

Article

'You can't really separate these risks, our environment, our animals and us': Australian children's perceptions of the risks of the climate crisis

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ABSTRACT

Perceptions of the risks associated with the climate crisis are shaped by a range of social and political contexts and information sources. While some have expressed concerns about the impact of the spread of climate misinformation through social media platforms on young people, others have shown that the youth climate movement has played a key role in countering misinformation. Despite this, there has been very limited research with children about how they conceptualize the risks associated with the climate crisis, how they receive climate information, and how they understand and apply this to their own and others' lives. The following qualitative study used photo-elicitation techniques and in-depth interviews with Australian children to address this gap. A total of $n = 28$ children (12–16 years) participated, with four themes constructed from the data using a reflexive approach to thematic analysis. Children were concerned about how the climate crisis would continue to harm their futures and the health of planet and people. They recognized that some groups and countries would experience more risks associated with the climate crisis as compared to others. While they received information from a range of different sources (school, family, social media), they mostly used social media to seek out climate information. They recognized that social media sites could be a source of climate misinformation, and argued that a range of strategies were needed to identify and counter false information about the climate crisis. Children's perspectives must be harnessed to improve information about climate risks and action.

Keywords: climate action, climate change, climate crisis, children, risk

BACKGROUND

Climate scientists and public health experts agree that the climate crisis poses the greatest threat to population health and well-being in the modern era (IPCC, 2023; Romanello *et al.*, 2023). A range of international climate treaties and strategies for climate action have been developed over decades of global collaboration (World Meteorological Organization, 1979; United Nations, 1997; United Nations, 2015). Despite these agreements, a global reliance on non-renewable energy

has permitted the excessive extraction of Earth's resources and production of carbon emissions, driving anthropogenic climate change and the planet towards critical 'tipping points' for the environment, and consequently for human health and wellbeing (Stoddard *et al.*, 2021; IPCC, 2023). However, the climate crisis will burden no one more than children, young people and future generations, who will grow and live to experience the most extreme and harmful outcomes from a rapidly changing climate (Clark *et al.*, 2020).

Contribution to Health Promotion

- This study investigates how children conceptualize the risks of the climate crisis, the sources informing their understanding, and how they interpret and relate climate information to their own lives and the lives of others.
- Children described how they conceptualized climate risks, including the inequitable nature of the climate crisis, key mechanisms facilitating their engagement with climate information, and the importance of developing mechanisms to safeguard against false information.
- Children have informed and empathetic perspectives about the climate crisis. Understanding their perspectives will improve how risks about climate are communicated to children and the broader public.

Perceptions of risks to health and wellbeing are shaped by a range of social and political contexts, and individual circumstances, including the immediacy of risks that an individual may be facing in their daily lives (Rhodes, 1997). Our perceptions of risk also shape how we see and interpret the world (Cori *et al.*, 2020), with decisions about how to respond to risk largely dependent on our perceptions about the perceived immediacy of the risks that we face, the benefits of action and our level of control over the risk (Rhodes, 1997). Researchers have demonstrated a range of factors that may influence how individuals conceptualize the risks associated with the climate crisis. These include political values, ideologies and moral concerns (Hornsey, 2021); the perceived negative impacts of the climate crisis (van der Linden, 2017); knowledge about the causes and consequences of the climate crisis (Yang *et al.*, 2018) and the level of empowerment and efficacy individuals feel in enacting change (McLoughlin, 2021). Researchers also argue that perceptions of the threats posed by climate are closely linked to culture and place (Taylor *et al.*, 2014), with perceptions of local climate change risks influencing people's responses (Weber, 2016). There is some indication, however, that there are also differences in intergenerational perceptions of climate risk, with young people exhibiting higher levels of concern as compared to older generations (Arnot *et al.*, 2023a; Arnot *et al.*, 2023b). Young people also perceive that climate risks are caused by a lack of action by governments and high polluting industries, rather than as a consequence of individual behaviours (Arnot

et al., 2023a; Arnot *et al.*, 2023b). This lack of action has motivated young people to engage in a range of advocacy and activism measures, including protests and climate strikes as a strategy to respond (Brügger *et al.*, 2020; Arnot *et al.*, 2023c).

Perceptions of risk are also influenced by how information about an issue is framed. Framing can influence how an individual understands, reacts and acts upon an issue (Maani *et al.*, 2022). Framing is an active and dynamic process and different groups may frame issues in different ways based on their values, lived experiences and how they see the world. For example, while messages about the risks associated with the climate crisis can appeal to a sense of need for urgent action for some individuals (Cammaerts, 2023; Arnot *et al.*, 2024), framing the climate crisis as a 'climate emergency' may also produce the opposite effect for others, wherein the word 'emergency' may demoralize and disempower citizens (Hodder and Martin, 2009; Feldman and Hart, 2021). In relation to this study, the term 'climate crisis' has increasingly been used in place of 'climate change' to communicate the rising urgency and scope, and capture the systemic nature of the issue (Kunelius and Roosvall, 2021).

Framings about an issue can also be contested and influenced by the vested interests and ideologies of different groups (Holder *et al.*, 2023). The power to influence the framing of political matters is referred to as 'discursive power' (Fuchs and Lederer, 2008; Carters-White *et al.*, 2022). Researchers have demonstrated that corporations that negatively impact population health (such as the alcohol, gambling and meat industries) often employ problematic or disingenuous framing of issues related to their products (Petticrew *et al.*, 2020; van Schalkwyk *et al.*, 2021; Clare *et al.*, 2022; Arnot *et al.*, 2023b; McCarthy *et al.*, 2023; Pitt *et al.*, 2024). For example, while there is evidence that the fossil fuel industry no longer engages in outright climate denialism, they still use a range of nuanced corporate social responsibility messaging tactics to obstruct and delay climate action (Si *et al.*, 2023). Governments and the news media can also significantly shape how the public sees an issue (Leeper and Slothuus, 2014; Carmichael and Brulle, 2017), particularly when issues are politicized through media representations (Chinn *et al.*, 2020). Climate change countermovement coalitions (Brulle, 2022), governments (Verhoeven, 2021; Abudu *et al.*, 2023; Heenan *et al.*, 2023), fossil fuel companies (Supran and Oreskes, 2021; Li *et al.*, 2022; Megura and Gunderson, 2022) and the media (Bergmann and Ossewaarde, 2020; Mayes and Hartup, 2022; Cammaerts, 2023) have enacted a range of messaging tactics and frames which have undermined climate action or downplayed its risks. New technologies such as social media and artificial intelligence also pose

novel challenges, such as their ability to rapidly generate and spread misinformation (unintentionally false) and disinformation (intentionally false) (Aimeur *et al.*, 2023). Weber (2010, 2016) argues that the extent to which individuals trust information sources has an impact on whether they pay attention to the information that is provided, and the extent to which they incorporate information into the decisions and actions they take.

Researchers have been concerned about the impact of climate misinformation and disinformation on young people—particularly given their reliance on social media as a key source of information (Schubatzky and Haagen-Schützenhöfer, 2023) and their ability to receive and rapidly share information online. However, research also shows that young people are not simply passive recipients of climate information. The growing youth climate justice movement has tried to reframe and respond to dominant narratives and misinformation (Collin and Matthews, 2021; Prendergast *et al.*, 2021), advocating for a change to top-down policy responses to climate and seeking to inspire bottom-up activism amongst their communities (Trott, 2021; Hilder and Collin, 2022). While digital and social media platforms may be a source of information risk in relation to climate, these platforms have also enabled children and young people to engage in new framings of the climate crisis, challenging misinformation and reaching global audiences with their messages (Boulianne *et al.*, 2020). It has also enabled them to share a variety of narratives about the climate crisis, including the need for urgent global responses, and framing the climate crisis as an issue of justice (Han and Ahn, 2020). For example, a study of social media posts by youth climate activist Greta Thunberg showed that Thunberg framed the climate crisis as a moral and ethical issue; and used emotional appeals of hope and motivational collective action to mobilise her audience to action (Molder *et al.*, 2022).

While there has been extensive research with adults and young adults on their perception of climate risk, most research with children has focused on children's beliefs about whether climate change is real, and their perceptions of the causes and solutions for the climate crisis (Lee *et al.*, 2020). There has been very limited qualitative research that has examined how children interpret and apply the information that they see and hear about climate risks and responsibilities (Crandon *et al.*, 2022). This study aimed to explore how children conceptualize the risks of the climate crisis, how they receive information about the climate crisis, how they interpret and apply this information to their own lives, and how they consider climate risks in the context of other lives. The study was guided by two research questions:

1. How do children conceptualize and frame the risks of the climate crisis?
2. How do children view the sources which inform their understanding of the risks of the climate crisis?

Using this information, the study then considered how the public health and health promotion community can help engage and empower children and young people, as the group most impacted, in framing messages about the climate crisis.

METHODOLOGY

Approach

This paper was part of a broader study that explored how Australian children (12–16 years) understand the risks of the climate crisis, and their power to engage in the decisions that are made about the climate crisis. Qualitative insights about the climate crisis offer diverse and nuanced perspectives that highlight the role of values in public support for climate and environmental policies (Kleinberg and Toomey, 2023). The study used photo-elicitation techniques to help children think through their own understandings and representations of the risks of the climate crisis, the power to respond to the climate crisis and their ability and agency to influence climate decision-making. Photo-elicitation is a creative and collaborative visual sociology technique wherein images are discussed in relation to the research objectives and analysed for symbolic representations (Glaw *et al.*, 2017). In doing so, 'different layers of meaning can be discovered' (Glaw *et al.*, 2017, p. 3), with photo-elicitation techniques helping to unearth topics and prompt conversations that may have otherwise been left undiscussed without images to stimulate dialogue (Leonard and McKnight, 2015). The use of photo-elicitation techniques in research with children recalls memories, contextualizes questions, provides a focus for responses and addresses barriers in communication and understanding (Pyle, 2013). Images can also aid in capturing the complexity and richness of young people's experiences and their social and cultural environments (Leonard and McKnight, 2015), and encourage reflections about issues they face and about their own thinking (Shaw, 2021).

Ethical approval was received from the Deakin University Health Ethics Advisory Group (HEAG-H 159_2021).

Sample and recruitment

Children aged 12–16 were invited to participate in the study. This reflects a gap in the data relating to children's views of climate risk (Lee *et al.*, 2020) and is an important age at which children develop their identity,

autonomy (Pfeifer and Berkman, 2018) and political perspectives and preferences (Russo and Stattin, 2017; Rekker et al., 2019). A range of strategies were used to recruit children to the study. Because of the age of the children, recruitment notices were targeted to parents. Notices about the study were distributed across social media platforms (Facebook, Twitter and Instagram), climate-specific agencies (such as parent action groups) and local neighbourhood groups. We also used a research recruitment agency to diversify the sample by sending information about the study to parents who had signed up to participate in research. Parents were able to request further information about the study, discuss the study with their child, and return the consent form with theirs and their child's signatures if they wished to participate. Prior to starting the interview, children were able to ask any further questions about the study with the researcher and then verbally reconfirmed their consent.

Data collection

All communications about the study were sent through parents. Children were asked to prepare and send the research team images prior to the interview about the impacts and risks of the climate crisis. They could either take their own photos or find images that they wanted to talk about from various media sources (including online sites and newspapers). No restrictions were placed on the types of images that children could send through—they could be pictures, videos, memes, news headlines or any material with visual elements—although they were asked to not take identifiable photographs of individuals.

Semi-structured, one-on-one interviews were conducted via video platform Zoom (audio-recorded and transcribed using the platform functions). These lasted for approximately 1 hour. An interview schedule was used to guide the conversation. Participants were asked a range of socio-demographic questions, including gender, age, school level, town and state of residence. They also described the type of area where they lived, including whether it was metropolitan or regional, and the type of environment around them. Questions in relation to this article included the risks of the climate crisis and its impacts on children and young people, the sources of information that shape their perceptions and their opinions about the responsibility and power to enact effective climate responses. Along with the images sent by children, the researcher shared three short videos and four images to stimulate and prompt discussion. Images were of young people holding posters with climate protest messages about the need for urgency, the need for policy action, the need to protect young people's futures and the barriers faced by young climate advocates. Shaffer's SHOWeD framework

(Shaffer, 1985) was used to guide interview questions about what participants observed happening in their images, the ways the image represented their perspectives and how it related to the interview prompts.

Data analysis

Interview data were analysed using a reflexive approach to thematic analysis (Braun and Clarke, 2021). Images were analysed for symbolic representations and meanings both ascribed by participants during discussions, and during analysis of the complete dataset.

RESULTS

Table 1 outlines the characteristics of the sample. A total of $n = 28$ children in Australia participated in this study. They were aged between 12 and 16 years ($\mu = 13.8$ years), with the mean school year being secondary-level Year 8 ($n = 6$, 21.4%). Over half identified as male ($n = 16$, 57.1%), and the majority lived in the two most populous Australian states of Victoria

Table 1: General characteristics of $n = 28$ young Australians (aged 12–16 years)

Characteristic	$n = 28$	%
Gender		
Male	16	57.1
Female	12	42.9
Age		
12	7	25.0%
13	7	25.0%
14	4	14.3%
15	6	21.4%
16	4	14.3%
School year		
Year 6	2	7.2%
Year 7	7	25.0%
Year 8	6	21.4%
Year 9	7	25.0%
Year 10	6	21.4%
State		
Victoria	11	39.3%
New South Wales	10	35.7%
Queensland	5	17.8%
South Australia	1	3.6%
Tasmania	1	3.6%
Type of area		
Metropolitan	22	78.6%
Regional	6	21.4%

($n = 11$, 39.3%) and New South Wales ($n = 10$, 35.7%). Roughly one in five lived in a regional area ($n = 6$, 21.4%).

Four themes were constructed from the data shown in Table 2.

Theme One: The climate crisis poses a threat to people and planet

Harming existing healthy standards of living

Participants conceptualized the risks associated with the climate crisis in a variety of ways, with the overall discussion situating the climate crisis as a threat to human existence. They often described how the climate crisis was rapidly creating a *'before and after'* situation in which the planet was once *'healthy'* and *'green'* but had now become a *'concrete jungle'*. Some used dramatic visual metaphors including that the planet would *'burn'* or *'die'*, while others stated that the climate crisis would change existing ways of living so fundamentally that it would *'completely shatter the way we used to live'*. Nine participants illustrated this perspective by presenting images of an Earth comprised of two halves—one half a healthy and liveable Earth, and the other half a scorched planet covered with smokestacks. Participants explained that children and future generations would be most impacted by changes to the planet if urgent climate action was not taken.

We don't have that much time left to turn that hourglass around. Being young people, this is kind of, like, our future. And then what happens today, we're going to have to live with tomorrow.—
15-year-old female, Victoria

Posing a range of risks to planetary health

There was a strong focus in participants' narratives about extreme weather events. For example, when describing harms to planetary health, participants referenced increasingly severe and common events including *'massive bushfires'*, *'massive droughts'* and *'a bunch of floods'*. They also talked about situations of deprivation and loss. For example, the impact of climate on the loss of wildlife was repeatedly raised, with many participants discussing the sadness they felt about images they had seen of emaciated and displaced species—especially polar bears. Some described a comprehensive list of detrimental outcomes to the planet's environmental health, including species displacement and extinction, biodiversity loss and ecosystem destruction. Many participants understood the consequences of the climate crisis with a highly visual lens, describing common climate motifs such as *'melting ice caps'*, *'bleaching coral reefs'* and *'oceans rising'*. They also described how the climate crisis was a threat to Earth's *'beautiful places to experience*

and visit', that the planet was *'losing natural beauty'*. A few participants approached conversations about the environmental impact of climate with data and science. They shared charts and diagrams, including about rapidly receding Arctic ice and increasing global average temperatures.

Threatening human physical and mental health

Participants also described a variety of outcomes that would cause an impact on health, ranging from individual issues such as increased rates of skin cancer and exacerbated respiratory issues such as asthma, to more systemic and global problems including supply chain issues and food and water insecurity. Others described the climate crisis as harming mental health, describing how they felt sad, scared and *'nihilistic'* about its impact on their futures. While some participants said that they did not think about the climate crisis *'too often'*, many said that it was often *'on my mind'* and expressed anxiety about what their future might look like as the climate crisis worsens. Some were able to describe specific processes of climate change which would lead to these outcomes, sharing diagrams showing the different ways in which the climate crisis impacts health and wellbeing. More sophisticated understandings of the risks of the climate crisis included the relationship between the natural environment and health, and how harmful human activity threatens all that rely on a healthy planet.

I think that you can't really separate these risks, our environment, our animals and us. I think that those risks are all the same, because if we destroy our environment, we automatically destroy ourselves and all the other species, because we all depend on that environment.—
13-year-old female, Queensland

Understanding of the interconnectedness of outcomes

Participants further discussed the interconnected nature of the consequences of the climate crisis and its impact on existing ways of living, such as *'flow on effects in terms of like the economic system'*. Some also described the converging nature of multiple crises—*'you'll die of sickness, and then we've also got world hunger'*. They described how these outcomes would continue to grow in their severity of impact, significantly inhibiting the ability to *'live a healthy life'*.

I think the main risks are that as we get older, our futures become more and more negatively impacted and it becomes harder and harder for us to live a healthy life as like pollution gets worse. Like the natural disasters increase, the world gets hotter, like all of that stuff and it becomes so much harder to function as human beings.—
14-year-old female, Queensland

Table 2: Themes constructed from $n = 28$ young Australians' (aged 12–16 years) about perceptions of the risks of the climate crisis

Themes	Sub-themes	Illustrative quotes
Theme One: The climate crisis threatens people and planet. Children were concerned about the ways in which the climate crisis would continue to harm their futures, and the health of both planet and people.	<ul style="list-style-type: none"> Harming existing healthy standards of living. 	<ul style="list-style-type: none"> For this generation, we go from knowing a world that's a lot less affected by climate change, to one becoming more and more affected. – 14-year-old female, Queensland
	<ul style="list-style-type: none"> Posing a range of risks to planetary health. 	<ul style="list-style-type: none"> When I think of climate change, I think of the ice caps melting and like, wildlife dying off. – 13-year-old male, Victoria
	<ul style="list-style-type: none"> Threatening human physical and mental health. 	<ul style="list-style-type: none"> All the floods, the fires, the droughts... none of that is healthy for like the people that live here. – 13-year-old-female, Queensland
	<ul style="list-style-type: none"> Understanding of the interconnectedness of outcomes. 	<ul style="list-style-type: none"> Like, the emissions coming in, and we have to solve all these problems, as well as animals coming into extinction and all that. It's just so complex. – 16-year-old-male, Victoria
Theme Two: Recognition of the inequities of the climate crisis. Children recognized that lower-middle income countries (LMICs) are more vulnerable to the climate crisis, and that living in a less impacted community enables not thinking about it.	<ul style="list-style-type: none"> Recognition of inequitable experiences. 	<ul style="list-style-type: none"> In China, they can't go out because of the air. It was really, really dusty and everything, so I think it depends how much cars and stuff there are, and how poor the country is, or developed it is. – 12-year-old female, Victoria
	<ul style="list-style-type: none"> Recognition of Australian context as a privilege and protective factor. 	<ul style="list-style-type: none"> Australians and Americans and people in the UK. Any first world country isn't really going to experience the changes as much as a third world country. – 15-year-old male, Victoria
	<ul style="list-style-type: none"> Potential for less day to day lived experience to enable avoiding thinking about the climate crisis. 	<ul style="list-style-type: none"> I think because climate change is so invisible in a way, until you can really see the effects. – 14-year-old female, Queensland
Theme Three: Mechanisms for receiving, engaging, and generating climate information. Children described how school education does not prepare children for engaging effectively with the climate crisis, and how they sought out other information sources.	<ul style="list-style-type: none"> School education largely provides information about individual actions. 	<ul style="list-style-type: none"> My teacher never heard of palm oil, and my principal had never heard about those things. I was kind of surprised that he hadn't, and I realized then that it's more than recycling. – 13-year-old female, Victoria
	<ul style="list-style-type: none"> Seeking out alternative sources of climate information. 	<ul style="list-style-type: none"> It was when my mum and dad put on the news, and there are a bunch of floods happening, like an increase of extreme weather, and I asked them, 'Oh, what's this about?' And they said, 'It's because of climate change'. And then I started to research and think about it. – 12-year-old male, Victoria
	<ul style="list-style-type: none"> Climate information source: Social networks. 	<ul style="list-style-type: none"> I think I'm really lucky that there's lots of people in my life, like the teachers and my family who can help me access that information. – 14-year-old female, Tasmania

Table 2. Continued

Themes	Sub-themes	Illustrative quotes
<p>Theme Four: Recognizing and countering false information about the climate crisis. There is a need for strategies and mechanisms to identify and counter false information about the climate crisis both online and by governments. The public must have access to accurate information to make informed decisions about their climate responses.</p>	<ul style="list-style-type: none"> Climate information source: Internet and social media. 	<ul style="list-style-type: none"> There's Twitter and Instagram...all these platforms, they help us connect with each other, and we can follow each other and express our opinions.— 13-year-old male, New South Wales
	<ul style="list-style-type: none"> Limited safeguards to control online mis- and disinformation. 	<ul style="list-style-type: none"> I think that any social media platform that has a 'no fake news' policy and stuff, then that would be a good way to spread good information.— 12-year-old female, Victoria
	<ul style="list-style-type: none"> The need to correct governments about false claims. 	<ul style="list-style-type: none"> The government's pretty bad for trying to not take responsibility for allowing climate change to go on by pretending they don't even know it exists.— 13-year-old male, Victoria
	<ul style="list-style-type: none"> The importance of climate information for public action. 	<ul style="list-style-type: none"> The most powerful thing people can do is start talking about it and start educating people on it, and trying to stand up and having a voice about it.— 12-year-old female, South Australia

Theme Two: Recognition of the inequities of the climate crisis

Recognition of inequitable experiences

Participants recognized the impacts of the climate crisis as an issue of inequity. They described how different risks impacted different groups, with some groups more vulnerable to these risks than others. They observed that these varied contexts would create a diversity of experiences among children and young people around the globe and would disproportionately impact those in lower-middle-income countries (LMICs) such as those in sub-Saharan Africa. They shared images of impoverished and drought-stricken communities, as well as heavily polluted land and waterways. A few participants also spoke about and shared images of communities in low-lying nations in the Pacific Island region which were in immediate danger of losing land to rising sea levels—*'like countries are literally sinking'*. Participants discussed recent extreme weather events in LMICs including flooding and heatwaves. To illustrate, one child showed an image of young men walking through waist-deep flood waters in Indonesia. Some described how such events would have harmful ongoing impacts such as *'agricultural loss'*, and described how communities may find themselves struggling to fulfil basic needs such as feeding their families. They contemplated other *'devastating'* consequences of food shortages in countries where individuals couldn't easily access food and *'just go to the supermarket'*, such as impacts on the health of young people.

Depending on if a country relies on farming and growing food, climate change can stop a food source and destroy the country because they're just not living with enough food. That can affect the health of young people.— 15-year-old male, New South Wales

Recognition of Australian context as a privilege and protective factor

Participants stated that such countries were not as *'privileged'* to have the resources and infrastructure to respond to the climate crisis as readily as other nations. Some also noted that these communities were the most impacted, yet contributed the least to the climate crisis. They thought that LMICs had not contributed as many carbon emissions (and general environmental harm) as wealthier nations that had access to and relied on fossil fuel energy. A small group described their own lived experience of climate risks, most commonly bushfires—*'I live in a rural area and we've had like fires here before'*. However, most participants considered that living in Australia largely protected them from vulnerability to climate risks, noting that *'Australia is a very rich country compared to the rest of the world'*. They described how children and young people in other countries currently faced more severe threats and daily interruptions from the climate crisis.

People my age around the world can be so varied and different just based on where they live, because they obviously have to deal with bigger

things than I am. Because, I mean, they're walking to school halfway through water.— 13-year-old female, Victoria

Potential for less day-to-day lived experience to enable avoiding thinking about the climate crisis

However, some also acknowledged that not feeling personally impacted by the climate crisis meant that it was easy to avoid thinking about the risks the climate crisis posed to daily life. They noted how in Australia there were fewer observable impacts compared to other nations—*'there's not lots of visuals as you can really see in other countries'*.

It's not a day to day thing that's going to affect you in Australia. You don't wake up, and you don't think about climate change. You don't go to school thinking about climate change. You don't actively see climate change happening. It's easy to shut off.— 15-year-old male, Victoria

Theme Three: Mechanisms for receiving, engaging and generating climate information School education largely provides information about individual actions

Participants stated that they learned about the climate crisis and associated risks from a range of formal and informal information sources. While many discussed school-based education as raising their first formal awareness about the climate crisis, most felt that this had been inadequate for equipping them to meaningfully engage in climate responses. They commented that most of the information they received was largely about individual responses. These included correct waste disposal, eating less meat, taking public transport, planting trees and other small-scale actions to help the environment and climate, rather than the broader structural issues associated with the climate crisis.

It was just more about like, you know, recycling and where to put your stuff in each bin and what purpose it serves to our environment.— 16-year-old male, Victoria

Seeking out alternative sources of climate information

Participants stated that they would prefer *'more of the actual science of it'* and *'the things we can do to actually make a difference'*. Some described how they actively sought out information, with some prompted to do this after experiencing or seeing extreme weather events, or to try and understand how bad the climate crisis was—*'facts about how much of the world is polluted'*. They discussed the need for climate crisis

discussions to be normalized within broader everyday school-based conversations.

I feel like I haven't learned more about it in school. I don't think it's talked a lot about in school, but I think that I've probably educated myself on it a lot more. Like I go into rallies and stuff like that.— 15-year-old male, Victoria

Climate information source: Social networks

Some participants learned about climate change through conversations with their parents and families (some of whom were actively engaged in climate action), as well as watching environmental documentaries together. While participants rarely engaged in informal discussions about climate with their peers, a couple had described attending climate justice protests and school strikes with friends or felt united with their friends in their anger about the climate crisis. They described the importance of connecting with others to build communities for action. Many participants shared images of climate justice protests and school strikes to illustrate collective power (particularly of young people), while a few shared images of people having discussions to illustrate the importance of connecting and sharing ideas.

I guess the more people that we get involved, the better it's going to be. And I guess it's kind of like a ripple effect, because like if people get their friends involved, then they'll get their friends' friends. Like it probably spreads a lot faster then.— 12-year-old female, South Australia

Climate information source: Internet and social media

Participants described how the internet facilitated access to climate information. Social media platforms specifically were considered an important gateway to climate information. The reach and power of social media enabled people to share information about the risks of the climate crisis and provided an inclusive and accessible space to meet and build like-minded communities.

It's easy if they already have an account, or if they don't, they can make an account and write what they feel about climate change and send it out there. And there'll be some people that will agree with them and there'll be some people that don't. There'll always be more people that agree with you than don't, so you can convince people to help you resolve climate change.— 12-year-old male, Victoria

Theme Four: Recognizing and countering false information about the climate crisis

Limited safeguards to control online misinformation and disinformation

Despite the strengths of online spaces, participants also considered social media as an environment in which both misinformation and disinformation about the climate crisis were often disseminated. A few participants described concerns including their perception that limited safeguards existed to control the spread of false information on social media, with any individual able to contribute to or *'push'* online discourses about climate, such as labelling it a *'hoax'*. Participants also described rhetoric they had heard about the importance of *'free speech'* online, but questioned the alleged benefits of a lack of safety measures to limit *'fake news'*, and described the need for strategies to mitigate the circulation of false information. This included the need for trusted and credible sources of online information, noting that *'it matters what sort of people are regulating what false information is'*.

I think that there's a lot of false information on social media, because everyone can post on social media as long as they have an account. Especially since there's this new policy on Twitter that says more "freedom", so basically you can spread more fake news... I think that there should be more precautions to not have fake news than less.– 12-year-old female, Victoria

The need to correct governments about false claims

The need for strategies and mechanisms to correct false misinformation about the climate crisis was not constrained to online spaces. Some participants described the need to educate governments about causes and consequences, with a few suggesting that they did not understand the realities of the climate crisis. However, many others suggested they were downplaying the severity of the crisis to avoid taking responsibility for it. A few participants described the need for mechanisms to correct political decision-makers on their claims about the risks of the climate crisis, such as the outcomes of proposed responses and solutions.

Say you have someone on the Liberal (conservative party) side going, "If we go to solar energy, then I'm going to lose all my money". Have someone in there who can actively go, "No, you won't. That's not what's going to happen". ... It's just the misinformation aspect of parliament that really bothers me.– 16-year-old male, Queensland

The importance of climate information for public action

Participants also discussed the importance of the public being exposed to accurate information to help them

make educated choices about their responses to risk, and mobilise and empower action. This included the need for climate information to be *'more publicized'* so that it reached a large number of people, and was easily and readily accessible.

I think part of climate empowerment is giving people like the information they need to be able to determine what matters to them. It's not just about making sure that they can act on their hopes, but that they can, you know, inform them, and that they have the power to make informed decisions about what they can do for climate change.– 14-year-old female, Tasmania

DISCUSSION

This study aimed to understand how children perceive the risks of the climate crisis, the sources of information which inform their understanding of these risks, and how they understand and apply this information to their own lives and the lives of others. In line with evidence from climate and public health experts (Clark *et al.*, 2020; IPCC, 2023), children in this study viewed the climate crisis as posing a serious, urgent and complex threat to the health of people and the planet. Some children used technical language and scientific evidence to describe the causes and consequences of the climate crisis, demonstrating their ability to engage with complicated concepts and terminology used in high-level discussions and reports (IPCC, 2023). Importantly, health was not only conceptualized as the physical and mental health impacts of the climate crisis on people but also as the health of ecosystems and a liveable planet.

Importantly, they recognized the climate crisis as an issue of inequity and justice, identifying that different groups were exposed to different risks in different ways, particularly in LMICs (Arpin *et al.*, 2021). Despite not being impacted by the climate crisis on a day-to-day basis, children in this study demonstrated a high level of consideration and empathy for the circumstances and challenges faced by others. Empathy in children and young people can be observed across other studies relating to climate (Hickman *et al.*, 2021), as well as in other public health issues such as gambling (Pitt *et al.*, 2022). Research shows that adults' personal experiences of the climate crisis influences their strength of belief and opinion about the need for climate mitigation (Weber, 2016). However, our study showed that children did not necessarily need personal lived experience to acknowledge and feel empathy for others' experiences of climate risks, and to support the need for climate action.

Children in this study received their information about the climate crisis from a range of sources.

While most had participated in school-based education, some felt that it reinforced messages about individualistic climate responses, rather than scientific information and ways of taking action on the risks posed by the climate crisis. Some used social media to actively search for information about the climate crisis in their own time, demonstrating the perceived inadequacy and untrustworthiness of other information sources. Despite recognizing the associated risks and limitations, some children use social media to access information about the climate crisis. This suggests the need for two courses of action. First, there is a need to invest in the creation and promotion of credible sources of climate information that appeal to children and young people. Second, children and young people should be actively involved in the development of sources of accurate information that can be disseminated on social media.

Using images to illustrate their perspectives, children in this study provided insight into the concepts and ways of thinking that they find compelling for telling a narrative about the risks of the climate crisis. These perspectives provide important information for building awareness and engagement among young people with a range of different experiences with the climate crisis. These could include viewing the climate crisis in terms of ‘current’ and ‘future’ impacts in terms of existing standards and ways of living; harming planetary health through extreme weather events and biodiversity loss, particularly animal species extinction; harming physical and mental human health, and showing the processes behind climate-related consequences and the interconnectedness of outcomes.

Advocacy initiatives including around junk food ([Bite Back, 2023](#)) and tobacco ([Truth Initiative, 2023](#)) have been important for engaging young people in public health issues. To address the growing climate crisis and engage children and young people in climate responses, there is a need to develop similar initiatives to help them share their experiences, build knowledge about inequities, develop credible sources of information and facilitate their influence over the framing and messaging of the climate crisis. This includes developing strategies to equip children to respond to, and challenge ‘discursive power’— in which governments and those with vested interests frame responses to the climate crisis, and try to influence policy-making processes ([Fuchs and Lederer, 2008](#); [Carters-White et al., 2022](#)). Framing has been used effectively by youth-led organizations to disrupt dominant and harmful narratives about climate, hold governments and industry to account, and engage a new generation of youth advocates in driving a climate justice agenda ([Hohenhaus et al., 2023](#)). Ensuring that the framing of public health responses to the climate crisis

represents what is important to children and young people and engaging them in creating these frames, will help to shape how the community thinks about and responds to the long-term impact of climate crisis on future generations. This will also be important in challenging narratives from commercial actors such as the fossil fuel industry ([Arnot et al., 2023b](#); [Pitt et al., 2024](#)). On a wider scale, there is a need for structural and systemic changes that enable children and young people to have influence in discussions and decisions about the climate crisis ([Arnot et al., 2023c](#); [Arnot et al., 2023a](#)). Global public health and health promotion communities have an important role to play in reframing climate narratives to harness motivations for action ([Maibach et al., 2010](#)). We must collaborate with children and young people to develop strategies and mechanisms to structure their perspectives into messaging about the climate crisis, including those who do not primarily conceptualize the climate crisis as a health issue. Engagement must occur at a population level to ensure the inclusion of those who may be unengaged in the climate movement and research ([Arnot et al., 2024](#)), as well as structurally marginalized children and young people in lower-middle-income countries ([UNICEF, 2023](#)) and Indigenous communities ([Ritchie, 2021](#)).

LIMITATIONS

The majority of the study sample were from the most populous Australian states of Victoria and New South Wales. There was some difficulty in recruiting children from other states who may have different experiences of the climate crisis. Future research should explore the climate experiences and risk perceptions of children and young people from these different contexts, particularly in Western Australia given the prolific presence of the mining industry.

CONCLUSIONS

Children have important and empathetic perspectives about the risks of the climate crisis. This includes conceptualizing the risks as a threat to people and planet and as an issue of inequity. There is a need to facilitate the global sharing of children and young people’s climate experiences to help broaden understanding of the impact of the risks of the climate crisis beyond local contexts. The public health promotion and health promotion communities have an important role to play in collaborating with children and young people to develop strategies and mechanisms that enable them to receive, engage with and generate accurate and trusted climate information.

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ETHICS DISCLOSURE

This study required the participation of human subjects. Ethical approval was granted by Deakin University's Human Ethics Advisory Group for the Faculty of Health (HEAG-H 159_2021).

REFERENCES

- Abudu, H., Wesseh, P. K. Jr and Lin, B. (2023). Does political propaganda matter in climate change? Insights from the United States of America. *Journal of Management Science and Engineering*, 8, 386–397.
- Aïmeur, E., Amri, S. and Brassard, G. (2023). Fake news, disinformation and misinformation in social media: a review. *Social Network Analysis and Mining*, 13, 30.
- Arnot, G., Pitt, H., McCarthy, S., Cordedda, C., Marko, S. and Thomas, S. L. (2024). Australian youth perspectives on the role of social media in climate action. *Australian and New Zealand Journal of Public Health*, 48, 100111.
- Arnot, G., Thomas, S., Pitt, H. and Warner, E. (2023a). Australian young people's perspectives about the political determinants of the climate crisis. *Health Promotion Journal of Australia*, 35, 196–206.
- Arnot, G., Thomas, S., Pitt, H. and Warner, E. (2023b). Australian young people's perceptions of the commercial determinants of the climate crisis. *Health Promotion International*, 38, 1–13.
- Arnot, G., Thomas, S., Pitt, H. and Warner, E. (2023c). 'It shows we are serious': young people in Australia discuss climate justice protests as a mechanism for climate change advocacy and action. *Australian and New Zealand Journal of Public Health*, 47, 100048.
- Arpin, E., Gauffin, K., Kerr, M., Hjern, A., Mashford-Pringle, A., Barros, A. *et al.* (2021). Climate change and child health inequality: a review of reviews. *International Journal of Environmental Research and Public Health*, 18, 10896.
- Bergmann, Z. and Ossewaarde, R. (2020). Youth climate activists meet environmental governance: ageist depictions of the FFF movement and Greta Thunberg in German newspaper coverage. *Journal of Multicultural Discourses*, 15, 267–290.
- Bite Back. (2023). *Bite Back 2030* [Online]. <https://www.bite-back2030.com/> (date last accessed 25 May 2023).
- Boulianne, S., Lalancette, M. and Ilkiw, D. (2020). 'School strike 4 climate': social media and the international youth protest on climate change. *Media and Communication*, 8, 208–218.
- Braun, V. and Clarke, V. (2021). *Thematic Analysis: A Practical Guide*. SAGE Publishing, Los Angeles.
- Brügger, A., Gubler, M., Steentjes, K. and Capstick, S. B. (2020). Social identity and risk perception explain participation in the Swiss youth climate strikes. *Sustainability*, 12, 10605.
- Brulle, R. J. (2022). Advocating inaction: a historical analysis of the global climate coalition. *Environmental Politics*, 32, 185–206.
- Cammaerts, B. (2023). The mediated circulation of the United Kingdom's YouthStrike4Climate movement's discourses and actions. *European Journal of Cultural Studies*, 27, 107–128.
- Carmichael, J. T. and Brulle, R. J. (2017). Elite cues, media coverage, and public concern: an integrated path analysis of public opinion on climate change, 2001–2013. *Environmental Politics*, 26, 232–252.
- Carters-White, L., Hilton, S., Skivington, K. and Chambers, S. (2022). Children's, parents' and professional stakeholders' views on power concerning the regulation of online advertising of unhealthy food to young people in the UK: a qualitative study. *PLoS One*, 17, e0268701.
- Chinn, S., Hart, P. S. and Soroka, S. (2020). Politicization and polarization in climate change news content, 1985–2017. *Science Communication*, 42, 112–129.
- Clare, K., Maani, N. and Milner, J. (2022). Meat, money and messaging: how the environmental and health harms of red and processed meat consumption are framed by the meat industry. *Food Policy*, 109, 102234.
- Clark, H., Coll-Seck, A. M., Banerjee, A., Peterson, S., Dalglis, S. L., Ameratunga, S. *et al.* (2020). A future for the world's children? A WHO–UNICEF–Lancet Commission. *The Lancet*, 395, 605–658.
- Collin, P. and Matthews, I. (2021). School Strike 4 climate: Australian students renegotiating citizenship. In *When Students Protest: Secondary and High Schools*. Rowman & Littlefield, US, pp. 125–143.
- Cori, L., Bianchi, F., Cadum, E. and Anthonj, C. (2020). Risk perception and COVID-19. *International Journal of Environmental Research and Public Health*, 17, 3114.
- Crandon, T. J., Scott, J. G., Charlson, F. J. and Thomas, H. J. (2022). A social–ecological perspective on climate anxiety in children and adolescents. *Nature Climate Change*, 12, 123–131.

- Feldman, L. and Hart, P. S. (2021). Upping the ante? The effects of ‘emergency’ and ‘crisis’ framing in climate change news. *Climatic Change*, **169**, 10.
- Fuchs, D. and Lederer, M. (2008). The power of business. *Business and Politics*, **9**, 1–19.
- Glaw, X., Inder, K., Kable, A. and Hazelton, M. (2017). Visual methodologies in qualitative research: autophotography and photo elicitation applied to mental health research. *International Journal of Qualitative Methods*, **16**, 1–8.
- Han, H. and Ahn, S. W. (2020). Youth mobilization to stop global climate change: narratives and impact. *Sustainability*, **12**, 4127.
- Heenan, M., Rychetnik, L., Howse, E., Beggs, P. J., Weeramanthri, T. S., Armstrong, F. et al. (2023). Australia’s political engagement on health and climate change: the MJA–Lancet Countdown indicator and implications for the future. *The Medical Journal of Australia*, **218**, 196–202.
- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E. et al. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *The Lancet Planetary Health*, **5**, e863–e873.
- Hilder, C. and Collin, P. (2022). The role of youth-led activist organisations for contemporary climate activism: the case of the Australian Youth Climate Coalition. *Journal of Youth Studies*, **25**, 793–811.
- Hodder, P. and Martin, B. (2009). Climate crisis? The politics of emergency framing. *Economic and Political Weekly*, **36**, 53–60.
- Hohenhaus, M., Rutherford, S., Boddy, J. and Borkoles, E. (2023). Climate warriors down under: contextualising Australia’s youth climate justice movement. *npj Climate Action*, **2**, 45.
- Holder, F., Mirza, S., Carbone, J. and McKie, R. E. (2023). Climate obstruction and Facebook advertising: how a sample of climate obstruction organizations use social media to disseminate discourses of delay. *Climatic Change*, **176**, 16.
- Hornsey, M. J. (2021). The role of worldviews in shaping how people appraise climate change. *Current Opinion in Behavioral Sciences*, **42**, 36–41.
- IPCC. (2023). Summary for policymakers. In Lee, H. and Romero, J. (eds.), *Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC, Geneva, Switzerland, 36.
- Kleinberg, S. and Toomey, A. H. (2023). The use of qualitative research to better understand public opinions on climate change. *Journal of Environmental Studies and Sciences*, **13**, 367–375.
- Kunelius, R. and Roosvall, A. (2021). Media and the climate crisis. *Nordic Journal of Media Studies*, **3**, 1–19.
- Lee, K., Gjersoe, N., O’Neill, S. and Barnett, J. (2020). Youth perceptions of climate change: a narrative synthesis. *Wiley Interdisciplinary Reviews: Climate Change*, **11**, e641.
- Leeper, T. J. and Slothuus, R. (2014). Political parties, motivated reasoning, and public opinion formation. *Political Psychology*, **35**, 129–156.
- Leonard, M. and McKnight, M. (2015). Look and tell: using photo-elicitation methods with teenagers. *Children’s Geographies*, **13**, 629–642.
- Li, M., Trencher, G. and Asuka, J. (2022). The clean energy claims of BP, Chevron, ExxonMobil and Shell: a mismatch between discourse, actions and investments. *PLoS One*, **17**, e0263596.
- Maani, N., van Schalkwyk, M. C., Petticrew, M. and Buse, K. (2022). The pollution of health discourse and the need for effective counter-framing. *BMJ*, **377**, 1–2.
- Maibach, E. W., 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 Public Health*, **10**, 1–11.
- Mayer, E. and Hartup, M. E. (2022). News coverage of the school strike for climate movement in Australia: the politics of representing young strikers’ emotions. *Journal of Youth Studies*, **25**, 994–1016.
- McCarthy, S., Pitt, H., Hennessy, M., Njiro, B. J. and Thomas, S. (2023). Women and the commercial determinants of health. *Health Promotion International*, **38**, 1–5.
- McLoughlin, N. (2021). Communicating efficacy: how the IPCC, scientists, and other communicators can facilitate adaptive responses to climate change without compromising on policy neutrality. *Climatic Change*, **169**, 5.
- Megura, M. and Gunderson, R. (2022). Better poison is the cure? Critically examining fossil fuel companies, climate change framing, and corporate sustainability reports. *Energy Research & Social Science*, **85**, 102388.
- Molder, A. L., Lakind, A., Clemmons, Z. E. and Chen, K. (2022). Framing the global youth climate movement: a qualitative content analysis of Greta Thunberg’s moral, hopeful, and motivational framing on instagram. *The International Journal of Press/Politics*, **27**, 668–695.
- Petticrew, M., Maani, N., Pettigrew, L., Rutter, H. and Van Schalkwyk, M. C. (2020). Dark nudges and sludge in big alcohol: behavioral economics, cognitive biases, and alcohol industry corporate social responsibility. *The Milbank Quarterly*, **98**, 1290–1328.
- Pfeifer, J. H. and Berkman, E. T. (2018). The development of self and identity in adolescence: neural evidence and implications for a value-based choice perspective on motivated behavior. *Child Development Perspectives*, **12**, 158–164.
- Pitt, H., McCarthy, S. and Arnot, G. (2024). Children, young people and the commercial determinants of health. *Health Promotion International*, **39**, 1–10.
- Pitt, H., Thomas, S. L., Randle, M., Cowlshaw, S., Arnot, G., Kairouz, S. et al. (2022). Young people in Australia discuss strategies for preventing the normalisation of gambling and reducing gambling harm. *BMC Public Health*, **22**, 956.
- Prendergast, K., Hayward, B., Aoyagi, M., Burningham, K., Hasan, M. M., Jackson, T. et al. (2021). Youth attitudes and participation in climate protest: an international cities comparison frontiers in political science special issue: youth activism in environmental politics. *Frontiers in Political Science*, **3**, 1–18.
- Pyle, A. (2013). Engaging young children in research through photo elicitation. *Early Child Development and Care*, **183**, 1544–1558.
- Rekker, R., Keijsers, L., Branje, S. and Meeus, W. (2019). The formation of party preference in adolescence and early adulthood: how and when does it occur in the multiparty context of the Netherlands? *Young*, **27**, 48–68.

- Rhodes, T. (1997). Risk theory in epidemic times: sex, drugs and the social organisation of 'risk behaviour'. *Sociology of Health & Illness*, **19**, 227.
- Ritchie, J. (2021). Movement from the margins to global recognition: climate change activism by young people and in particular indigenous youth. *International Studies in Sociology of Education*, **30**, 53–72.
- Romanello, M., Napoli, C., Green, C., Kennard, H., Lampard, P., Scamman, D. *et al.* (2023). The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms. *The Lancet*, **402**, 2346–2394.
- Russo, S. and Stattin, H. (2017). Stability and change in youths' political interest. *Social Indicators Research*, **132**, 643–658.
- Schubatzky, T. and Haagen-Schützenhöfer, C. (2023). Inoculating Adolescents against Climate Change Misinformation. In *Fostering Scientific Citizenship in an Uncertain World: Selected Papers from the ESERA 2021 Conference*. Springer Cham, New York, NY, pp. 275–292.
- Shaffer, R. (1985). *Beyond the Dispensary*. African Medical and Research Foundation, Nairobi.
- Shaw, P. A. (2021). Photo-elicitation and photo-voice: using visual methodological tools to engage with younger children's voices about inclusion in education. *International Journal of Research & Method in Education*, **44**, 337–351.
- Si, Y., Desai, D., Bozhilova, D., Puffer, S. and Stephens, J. C. (2023). Fossil fuel companies' climate communication strategies: Industry messaging on renewables and natural gas. *Energy Research & Social Science*, **98**, 103028.
- Stoddard, I., Anderson, K., Capstick, S., Carton, W., Depledge, J., Facer, K. *et al.* (2021). Three decades of climate mitigation: why haven't we bent the global emissions curve? *Annual Review of Environment and Resources*, **46**, 653–689.
- Supran, G. and Oreskes, N. (2021). Rhetoric and frame analysis of ExxonMobil's climate change communications. *One Earth*, **4**, 696–719.
- Taylor, A. L., Dessai, S. and de Bruin, W. B. (2014). Public perception of climate risk and adaptation in the UK: a review of the literature. *Climate Risk Management*, **63**, 1–39.
- Trott, C. D. (2021). What difference does it make? Exploring the transformative potential of everyday climate crisis activism by children and youth. *Children's Geographies*, **19**, 300–308.
- Truth Initiative. (2023). *Truth Initiative* [Online]. <https://truthinitiative.org/> (last accessed 25 May 2023).
- UNICEF. (2023). *Nearly 70 per cent of young people believe their actions can improve climate policies—UNICEF South Africa U-Report poll*. [Online]. <https://www.unicef.org/southafrica/press-releases/nearly-70-cent-young-people-believe-their-actions-can-improve-climate-policies> (last accessed 14 December 2023).
- United Nations. (1997). *The Kyoto Protocol. United Nations Framework Convention on Climate Change*, Kyoto, Japan.
- United Nations. (2015). *The Paris Agreement. United Nations Framework on Climate Change*, Paris, France.
- van der Linden, S. (2017). Determinants and measurement of climate change risk perception, worry, and concern. In Nisbet, M. C., Schafer, M., Markowitz, E. Ho, S. O'Neill, S. and Thaker, J. (eds), *The Oxford Encyclopedia of Climate Change Communication*. Oxford University Press, Oxford, UK.
- van Schalkwyk, M. C., Maani, N., McKee, M., Thomas, S., Knai, C. and Petticrew, M. (2021). 'When the Fun Stops, Stop': an analysis of the provenance, framing and evidence of a 'responsible gambling' campaign. *PLoS One*, **16**, e0255145.
- Verhoeven, I. (2021). Contentious governance around climate change measures in the Netherlands. *Environmental Politics*, **30**, 376–398.
- Weber, E. U. (2010). What shapes perceptions of climate change? *Wiley Interdisciplinary Reviews: Climate Change*, **1**, 332–342.
- Weber, E. U. (2016). What shapes perceptions of climate change? New research since 2010. *Wiley Interdisciplinary Reviews: Climate Change*, **7**, 125–134.
- World Meteorological Organization. (1979). World Climate Conference (WCC-1) Declaration and Supporting Documents, Geneva, Switzerland.
- Yang, L., Liao, W., Liu, C., Zhang, N., Zhong, S. and Huang, C. (2018). Associations between knowledge of the causes and perceived impacts of climate change: a cross-sectional survey of medical, public health and nursing students in universities in China. *International Journal of Environmental Research and Public Health*, **15**, 2650.