhai P, Portner H, Roberts D, Skea J, Shukla P, et al. Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Available from: <https://www.ipcc.ch/sr15/>. [19 May 2020].
- Matlock, M Hopper, S Ogunseitan, O (2019) Communicating Risk for a Climate-Sensitive Disease: A Case Study of Valley Fever in Central California. *International Journal Environmental Research and Public Health*, 16,3254
- Myers, T Nisbet, M Maibach, E Leiserowitz, A (2012) A public health frame arouses hopeful emotions about climate change. A letter. *Climatic Change*, 13:1105–1112 DOI 10.1007/s10584-012-0513-6
- Patrick, R Armstrong, F Borda, A Hanna, E and Taylor, T (2017) National Consultation regarding a National Strategy on Climate, Health and Well-being for Australia - Final Consultation Report. Climate and Health Alliance. Available from: https://d3n8a8pro7vhmx.cloudfront.net/caha/pages/40/attachments/original/1496970197/CAHA_Final_Consultation_Report_May_2017_FINAL.pdf?1496970197 <Accessed 5th May 2020>

Perlata, C Wojcieszak, M Lelkes, Y and de Vreese, C (2017) Selective exposure to balanced content and evidence type: The case of issue and non-issue publics about climate change and health care. *Journalism & Mass Communication Quarterly*, vol 94(3) pp833-861

Rudolph, L., Harrison, C., Buckley, L. & North, S. (2018). Climate and Health Communications, In Climate Change, Health, and Equity: A Guide for Local Health Departments. Oakland, CA and Washington D.C., Public Health Institute and American Public Health Association

Sustainability Victoria (2020) Linking Climate Change and Health Impacts- research snapshot. Available from: <https://sustainability.vic.gov.au>

Van den Bergh, J and Pillay, C (2016) Human health impacts of climate change as a catalyst for public engagement Combining medical, economic and behavioural insights. *International Journal of Climate Change Strategies and Management*, Vol 8 , no 6 pp.578-596

Weathers, M Maibach, E and Nisbet, M (2017) Communicating the Public Health Risks of Climate Change. Oxford Research Encyclopedia of Climate Science DOI: 10.1093/acrefore/9780190228620.013.428

World Health Organization. 2015. WHO calls for urgent action to protect health from climate change – Sign the call. Available from: <https://www.who.int/globalchange/global-campaign/cop21/en/> < accessed 5th May 2020>

World Health Organization. Climate change and health - key facts. Available from: <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>, <accessed 5th May 2020>