



A social-ecological perspective on climate anxiety in children and adolescents

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Experiences of 'climate anxiety' are considered an adaptive response to a real threat, as well as a potential cause of impairment. To date, little attention has been paid to how children and adolescents may be uniquely predisposed to climate anxiety, despite being an age cohort particularly vulnerable to the impacts of climate change. This Review uses a social-ecological framework to identify the influences on climate anxiety for young people. We explore the directionality and interplay between individual factors, the physical environment and the influence of micro- (family, peers), meso- (school, community), exo- (government, media) and macro- (culture) systems on children's and adolescents' experience of climate anxiety. The Review highlights future research considerations and key issues relevant to professionals working with youth.

Experiences during the formative years are underpinned by a range of biological, psychological and social factors. Persistent stressors during childhood can profoundly impact psychological health in both the short and long term. Exposure to life stressors during childhood and adolescence is relatively common, and these experiences increase risk of mental disorders¹, which are among the leading causes of disease burden in children and youth². In addition to extensively researched external stressors such as child maltreatment, family violence, bullying victimization, poverty and conflict, young people report increasing concern about climate change³.

The term 'climate anxiety' describes how humans perceive, fear and dread the impacts of climate change. Anxiety is considered an adaptive psychological, physiological and behavioural response to threat⁴. However, anxiety can also become clinically maladaptive and lead to chronic worry, restlessness, irritability, panic and sleep disturbance^{4,5}. While climate anxiety in the general population is receiving increasing attention⁶, there is limited discussion about how children and adolescents may be uniquely predisposed to climate anxiety⁷. This is concerning, given that children and adolescents are more vulnerable to the negative effects of climate change and will have greater exposure to climate change over their lifetime compared with adults⁸. How young people experience climate anxiety will be shaped by their surrounding environments, and thus it is imperative to consider the influence of wider social-ecological systems.

This Review aims to achieve the following:

1. Provide a brief background on climate anxiety and its relationship with other mental disorders
2. Draw on a social-ecological theoretical framework to discuss how children and adolescents may be uniquely predisposed to climate anxiety
3. Examine factors that may increase or reduce climate anxiety in children and adolescents

Overall, the main objectives of this Review are to highlight key issues and limitations of current knowledge, and to identify future directions for researchers, educators and health professionals.

Conceptualizing climate anxiety

Awareness of climate change may provoke worry and apprehension over both imminent and future threats^{4,9}. Concerns may relate to perceived negative outcomes for oneself (egoistic) and for others and future generations (social-altruistic), as well as for the environment and animals (biospheric)¹⁰. An emerging consensus among researchers is that, while climate anxiety can stimulate adaptive responses (for example, reducing one's carbon footprint), it has the potential to cause functional impairment^{11,12}. There is an overlap in symptomatology between climate anxiety and anxiety disorders. In the DSM-5 (*Diagnostic and Statistical Manual of Mental Disorders* 5th edn), anxiety disorders are characterized as groups of symptoms that are chronic, severe and disproportionate to the actual threat⁵. Symptoms diverge between individuals and across ages; however, they may include rumination and excessive worrying, restlessness, insomnia and panic attacks⁵. Climate anxiety has been associated with rumination, difficulty sleeping and negative impacts on work, study and family relationships^{11,13}. However, as with other experiences of 'normal' and adaptive anxiety, climate anxiety diverges from anxiety disorders in that it is a rational response to a real, major and global threat. Because of this, there is caution against pathologizing climate anxiety, with research suggesting it may be associated with pro-environmental behaviour^{9,14}.

While climate anxiety is largely considered an adaptive response, it is also acknowledged that maladaptive climate anxiety can occur when symptoms cause severe distress and greatly interfere with an individual's occupational and social roles¹². Where adaptive climate anxiety may facilitate problem-solving and pro-environmental behaviour, maladaptive climate anxiety becomes overwhelming⁹. This overwhelming level of anxiety may involve fear, helplessness, hopelessness, powerlessness and an avoidance of the threat^{12,15,16}. Another consideration is whether, for some, climate anxiety is but one dimension of a pre-existing anxiety disorder⁹.

As the conceptualization of climate anxiety evolves, there is a need to clearly define the relationship between climate anxiety and clinical anxiety. This is perhaps best achieved by developing a strong, consistent conceptualization of climate anxiety. Using terms such as 'climate distress' or 'climate empathy' may, for example, reflect

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the expected, understandable experience of worry and distress in response to climate change. Climate anxiety may alternatively describe responses akin to clinical anxiety, whereby an unhelpful or excessive cognitive pattern may lead to avoidance or distress accompanied by functional impairment. Whether climate distress and climate anxiety lie on a single continuum of increasing severity and impairment or are qualitatively distinct entities is an area for further investigation. A clearer conceptualization of climate anxiety will help guide practitioners in delivering targeted individual support. However, it is also imperative to consider that individual experiences of climate anxiety are shaped by surrounding social-ecological systems. Thus, regardless of the 'type' of climate anxiety (for example, climate distress, clinical anxiety), support must also be delivered across these multilevel systems.

In contrast to the research on climate anxiety in adults, the current understanding of climate anxiety in children and adolescents is sparse. The following sections focus on climate anxiety in relation to young people and consider systemic influences on youth climate anxiety.

A social-ecological perspective of climate anxiety

Climate change has far-reaching ramifications across personal, social, ecological and societal domains. To conceptualize how young people interpret these threats, it is necessary to examine the interaction between young people and the systemic contexts within which they live. Bronfenbrenner's social-ecological perspective proposes that each individual's development is shaped by the environment¹⁷. At the centre, there is an interplay between an individual's genetic and psychological traits, their immediate physical environment, and the relationships and environments that directly surround them. These are further influenced by the broader systems within which they are nested. Applying this framework, it is theorized that climate anxiety results from an interplay of individual factors: the micro- (family, peers), meso- (school, community, local physical environment), exo- (government, media, global physical environment) and macro- (culture) systems surrounding children and adolescents (Fig. 1). This structure of systems is also subject to climatic changes over time, which evolve on the basis of the behaviours of individuals, families, schools, communities, media, governments and cultures.

Systemic factors that influence and mitigate climate anxiety in youth, as well as areas of opportunity for researchers to explore, are discussed in the following sections (see Table 1 for an overview).

Individual influences on child/adolescent climate anxiety

This section highlights the physical and developmental factors that may influence climate anxiety in children and adolescents.

Physical vulnerability. Children and adolescents will have greater exposure to climate-change-related stressors across the course of their lives compared with adults⁸. This, coupled with their immature physiology, means they are more susceptible to negative climate-related health effects^{7,18–20}. Limited capacity for heat adaptation, as well as greater consumption of oxygen, food and water relative to their size, places young people at greater risk of air-borne viruses, dehydration, contaminated food and malnutrition^{8,21}. Two-thirds of illnesses known to be influenced by climatic changes are projected to disproportionately burden children and adolescents (for example, diarrhoea, malaria and lower-respiratory-tract infections)^{8,21,22}. Compared with adults, children under 5 years in age in particular are more affected by illness-related mortality (for example, malaria)^{21,23} and injury sustained during disasters (for example, falls, burns and drowning)²². Maternal exposure to climate-related changes is also associated with complications in pregnancy and birth. Increased humidity and heat waves have been associated with low birth weight, preterm births, and prenatal complications such

as preeclampsia and eclampsia^{24,25}. It is clear that climate change confers an increased risk of harmful physical outcomes for children and adolescents. Physical illness is associated with symptoms of anxiety²⁶; however, the relationship between physical threats and climate anxiety is unclear. Future research is needed in this area, given the potential bidirectional influence of physical health and climate anxiety.

Physical environment. Not all children and adolescents are equally vulnerable to climate change and climate anxiety. Globally, approximately 85% of children and adolescents reside in the Majority World (referring to populations living in low- and middle-income countries)^{23,27}. Climatic changes in parts of Africa and Asia will amplify pre-existing vulnerabilities to extreme weather (for example, flooding), slower-onset disasters (for example, drought), poverty, scarcity of resources (for example, food and water), disease and child death^{22,25,28,29}. Disasters such as droughts, floods and fires can impact a child's immediate (for example, home), local (for example, parks, schools) and global (for example, countries, islands) physical environment. In a baseline climate change scenario, child deaths in the Majority World are projected to increase between an additional 40,000 and 160,000 by 2100, and in a more severe scenario between 60,000 and 250,000 (ref. ¹⁹). Fragile healthcare systems in many Majority World countries may have limited the ability to respond or adapt to these risks for youth²⁸. Furthermore, nations in the Global South commonly rely on agriculture, forestry and fishery for food and employment^{25,29,30}. Changes to the climate (for example, rainfall patterns, drought conditions) will negatively impact livestock and crops, which could exacerbate economic disadvantage, malnutrition and forced migration for families^{31–33}.

Children and adolescents of the Majority World are already noticing changes to the climate. One survey found that concerns and beliefs about climate change are higher in lower-middle- and upper-middle-income countries than in high-income countries. A greater proportion of young people in Turkey (91%), Brunei (91%) and India (89%) expressed that they are 'very' or 'quite' worried about climate change, compared with children in the United Kingdom (50%), Australia (58%) and the United States (53%)³. Another study found that high proportions of youth (aged 16–25 years) reported being 'very' or 'extremely' worried about climate change in the Philippines (84%), India (68%), Brazil (67%) and Nigeria (51%)¹³. These findings highlight a need to further investigate whether and how climate anxiety may be experienced by children and adolescents who are and will be most impacted by climate change.

Child development. Studies have demonstrated greater levels of anxiety and concern about climate change in younger populations^{11,34}. However, there is also evidence that psychological responses to climate change differ across the course of development from the ages of 7 to 18 years (ref. ³⁵). Research suggests that environmental concern, attitudes and behaviours may dip in adolescence (decreasing from approximately 14 years and increasing after 18 years)^{36–38}. Fluctuation in environmental concern over time reflects emerging and fluid attitudes, values and behaviours across childhood and adolescence.

It is also possible that the way in which young people perceive threats of climate change is in flux across development. In childhood, environmental attitudes and behaviours may be influenced by parent modelling and parent-child interactions about environmental issues³⁹. As children grow into early adolescence, they may begin to more fully comprehend the threats that climate change imposes, potentially deepening feelings of anxiety. Adolescents acquire knowledge from multiple sources, as opposed to predominantly from parents. As adolescents come to learn more about the global ramifications of climate change, ideas of the future may become laden with hopelessness^{40–42}. This hopelessness may be furthered by

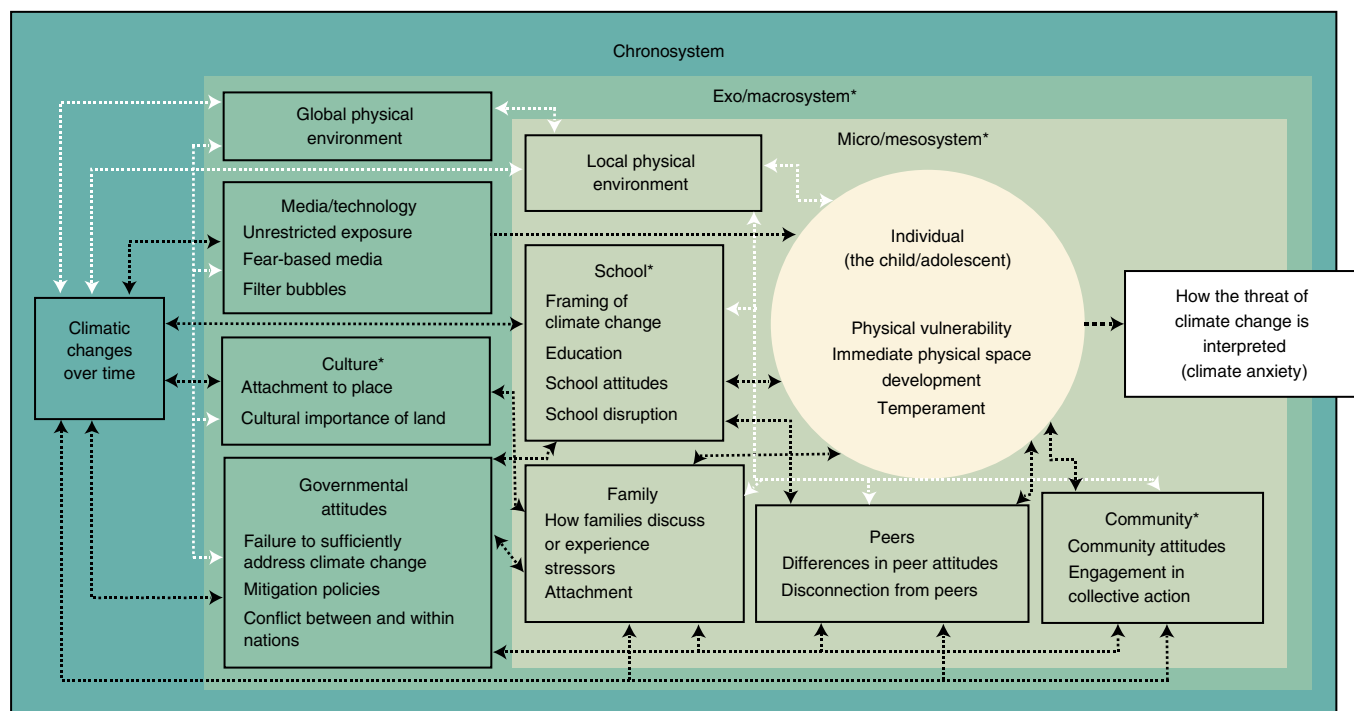


Fig. 1 | A social-ecological framework of climate anxiety for children and adolescents. This model depicts factors that may influence climate anxiety for a child or adolescent across a range of social-ecological systems. Arrows represent the direction of influence between factors, where double-ended arrows highlight bidirectional interactions. White arrows highlight links to physical environmental changes. Colours represent the layers of social-ecological systems within which factors fall, including the microsystem and mesosystem (lighter green), exosystem and macrosystem (medium green) and chronosystem (turquoise). As the micro/mesosystems and the exo/macrosystems are grouped by the same colour, the "*" symbol is used to distinguish the system within which a given factor operates.

an inability to use individual problem-solving for an issue as vast as climate change. Adolescents who want to act may also not have the agency or resources to do so (especially in comparison with adults), and this limited power may exacerbate climate anxiety^{16,43}.

Yet there is also considerable variation in the development of children and adolescents. As children grow, their understanding and concern about climate change may diverge on the basis of: (1) their values or temperament (individual); (2) their parents and peers (microsystem); (3) the type of education they receive, their community or their local physical environment (mesosystem); (4) the nature of their access to media and technology, the government and laws of their country, and their global physical environment (exosystem); and (5) their cultural values (macrosystem)— see Fig. 1. These influences on the development of climate anxiety are dynamic, evolving alongside the worsening climate crisis (chronosystem). Clearly, children and adolescents do not constitute a single homogeneous group. Education and mental health support should therefore be age appropriate and reflect differing unique responses. Future research is needed to further understand how climate anxiety differs across developmental stages, by involving parents or teachers in studies alongside children and adolescents.

Microsystem influences on child/adolescent climate anxiety

The following section discusses how the microsystemic relationships most closely surrounding a child or adolescent may influence climate anxiety.

Family. Parents are influential in how young people become aware of climate change, as well as how they respond^{44–46}. Their environmental values and behaviours can influence their children^{47,48}, shaping how young people perceive or feel anxious about environmental

threats. This influence is bidirectional (Fig. 1), with evidence showing that children can foster climate change concern in their parents⁴⁹. How parents choose to share and discuss information about climate change will also undoubtedly influence levels of climate fear and anxiety for their children.

The way in which parents communicate and convey threats is considered critical to how fear manifests in childhood^{50,51}. Providing negative or threatening information, for instance, can magnify or create new fears⁵². This raises concern when considering that many families are already experiencing stressors such as financial strain, forced migration, natural disasters, injury, illness and death due to climate change. For example, coastal flooding in Alaska and Tuvalu has forced families to relocate as 'climate refugees'⁵³, and in Australia families have lost homes and livelihoods due to bushfires⁵⁴. How parents and children experience, learn about, respond to and discuss climate change stressors creates a myriad of potential pathways for anxiety to transmit. Parents should be oriented to available resources that may support them in discussing and responding to climate change with their children in developmentally appropriate ways^{55,56}. There is also a need for evidence-based support that may help families manage or cope with climate-change-related issues (for example, health, environmental, socioeconomic).

Attachment. Children have an innate need to feel safe and receive consistent, reliable and responsive caregiving⁵⁷. These conditions underpin social-emotional development. Bowlby's attachment theory argues that consistent and reliable caregiving creates a healthy attachment⁵⁷. In turn, children explore new experiences from this secure base with confidence and trust. Conversely, inconsistent or negligent caregiving can increase a child's uncertainty and anxiety⁵⁸. For instance, among children aged 6–17 years that were exposed

Table 1 | Overview of factors to be considered when researching and working with climate anxiety in children and adolescents

Social-ecological context	Factors that may influence climate anxiety	Mitigating factors	Research opportunities	Healthcare/education/policy considerations
Individual	<ul style="list-style-type: none"> ●Physical vulnerabilities ●Immediate physical space ●Developmental stages across childhood and adolescence ●Temperament/psychological traits 	<ul style="list-style-type: none"> ●Coping style (problem-focused coping, meaning-focused coping, distancing the threat) ●Hope, agency, empowerment ●Pro-environmental behaviour 	<ul style="list-style-type: none"> ●Investigating links between physical and developmental factors and climate anxiety ●Investigating climate anxiety in youth of the Majority World ●Research on temperament/psychological traits and youth climate anxiety ●Exploring climate anxiety at different ages or stages of development ●Parents' and teachers' reports of climate anxiety in children and adolescents 	<ul style="list-style-type: none"> ●Education, information and support that is developmentally appropriate ●Supporting young people with maintaining hope and action
Microsystem (relationships)	<ul style="list-style-type: none"> ●Fear-based communication ●Family experiences of climate-related stressors ●Disruption to parent-child attachment ●Conflict, tension, isolation, disconnection from peers 	<ul style="list-style-type: none"> ●Hope/empowerment communication ●Social support 	<ul style="list-style-type: none"> ●Family interventions for climate anxiety that focus on communication and parenting ●Family interventions that help families to manage or cope with climate-related stressors 	<ul style="list-style-type: none"> ●Encouraging families to access available resources around discussing climate change with children in a developmentally appropriate way ●Collaboration between parents, educators, schools and young people ●Facilitating connection between peers
Mesosystem (school, community, local physical environment)	<ul style="list-style-type: none"> ●Fear-based education ●Limited or poor-quality education ●Lack of open discussion ●Socioeconomic disparities ●School disruption ●Local natural disasters (for example, droughts, fires, floods) 	<ul style="list-style-type: none"> ●Education framed on action ●Open discussion ●Collective community action ●Opportunities to engage in action 	<ul style="list-style-type: none"> ●Empirical evidence regarding climate change action programme outcomes for mental health in the long term ●Investigation into links between climate anxiety and the youth climate movement 	<ul style="list-style-type: none"> ●Facilitating action to build agency ●Training educators to facilitate open discussion, build agency and encourage action
Exosystem (government, society, global physical environment)	<ul style="list-style-type: none"> ●Fear-based media ●Media exposure to catastrophic events ●Government inaction or ineffectual/insufficient responses ●Ignoring or excluding young people from policy decision-making ●Policies that impact family livelihoods ●Social divide and conflict ●Global natural disasters (for example, droughts, fires, floods) 	<ul style="list-style-type: none"> ●Collective action ●Media or information framed with hope, empowerment, agency, action 	<ul style="list-style-type: none"> ●Investigating whether youth engagement in policy decision-making may mitigate climate anxiety ●Investigating the risk of insufficient policy responses that address climate change on child and adolescent mental health and climate anxiety ●Investigating the risk factors of policy changes on families and young people ●Understanding the geographical, geopolitical and technological influences on climate anxiety 	<ul style="list-style-type: none"> ●Regulating access and exposure to fear-based media ●Devising policies that are protective of and sensitive to youth ●Governments listening to youth and engaging with them as key stakeholders in climate policy issues
Macrosystem (cultural background and spirituality)	<ul style="list-style-type: none"> ●Cultural background and spirituality ●Disrupted attachment to places of spiritual or cultural importance 	<ul style="list-style-type: none"> ●Connection to nature, collective action to protect the environment 	<ul style="list-style-type: none"> ●Improving understanding of how climate anxiety may relate to culture, and disconnection to culturally or spiritually important places 	<ul style="list-style-type: none"> ●Facilitating preparation and adaptation to cultural losses in youth ●Helping to facilitate connection to culture and land beyond loss

to Hurricane Katrina in the United States, those who were more insecurely attached to their parents (had lower levels of trust and communication with their parents) had greater anxiety following the disaster⁵⁹. It should also be acknowledged that the attachment relationship is dyadic, as both parents and children may influence

the attachment and the development of trust. For parents, climate-change-related concerns and anxiety about the security of their child's future may influence this bond. For children, perceiving parents to be in denial, negligent or not taking substantive action could disrupt attachment and deepen their climate anxiety.

Peers. Adolescence is a time during which peers surpass parents as the primary source of social support and influence⁶⁰. Validation, support and approval in peer relationships can mitigate anxiety in adolescents^{60,61}. Evidence suggests that social support can improve resilient responses and buffer against negative mental health outcomes following disasters⁶². With regard to climate change, peers are able to inspire climate change concern and pro-environmental behaviour^{48,63}. However, little attention has been paid to how climatic changes will influence peer dynamics and, in turn, climate anxiety.

There is potential for peer dynamics to change due to differing perspectives or behaviour in relation to climate change. These differences could lead to disagreements, and at extreme levels rejection and victimization by peers. Additionally, connection to peers at school could be jeopardized by extreme weather events, forced migration and financial strain. These threats may potentially exacerbate worries for peers who are unable to help or connect with their friends, and children and adolescents may also become more reliant on technology to drive communication with peers. Empirical evidence is needed to explore these possibilities, given that social support may buffer against climate anxiety. Parents, health professionals and schools should also actively assist young people in maintaining their peer connections, particularly during climate-change-related stressors.

Mesosystem influences on child/adolescent climate anxiety

This section identifies the school and community contexts that may influence climate anxiety in children and adolescents.

How climate change is framed and taught in school. Schools have an important role to play in supporting young people's engagement in climate change mitigation. Action can be an 'antidote' for climate anxiety²⁷. Education geared towards action, rather than fear-based information, empowers youth with tangible strategies that they can collectively implement⁶⁴. This process establishes a meaningful role and agency for children and adolescents, allowing for adaptive rather than maladaptive responses²⁷. Conversely, not providing a safe space to engage in dialogue about climate change (which can help a young person feel understood) isolates children and adolescents within their own experience of anxiety. This silence also communicates that discussing the topic is unnecessary or futile⁶⁵.

An accurate understanding of climate change is necessary to develop agency and empowerment. Yet some young people carry an array of misconceptions about climate change, including vague ideas about the causes of climate change and incorrectly conflating climate change with depletion of the ozone layer^{30,37,41,66}. These misconceptions can persist into adolescence and adulthood, limiting further learning³⁷. Limited focus on climate change in the school curriculum in many countries, for example, leaves many young people unaware of the causes or consequences of climate change or mitigation responses^{32,43,67,68}. With many children and adolescents already noticing climatic changes and threats, misconceptions may fuel climate anxiety through increased uncertainty and confusion. Lack of information about how to mitigate climate change also limits a young person's ability to manage their anxiety using action. This is not necessarily the fault of educators. Indeed, the complexity of the topic, parent attitudes, the learning curriculum and self-reported lack of knowledge can act as barriers for teachers^{40,69,70}. This in turn will shape climate anxiety and perceived agency in youth.

Opportunities to engage in action. Identification of these issues has encouraged schools and local communities to design educational programmes aimed at strengthening youth agency^{71,72}. There is a body of research showing that youth-targeted engagement programmes can increase awareness, self and collective efficacy, knowledge, motivation and sense of empowerment to mitigate climate change, as well as leading to greater pro-environmental behaviour^{71,73-76}. However, it is unclear whether educational programmes

on climate change have long-term benefits for child mental health or climate anxiety symptoms. It would be beneficial for researchers to examine how engagement in youth climate action programmes, and more generally the youth climate movement, may moderate climate anxiety and mental health over time.

School disruption. Geographical and socioeconomic disparities are likely to play a role in whether a young person can engage with local community programmes, school programmes and education. Climate-change-related stressors (for example, extreme weather, migration) have caused and will continue to cause disrupted schooling for many children and adolescents, particularly in the Majority World^{19,31,68,77}. Schools and communities in lower-socioeconomic-status areas may not have equal access to resources. Therefore, consideration should be given to how communities educate and empower youth with differences in access to resources, location and quality of education. This might involve online resources for parents and educators⁷⁸, training educators in how to facilitate open discussion about climate change, or training parents or teachers to practice exercises that can build emotional resilience and agency within the classroom and at home⁷⁹.

Exosystem influences on child/adolescent climate anxiety

The following section highlights societal influences on climate anxiety in which children and adolescents may not have an active role.

Technology and social media. The virtual world has rapidly become a space where children and adolescents consume the majority of their information and knowledge. Access to resources on how to engage in pro-environmental behaviour, as well as connecting with like-minded peers on the topic, could empower young people to manage climate anxiety⁴¹. Yet, given the volume of information on the internet, there is limited ability to regulate how information about climate change is framed⁸⁰. Children and adolescents often have unrestricted exposure to sensationalist media, as well as news and images about global disasters, environmental destruction and death. This raises concern, as framing climate change as an impending environmental catastrophe may contribute to a sense of despair and helplessness⁸¹. As an alternative, framing media messages with hope and tangible action may be more conducive to empowerment and positive well-being for young people.

Furthermore, internet 'filter bubbles'—a process in which internet users become isolated in their ideological bubbles—may exacerbate worry for children and adolescents who are already anxious about climate change. The act of following news outlets or organizational pages online increases exposure to similar content. Children and adolescents who are concerned about climate change, for example, may subscribe to social media pages about climate change, permitting social media companies to display this content on their media feed. This greater exposure to images and information about climate change raises the salience of the threat, and can in turn trigger anxiety⁸². Empirical evidence is needed to determine the degree of impact this exposure may have, and therefore whether parents, educators, media and governments should better regulate how young people access age-appropriate information about climate change.

Government attitudes and policies. As part of a globally coordinated climate change mitigation plan, countries are beginning to implement long-term policies, such as a transition to cleaner energy, sustainable transport and forestry management, to name a few⁸³. Failure or ineffectual implementation of such policies will lead to long-term and global catastrophic risks for humankind. Initially, negative outcomes may be more salient for disadvantaged and vulnerable families. In the Majority World, where children and adolescents are the largest demographic group in the population,

family livelihoods most commonly rely on natural resources^{28,29}. Changes to livelihoods and resources resulting from unmitigated climate change will probably further reduce the financial resources that these families have to invest in safe housing, education and healthcare³¹. In the Minority World (referring to populations from high-income countries), disadvantaged families will have less access to technological, medical and financial resources⁸⁴. These discrepancies between and within nations may weaken collective action and hope, and create social divide and conflict, as well as exacerbating climate anxiety. In turn, conflict for resources places young people at greater risk of negative psychological, educational and developmental outcomes⁸⁵. Regardless of geographic location or socio-economic status, unmitigated (or insufficiently mitigated) climate change will leave younger generations to face a future of increasing displacement, illness, resource shortage, conflict and death^{19,81,86}.

Concern about insufficient governmental responses has led to youth taking action to try to force governments to respond to climate change as a serious threat^{13,27,37,81}. However, many countries are failing to engage with youth voices and structure policies in ways that are sensitive to and protective of children and adolescents⁸⁶. In one study conducted across ten countries (including countries from the Majority and Minority Worlds), young people reported feeling that their government was dismissing others' stress (60%), lying about the impact of actions taken (64%) and failing young people (65%)¹³. Failing to adequately address climate change and ignoring or excluding young people from decision-making may foster climate anxiety that is characterized by powerlessness, hopelessness and helplessness for some youth.

Transitions brought by policy changes can also present short-term risks (for example, economic hardship) for particular families and their children⁸⁷. Governments must therefore be sensitive to the flow-on effects that policies may have on children and adolescents across the world. Listening to and incorporating youth as key stakeholders in climate policy issues, as well as structuring policies around child-sensitive principles, is recommended⁸⁶.

Macrosystem influences on child/adolescent climate anxiety

This section describes potential larger cultural influences on climate anxiety for children and youth.

Cultural importance of place. Place attachment refers to the connection that individuals have with their surroundings. Attachment to place can differ greatly depending on individual and cultural concepts of place and features that make a place meaningful⁸⁸. Attachment to natural places is linked to pro-environmental behaviour, nature identity and environmental concern⁸⁸. In early childhood, salient places commonly involve outdoor places built for play, such as parks, tree houses and sports fields. For primary-aged children (7–12 years), places of attachment are typically natural outdoor settings such as forests and beaches. Adolescents attach to places of cultural and social relevance (for example, cinemas, youth centres) and derive a sense of identity by personalizing places (for example, decorating their bedrooms)⁸⁹. Destruction and displacement following natural disasters may evoke emotional distress, disorientation and loss in children and adolescents^{89,90}. In the context of climate change, this is often referred to as 'solastalgia'—mourning and loss in response to environmental change. Gradual changes to meaningful places may also cause disrupted attachment and distress in young people⁹¹.

Children and adolescents whose well-being, spirituality and culture are connected to the land on which they live will be more greatly affected by environmental and climatic change. Dene Tha' First Nation youth from Canada reported a severed connection to meaningful places due to environmental changes such as forestry or industrial development⁹². While some families may be able to prepare for and mitigate gradual environmental change using

knowledge about the land (such as communities from the Torres Strait using native species to revegetate sand cays)⁹³, others may be less prepared to manage natural disasters that occur to spiritually important places (such as in rural India)⁹⁴. Further, as climate change worsens over time, disconnection between young people, their land and their culture may deepen. Very few studies to date have considered how 'loss of place', and particularly loss of culturally important places, could exacerbate the perceived threat and anxiety towards ongoing and future environmental change in youth. Future research and practice should consider how place attachment may mediate climate anxiety, particularly as many researchers endorse connection to nature for future interventions. Health practitioners working with youth who feel anxious about these climatic threats may help young people to prepare for and adapt to unavoidable environmental losses, and to continue their bonds with culture and land after loss.

Overview of protective factors

Studies examining child and adolescent anxiety have demonstrated an array of intrinsic (for example, coping skills, emotional knowledge) and environmental (for example, parent–child relationship, classroom environment) protective factors^{95,96}. While less extensive, research has also begun to mobilize around factors that may mitigate youth anxiety in the context of climate change. In particular, Ojala⁹⁷ examined coping responses and their relationship with climate anxiety from late childhood to early adulthood. The study showed that problem-focused coping (action to reduce the cause of the problem) and distancing from the threat helped regulate anxiety symptoms. In addition, meaning-focused coping evoked hope, which has been associated with active engagement with environmental issues and subjective well-being among youth^{42,98}. Evidence also suggests that hope increases pro-environmental behaviour and reduces the risk of reduced well-being as a result of climate anxiety⁹⁹.

Education framed around tangible action and open discussion helps channel feelings of anxiety into agency and empowerment^{27,65}. Connection to nature is correlated with greater emotional well-being, greater ability to regulate challenging emotions, reduced stress and improved self-efficacy for young people^{91,100}. Additionally, collective action at the community and global levels may allow for the burden of climate change to be shared with others, with youth reporting a stronger connection to culture, land and communities following engagement in collective climate action⁴⁴.

Bidirectional influences. It is important to acknowledge that the multisystemic influences on climate anxiety in children and adolescents are not unidirectional, but rather interact bidirectionally (as illustrated in Fig. 1). Climatic changes and the physical landscape influence and are influenced by the actions of governments, cultures, communities, families and young people. Governmental positions influence media content, as well as how communities, schools, peers and families discuss and experience climate change alongside a child. To help empower or protect young people, communities, schools and families may stimulate governmental change. Peer interactions are influenced by school attitudes and disruption to schooling. At the centre of these systems, a child or adolescent may also guide how their peers, families, communities and governments respond to climate change. These are merely a few of the bidirectional influences that shape how children and adolescents perceive climate change, and therefore whether and how they experience climate anxiety.

Conclusions

A systems approach informs future directions to advance the current understanding of what shapes children's and adolescents' experience of climate anxiety. Future investigations should explore the relationships between child and adolescent climate anxiety and: (1) individual characteristics (physical vulnerability, development,

temperament); (2) the microsystem (impacts on families, family communication about climate change); (3) the mesosystem (potential long-term benefits of school/community climate action for youth climate anxiety or mental health); (4) the exosystem (climate change mitigation policies, technology's role in exacerbating fears); and (5) the macrosystem (loss of cultural and spiritual connections to land), as well as changes that will occur to the physical environment by geography. These are only some examples of the numerous areas of study open to researchers who adopt a systems approach.

Of particular importance is to distinguish rational, adaptive responses to climate change (for example, climate distress/climate empathy) from clinically maladaptive climate anxiety (for example, clinical climate anxiety/adjustment disorder) and broader clinical anxiety in children and adolescents. This should include estimating the prevalence of clinical levels of climate anxiety in children and adolescents. Separating these concepts (or investigating whether they lie on a single continuum of increasing severity and impairment) will help guide professionals in providing more appropriate individual support. In the effort to help young people cope with the unavoidable impacts of climate change, support must also be delivered systematically (for example, family interventions, public messaging). Most importantly, urgent action must be taken to reduce the severity of climate change and its impacts on younger and emerging generations.

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Competing interests

The authors declare no competing interests.

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