The 2021 China report of the *Lancet* Countdown on health and climate change: seizing the window of opportunity

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Executive summary

China, with its growing population and economic development, faces increasing risks to health from climate change, but also opportunities to address these risks and protect health for generations to come. Without a timely and adequate response, climate change will impact lives and livelihoods at an accelerated rate. In 2020, the *Lancet* Countdown Regional Centre in Asia, led by Tsinghua University, built on the work of the global *Lancet* Countdown and began its assessment of the health profile of climate change in China with the aim of triggering rapid and health-responsive actions.

This 2021 report is the first annual update, presenting 25 indicators within five domains: climate change impacts, exposures, and vulnerability; adaptation, planning, and resilience for health; mitigation actions and health co-benefits; economics and finance; and public and political engagement. The report represents the contributions of 88 experts from 25 leading institutions in, and outside of, China. From 2020 to 2021, five new indicators have been added and methods have been improved for many indicators. Where possible, the indicator results are presented at national and provincial levels to facilitate local understanding and policy making. In a year marked by COVID-19, this report also endeavours to reflect on China's pathway for a green recovery, ensuring it aligns with the carbon neutrality goal, for the health of the current and future generations.

The increasing health risks of climate change in China

The findings presented in this China report of the *Lancet* Countdown reaffirm those of the previous report—namely, that the climate-related health threats are worsening in China. In 2020, the heatwave exposures per person in China increased by 4·51 days compared with the 1986–2005 average, resulting in an estimated 92% increase in heatwave-related deaths. The resulting economic cost of the estimated 14 500 heatwave-related deaths in 2020 is US$176 million (indicators 1.1.1 and 4.1.1). Increased temperatures also caused a potential 31·5 billion h in lost work time in 2020, which is equivalent to 1·3% of the work hours of the total national workforce, with resulting economic losses estimated at 1·4% of China's annual gross domestic product (indicators 1.1.2 and 4.1.2). Although the population-weighted fire risk has decreased, actual population exposure to wildfires has increased in 20 provinces from 2001–05 to 2016–20 (indicator 1.2.1). Additionally, the vectorial capacity for the transmission of dengue by *Aedes* mosquitoes in China has increased by 25·4% in 2016–19 compared with 2004–07 (indicator 1.3). The frequency and intensity of flood events in China continue to increase and, although the emergency response capacity has reduced the number of people affected by floods, the extreme floods in 2020 and 2021 have the potential to reverse this progress (indicator 1.2.2). The sixth assessment report of the Intergovernmental Panel on Climate Change makes it clear that the health threats from climate change will increase in the coming decades, even if mitigation efforts limit global temperature rise to 1·5°C, which emphasises the necessity of health adaptation.

Each region in China faces its specific health threats, depending on its local environmental and socioeconomic conditions. The most concerning trends are the rising heat-related mortality, labour loss, and dengue risk in Guangdong province; flood and drought risks in Sichuan province; and wildfire exposures in Liaoning and Jilin provinces. Developing tailored policies according to these threats is essential to improve the efficiency and effectiveness of climate adaptation responses.

Mixed progress in responding to climate change

The COVID-19 pandemic and the announcement of China's carbon neutrality goal have increased the news coverage and awareness of public health and climate change in China (indicators 5.1.2 and 5.2). However, the growth in awareness has not been sufficient to catalyse actions in all aspects of adaptation and mitigation, and the indicators in these domains identify mixed progress.

For adaptation efforts, there has been steady progress in local adaptation planning and assessment in 2020, urban green space growth in 2020, and health emergency management in 2019. 12 of 30 provinces reported that they have completed, or were developing, provincial health adaptation plans (indicator 2.1). Urban green space, which is an important heat adaptation measure, has increased in 18 of 31 provinces in the past decade, and the capacity of China's health emergency management increased in almost all provinces from 2018 to 2019

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(indicators 2.2.3 and 2.2.1). However, additional actions are needed given the absence of a stand-alone national health adaptation plan, the absence of assessment and adaptation planning process in the majority of provinces, the sparse engagement of climate information services in public health policy making (indicator 2.3), and the absence of reference to climate change in the responsibilities of the newly established National Bureau of Disease Control and Prevention.

Looking towards China's plan for peak emissions before 2030 and to achieve carbon neutrality before 2060, there were some positive signs, marked by the improving energy investments, the continuous rise in clean energy, and the steadily decreasing carbon intensity of the energy system (indicator 3.1). Despite the shock of COVID-19, low-carbon investments still increased from 2019 to 2020, which are now 9·5 times higher than those of coal, and fossil fuel subsidies in 2019 were 40% lower than in 2018, reversing the upward trend that was seen during the previous 3 years (indicators 4.2.1 and 4.2.3). As a result of China's persistent efforts to clean its energy structure and control air pollution, the premature deaths due to exposure to ambient particulate matter of 2·5 µm or less ($PM_{2·5}$) and the resulting costs continue to decline. However, 98% of China's cities still have annual average $PM_{2·5}$ concentrations that are more than the WHO guideline standard of 10 µg/m³ (indicator 3.3). China announced strict control on coal-fired power plants in April, 2021, which will greatly benefit both carbon mitigation and air pollution control. Despite the worldwide call for a green recovery, after a steep but temporary drop in the first quarter of 2020, the overall carbon emissions in China increased by 1·28% in 2020.

Seizing the window of opportunity

During this important junction in time, the health policy makers in China are reflecting on COVID-19 and have established a new and more powerful National Bureau of Disease Control and Prevention to improve overall public health. At the same time, climate policy makers and macroeconomic planners are designing China's National Climate Change Adaptation Strategy 2035 and are exploring how to achieve short-term economic recovery while ensuring long-term carbon neutrality. However, the dialogues between these different groups of decision makers are limited by their scope and recognition of their intersecting agendas and impacts. The risk of decisions made in isolation is that China might not fully realise the health and economic benefits of addressing the pandemic alongside tackling climate change, which is likely to be a larger global public health threat than COVID-19 in the long run. Therefore, we propose four recommendations for the key stakeholders in health and climate change in China.

The first proposal is to promote systematic thinking in the related departments and strengthen multidepartmental cooperation. Given the huge gap between current global climate commitment and the 1·5°C target, the potential health benefits of climate change mitigation, and the health threats from climate change (even with 1·5°C of warming), addressing health threats from climate change requires long-term and compound efforts in both mitigation and adaptation. Therefore, multiple departments should work together on this issue to comprehensively protect and improve the health of people in China. The health-care sector, especially the newly built National Bureau of Disease Control and Prevention, should recognise climate change as a major health threat in China and mount a commensurate response. Furthermore, sectors related to climate and development in China should incorporate health perspectives into their policy making and actions, demonstrating WHO's and President Xi Jinping's so-called health-in-all-policies principle.

The second proposal is to do additional assessments of the health impacts of climate change and make national and region-specific adaptation plans. It is necessary to include clear goals and timelines for climate-related health impact assessments and health adaptation plans at both the national and the regional levels in the National Climate Change Adaptation Strategy 2035. A new domain in the annual Healthy China Work Priorities that focuses on reducing the climate-related health risks is also urgently needed. This domain should include specific priorities on improving early warning and response networks for climate-related health risks, on promoting systematic health risk and vulnerability assessments, and on increasing the preparedness of health-care agencies to climate-related health risks.

The third proposal is to strengthen China's climate mitigation actions and ensure health is included in China's pathway to reach carbon neutrality. Considering the prominent health co-benefits related to air quality improvement from coal phase-out, a carbon neutrality pathway with over-reliance on coal combined with carbon capture and storage might lead to additional morbidity and mortality attributable to air pollution, despite the alleviated threats from climate change. Therefore, coal phase-out is imperative for China if it is to opt for a carbon neutrality pathway that maximises the health benefits for people in China. On the basis of the country's first coal phase-out commitment, it is important to send strong signals to the investors and producers and stop financing new coal activities. Specifically, by promoting investments in zero-carbon technologies and reducing fossil fuel subsidies, the current rebounding trend in carbon emissions will be reversed and lead to a healthy, low-carbon future.

The fourth proposal is to increase awareness of the linkages between climate change and health at all levels. Health professionals, the academic community, and traditional and new media should raise the awareness of the public and policy makers on the important linkages between climate change and health. Local and national campaigns that link the response to climate change with health benefits for people today, and protect future generations, will be crucial for building confidence and support in mitigation and adaptation actions.

The health impacts of climate change continue to worsen in every province in China and there is mixed progress in the adaptation and mitigation responses. With several key health and climate decisions being developed, the country has a unique opportunity to increase its leadership in committing to global climate mitigation actions that benefit and protect health. After the painful lessons from COVID-19, this important opportunity to protect the health of people in China, both now and in the future, cannot be missed.

Introduction

No country can avoid the health impacts of climate change.[1,2] As the world's largest emitter of greenhouse gas and the home of a fifth of the world's population, China is facing the health threats posed by climate change. Every province in the country is affected by climate change and each province faces unique risks.[2] Without a timely and adequate response, climate change will increasingly threaten lives and livelihoods,[3–5] jeopardising the realisation of the Healthy China goals and Beautiful China goals (a policy goal proposed by Chinese Government for sustainable development in China, with specific quantified goals for environmental issues, such as air quality).[6,7]

With several national health and climate change decisions being developed, 2021 is a very important year for China. The National Bureau of Disease Control and Prevention, a vice-ministerial bureau directly administered by the National Health Commission, was set up in April, 2021,[8] highlighting the country's determination to learn from the COVID-19 pandemic and strengthen early disease intervention. China is also debating how to align short-term economic recovery goals with long-term climate goals to peak emissions before 2030 and achieve carbon neutrality by 2060. The major tasks to be included in the National Climate Change Adaptation Strategy 2035 are also being discussed among scholars and government departments, with the strategy expected to be released at the end of 2021. Furthermore, China has agreed to unveil its carbon neutrality plan before the upcoming climate negotiations at the UN Framework Convention on Climate Change 26th Conference of the Parties (COP26), to be held in November, 2021, in Glasgow.[9] Surrounded by all these important developments, it is crucial that the interlinkages of climate and health are incorporated throughout these policy-making processes. It is also essential to evaluate the adequacy of the health and climate responses in China and highlight policy recommendations to seize the opportunity to improve the health of the current and future generations.

To meet these objectives, the *Lancet* Countdown Regional Centre in Asia, led by Tsinghua University, has produced the first annual update of the China *Lancet* Countdown report, aimed at tracking the health profile of climate change in China. This report represents the contributions of 88 experts from 25 leading institutions within and outside of China. The 25 indicators tracked in this year's report fall into five domains, mirroring those of the global *Lancet* Countdown report:[1] climate change impacts, exposures, and vulnerability; adaptation,

Panel 1: The 2021 China *Lancet* Countdown report indicators

Climate change impacts, exposures, and vulnerability

- 1.1: health and heat
  - 1.1.1: heatwave-related mortality
  - 1.1.2: change in labour capacity
- 1.2: health and extreme weather events
  - 1.2.1: wildfires
  - 1.2.2: flood and drought
- 1.3: climate-sensitive infectious diseases

Adaptation, planning, and resilience for health

- 2.1: adaptation planning and assessment
- 2.2: adaptation delivery and implementation
  - 2.2.1: detection, preparedness, and response to health emergencies
  - 2.2.2: air conditioning—benefits and harms
  - 2.2.3: urban green space
- 2.3: climate information services for health

Mitigation actions and health co-benefits

- 3.1: energy system and health
- 3.2: clean household energy
- 3.3: air pollution, transport, and energy

Economics and finance

- 4.1: health and economic costs of climate change and benefits from its mitigation
  - 4.1.1: economic costs of heat-related mortality
  - 4.1.2: economic costs of heat-related labour productivity loss
  - 4.1.3: economic costs of air pollution-related mortality
  - 4.1.4: economic costs due to climate-related extreme events
- 4.2: the economics of the transition to zero-carbon economies
  - 4.2.1: investment in new coal and low-carbon energy and energy efficiency
  - 4.2.2: employment in low-carbon and high-carbon industries
  - 4.2.3: net value of fossil fuel subsidies and carbon prices

Public and political engagement

- 5.1: media coverage of health and climate change
  - 5.1.1: media coverage of health and climate change on social media
  - 5.1.2: newspaper coverage of health and climate change
- 5.2: individual engagement in health and climate change
- 5.3: coverage of health and climate change in scientific journals
- 5.4: government engagement in health and climate change

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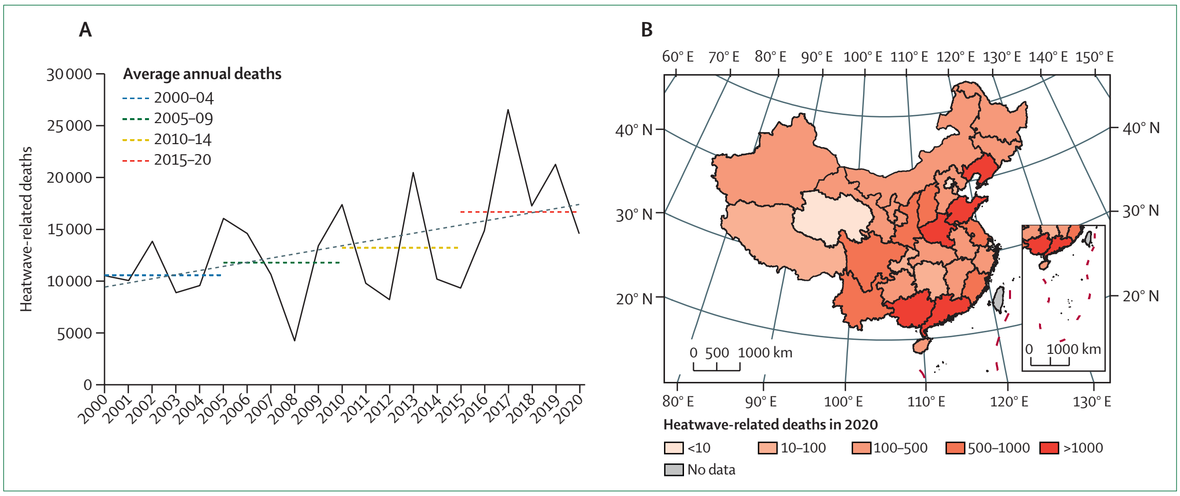

Figure 1: **Heatwave-related mortality in China**
(A) Trend of heatwave-related mortality in 2000–20; the grey dotted line shows the linear trend in heatwave-related deaths (397 × year – 785 447; p=0·029) and the horizontal dashed lines show the average annual deaths in 2000–04, 2005–09, 2010–14, and 2015–20. (B) Heatwave-related mortality by province in 2020; the premature deaths were estimated at grid level and daily level, which were then summed at province level and yearly level (appendix p 5).

planning, and resilience for health; mitigation actions and health co-benefits; economics and finance; and public and political engagement (panel 1). Many indicators have undergone methodological improvements and, where possible, the indicator results are presented at the national and provincial level to represent the interlinkages between climate and health in China and to facilitate local understanding and policy making. Five new indicators have been added since the 2020 report: flood and drought (indicator 1.2.2); urban greenness (indicator 2.2.3); climate information services for health (indicator 2.3); and newspaper and governmental engagement (indicators 5.1.2 and 5.4). Details of methods, data, caveats, and plans for future improvements of each indicator are provided in the appendix.

See Online for appendix

Section 1: climate change impacts, exposures, and vulnerability

Climate change is threatening human health through many pathways. This section tracks the interactions between climate change and health in China. Building on the previous year's work, five indicators are presented in this section, with updated data and methods, exploring several dimensions of heat and health (indicators 1.1.1 and 1.1.2), health and extreme weather events (indicators 1.2.1 and 1.2.2), and climate-sensitive infectious diseases (indicator 1.3).

Indicator 1.1: health and heat

Indicator 1.1.1: heatwave-related mortality

When people are exposed to consecutive days of heat beyond thresholds, the risk of death increases substantially.[10] Indicator 1.1.1 tracks non-accidental (ie, disease-related) heatwave-related mortality in China. This year's report uses monthly mortality rates and combines provincial relative risks by climate zones to better reflect seasonal and regional patterns of mortality risk during heatwaves (appendix pp 5–7).[11]

In 2020, every person in China had 4·51 more heatwave days than in the 1986–2005 average. The resulting increase in heatwave-related mortality was 92%, with an estimated 14 500 deaths in 2020, 77% of which were people older than 65 years. Although there is annual variation, a clear increasing trend in mortality can be seen during the past two decades. Compared with 2000–04, heatwave-related mortality has increased by 63·6% to an annual average of 17 270 deaths in 2015–20 (figure 1A). Guangdong, Guangxi, and Liaoning provinces had the highest heatwave-related deaths, accounting for 31·7% of total deaths in 2020 in China (figure 1B). With a warming climate and an ageing population, and without additional adaptation measures, it has been estimated that heat-related deaths in China could increase to five to nine times of those in 2010 by the end of this century.[4]

Indicator 1.1.2: change in labour capacity

Heat exposure during work can reduce labour capacity and lead to an increased socioeconomic burden through reduced wages, which worsens health outcomes.[12–14] This indicator uses similar methods to the global *Lancet* Countdown report,[1] with national data and legal work stipulations, and this year's report has been improved to capture the ratio of indoor and outdoor workers (appendix pp 7–9).

Potential heat-related productivity loss has increased in the past two decades, reaching 31·5 billion h of work (or 1·3% of the total national work hours) in 2020, a trend that has been affected by the changing labour force and rising temperatures. Although still accounting for 68·9% of total losses, the heat-related productivity loss in China's agriculture sector has decreased along with the reduction of the agricultural labour force; however, the losses in construction and manufacturing sectors have increased rapidly, with annual average growth rates of heat-related productivity loss being 8·4% for the construction sector and 9·5% for the manufacturing sector. The southern provinces of Guangdong and Guangxi had the greatest heat-related productivity losses, accounting for 27·5% of the national total loss. Such a large loss of labour capacity has impacted economic performance and caused large wage losses, particularly for outdoor workers, placing their livelihoods and health in jeopardy.[1,12,13]

Indicator 1.2: health and extreme weather events

Indicator 1.2.1: wildfires

A warmer and drier climate is likely to increase wildfires, which cause morbidity and mortality through thermal injuries and smoke exposure. For example, the 2019–20 Australian wildfires caused 33 direct deaths, more than 4400 admissions to hospital, and 400 excess deaths due to smoke exposure.[15,16] This year, we track model-based wildfire risk (ie, the annual average number of days people are exposed to very high or extremely high wildfire risk;[17] defined in the appendix [pp 17–18]) and satellite-observed exposure (ie, the change in population exposure to wildfires).[18,19]

From 2001 to 2020, there was a reduction in population-weighted wildfire risk, but population exposure to wildfires increased in most years. In 2016–20, national annual average wildfire exposure increased by 24·5% compared with 2001–05, and 20 provinces had an increase in wildfire exposure, with the northeast provinces showing a rise of 331·4% due to increasing temperatures during the fire season. The Daxing'anling forest fire on May 30, 2020, burned around 16 000 m² and more than 2000 firefighters were directly exposed to fire smoke.[20,21] One forest fire in Sichuan province on March 20, 2020, killed 19 people, including 18 firefighters.[22] See the appendix (pp 19–20) for a detailed description of the method.

Indicator 1.2.2: flood and drought

Floods are among the most frequent natural disasters in China.[23] Climate change tends to alter precipitation patterns and temperature, increasing the risk of local flood and drought events, causing direct injuries, damaging essential infrastructure, and exacerbating the spread of vector-borne and water-borne diseases.[24,25] This indicator has changed data source since the 2020 report to the Yearbook of Meteorological Disasters in China,[26] which provides more detailed information about dates, the affected area, the affected population, and economic losses for China (appendix pp 22–26).

The number of flood disasters increased substantially during 2000–19, the number of drought disasters remained stable, and overall the damage caused by floods and droughts in China has decreased from 2004 to 2018, due to improvements in emergency response capacity. However, increased extreme precipitation and flooding, such as that seen along the Yangtze River in 2020 and in the Henan province in 2021, has the potential to reverse this downward trend in flood damage. In 2018, there were 35·26 million people affected by floods and 27·43 million affected by droughts, with Sichuan province being the most affected during the past years. In July, 2020, the average precipitation in areas along the Yangtze River reached the highest amount since 1961, threatening the lives and homes of people in 27 provinces across central and southern China.[27] In July, 2021, Henan, one of the most populated and flood-prone provinces in China, saw record-breaking precipitation and more than 300 people were killed in the flood, equivalent to nearly 80% of the total death tolls from floods in China in 2018.[28] Without actions taken, China could become the country that is most impacted by floods in the world.[24]

Indicator 1.3: climate-sensitive infectious diseases

As a result of changing environmental conditions, the suitability for the transmission of many food-borne, water-borne, and vector-borne pathogens is rising.[29,30] This indicator tracks the climate suitability for *Aedes aegypti* and *Aedes albopictus* and the disease burden for dengue in China (appendix pp 36–41).

During 2004–19, as a result of warmer daily temperatures, vectorial capacity for the transmission of dengue fever through *A aegypti* and *A albopictus* increased by 25·4% in China. Upward trends are seen in 18 provinces, and only Shanghai had a substantial decrease in vectorial capacity for dengue transmission. Compared with 2005, the all-age disability-adjusted life-year rate of dengue fever increased by 21 times in 2019, reaching 0·66 per 1 000 000 population. The high-risk areas would increase by 2·9 times and the population in these high-risk areas would increase by 4·2 times in the Representative Concentration Pathway of 8·5 W/m² greenhouse gases in the atmosphere scenarios by the end of this century compared with the average level in the 1981–2016 period.[5]

Conclusion

The health impacts of climate change in China are rising. Although fewer heatwave exposures in 2020 than in 2019 resulted in a slight decrease in heatwave-related mortality and labour productivity losses, the overall trends continue upwards. This year's unprecedented floods have the potential to reverse the previous downward trend in flood damage in China and the vectorial capacity for the transmission of dengue is rising. Without timely responses, such threats will continue to grow and could overwhelm the country's health system.

Different regions in China are confronted with unique health threats, as shown in figure 2. Among the most concerning trends are the rising heat-related mortality, labour loss, and risk of dengue fever in Guangdong

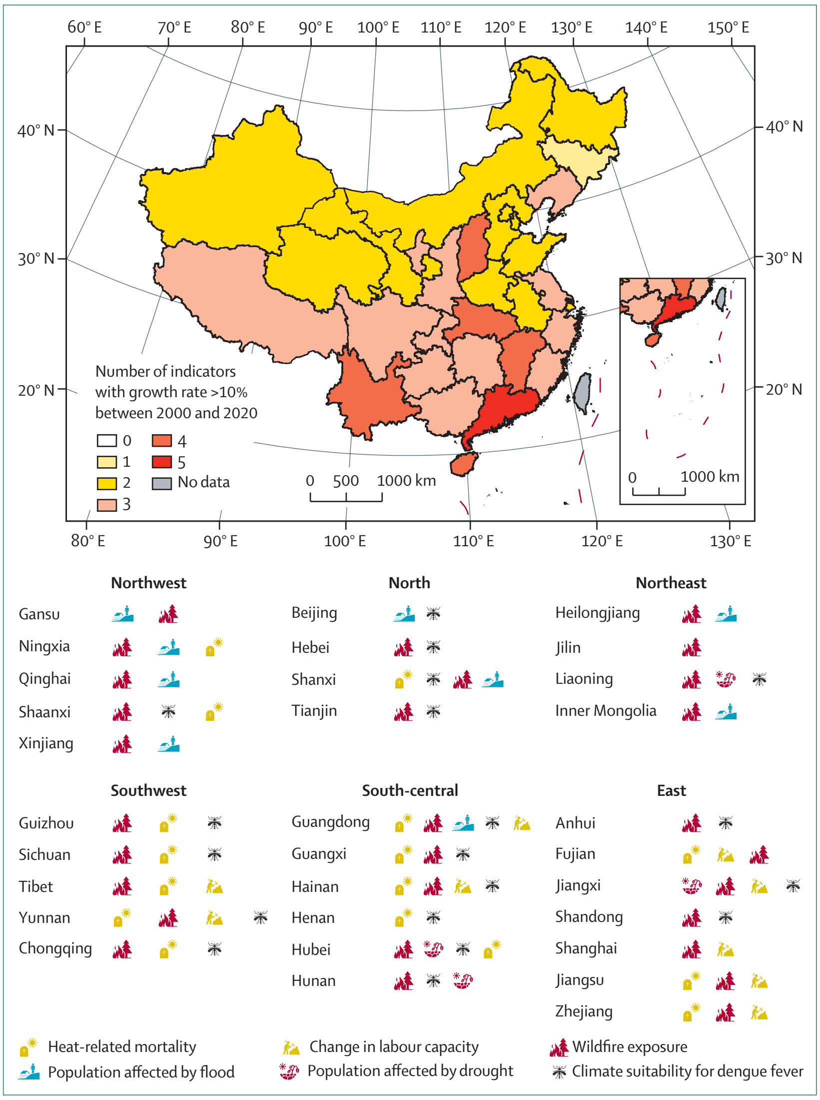

Figure 2: **The key rising health exposures from climate change in each province in China (2000–20)**
Each province is coloured according to the number of indicators with growth of larger than 10% between 2000 and 2020, and the icons represent indicators that have changed by more than 10% for each province. Within each province, the indicators with a growth rate higher than 10% were ranked in order with the indicator with the greatest change range being listed first.

province; flood and drought in Sichuan province; and wildfire exposures in Liaoning and Jilin provinces. Region-specific policies are necessary to improve the efficiency and effectiveness of climate change adaptation for health, which is discussed in section 2.

Section 2: adaptation, planning, and resilience for health

The shock of COVID-19 on the health-care system emphasised the necessity of risk assessment, adaptation planning, and emergency response capabilities. As climate change is likely to be an even larger global public health threat in the medium and long term than COVID-19,[31,32] adaptation to climate change from the health perspective is crucial. This section explores health adaptation from three aspects: adaptation planning and assessment (indicator 2.1), adaptation delivery and implementation (indicators 2.2.1, 2.2.2, and 2.2.3), and climate information services for health (indicator 2.3). Furthermore, in a year marked by COVID-19, panel 2 discusses the lessons from the pandemic, with the aim of shedding light on policy recommendations on how to better protect public health from climate change in China.

Indicator 2.1: adaptation planning and assessment

Although China has a national-level adaptation plan for climate change that includes a chapter on health, it still does not have a stand-alone national adaptation plan for health. In this indicator, we gather detail on health adaptation progress in each province, adapting the design of the *2018 WHO Climate and Health Country Profile Survey*[42] and collecting data in March, 2021. The survey received responses from 30 of 31 provincial-level centres for disease control and prevention in mainland China and follow-up phone calls were made to ensure the credibility and accuracy of the survey results (appendix pp 42–52).

Six provinces (Guangdong, Hunan, Yunnan, Sichuan, Shanghai, and Jiangxi) reported that they have formulated health and climate change adaptation plans or measures at the provincial level and an additional six provinces reported being in the process of developing relevant adaptation plans. For all responding provinces, the absence of a mechanism for multidepartmental co-operation (73%) was identified as the most important constraint to developing adaptation plans. Only four provinces (Guangdong, Jiangsu, Jiangxi, and Shanghai) have completed an assessment of the health impacts of climate change and a vulnerability assessment. In five provinces the survey showed that more attention was paid to climate change because of the COVID-19 pandemic.

Indicator 2.2: adaptation delivery and implementation

Indicator 2.2.1: detection, preparedness, and response to health emergencies

For this indicator, a comprehensive index system was used to track the ability of provinces to detect and rapidly respond to a health emergency, including climate-related health emergencies. This index system is described in the appendix (pp 55–62). The index score increased from 2018 to 2019 in 28 of 31 studied provinces and the average index score across all provinces improved by 5·3 (from 48·1 to 53·1 of 100·0). The provincial variance reduced by 23·6% within a year (the SD of scores decreased from 75·4 to 57·6); however, provinces in east China were the most prepared for health emergencies. As the data used to obtain the index score had not been updated for 2020, we are unable to track the impacts of COVID-19 on health emergency management capacity in this year's report. However, as extensive efforts are being put into containing

Panel 2: **COVID-19 and the climate-health challenges in China**

The outbreak of COVID-19 has been a reminder of the importance of the health and safety of the people and the country. China's economy had its first contraction in decades, contracting by 6·8% year-on-year in the first quarter of 2020. Urban unemployment also rose to an unprecedented 6·2% of the total working-age population in February, 2020, far higher than past levels of 4·8–5·3%.[33] Furthermore, China set up a special fund of US$2·96 billion[33,34] (equivalent to 30% of the national fiscal expense in foreign affairs in 2019) to help treat COVID-19 patients in designated admission facilities.

From the pandemic, China has learned to attach more importance to the early prevention of diseases. This lesson has been reflected in the establishment of the National Bureau of Disease Control and Prevention (NBDCP) in April, 2021,[8] which is a vice ministerial-level bureau directly administered by the National Health Commission.

The five major responsibilities of the NBDCP are: to formulate policies on prevention and control of infectious diseases and on public health supervision; to guide the construction of a disease prevention and control system; to plan and guide the construction of an epidemic monitoring and early warning system; to guide the construction of a scientific research system on disease control; and to supervise public health and infectious disease control. However, within the NBDCP mandate, there is no direct reference to the health impacts of climate change, signifying a worrying absence of attention to the top global risk identified.[35,36] In April, 2021, President Xi Jinping clearly named climate change and the COVID-19 pandemic as two major challenges faced by the world and advocated that countries should work together to formulate a collective response.[10]

The impacts of COVID-19 have been devastating and, as of Oct 4, 2021, COVID-19 has killed about 4·8 million people worldwide.[37] Although the COVID-19 pandemic represents an acute health crisis, the health impacts of climate change will continue to worsen in the coming years and decades without additional action. Taking a very conservative estimate, climate change has been already linked to an additional 150 000 deaths since 2000, a number that will rise to 250 000 in 2030.[38] The health burden from climate change would increase rapidly if climate change is not addressed in a timely and adequate manner.[4,5,24] The COVID-19 pandemic and climate change have a lot in common, with interlinkages in the root causes and the response measures.[1,39–41] The health impacts from the pandemic are immediate and radical, and they require a rapid and integrated response; however, it is also important to jointly fight climate change, which is a broader, longer-term, and more complex challenge that society faces. Preventing the health risks of climate change should become a key responsibility of the new NBDCP. Underestimating the health risks from climate change will be something that our health and economy cannot afford to do.

the pandemic, it is foreseeable that this index will improve substantially in the years to come.[43]

Indicator 2.2.2: air conditioning—benefits and harms

Household air conditioning use is an important measure to avoid heat-related and heatwave-related morbidity and mortality. However, it is also a major source of household carbon and particulate matter of 2·5 μm or less ($PM_{2·5}$) emissions from energy use. This indicator tracks household air conditioning use, its benefits in terms of the prevented fraction of heatwave-related mortality, and its harms from its contribution to additional carbon emissions (appendix pp 62–64).

With the rapid increase in household income, many families in China can afford separate air conditioners in different rooms: the national air conditioner inventories per 100 households increased from 70·4 in 2013 to 115·6 in 2019. The prevented fraction of heatwave-related mortality due to the use of air conditioning increased from 19% in 2000 to 49% in 2019. Carbon emissions from air conditioning also increased by more than 4·5 times since 2000, reaching 278 million tons in 2019. These trends highlight the need for more effective and climate-friendly heat adaptation measures, such as smart building design, passive ventilation, and increased urban greenness.[44–46]

Indicator 2.2.3: urban green space

Urban green spaces provide benefits for human health by improving air quality,[47] mitigating urban heat island effects,[48] and encouraging physical activity.[49,50] For this year's report, we introduced this indicator to track the level of urban greeness with a population-weighted normalised difference vegetation index (NDVI). NDVI is obtained from satellite-observed data[51] and the higher the NDVI value, the higher the level of greenness (appendix pp 65–67).

In 2020, three provinces had a very high level of urban greenness, six had high levels of urban greenness, and six had moderate levels of urban greenness. The provinces falling in these three categories have a total population accounting for half of China's population. The greenness levels in the southern provinces are substantially higher than those of the northern provinces. The high level and increasing trend of greenness echoed the efforts of urban planning in Chinese cities, but more effort is needed in remote provinces with low levels of greenness, fragile ecology, and a less developed economy, most of which are located in the inland northwest areas.

Indicator 2.3: climate information services for health

The use of meteorological services in the health sector is important for building early warning systems for climate-related public health risks.[1] The provision of information services is the first step to building multi-sector collaborations on health adaption to climate change. Deeper engagement between sectors in decision-making and policy practices is also essential for climate change adaptation for health. Using a survey targeting provincial meteorological departments, this indicator tracks the collaboration between meteorological departments and health departments (appendix pp 68–71).

Of 31 provincial meteorological departments, 21 reported providing meteorological information or products to the public health sector, but only ten reported supporting public health-related decision making.

Conclusion

The outbreak of COVID-19 and the extreme precipitation in Henan have highlighted the importance of pre-risk assessment, planning, and multidepartmental collaboration. However, the increased attention on health emergency management was not fully translated into adaptation actions towards climate change. The overall trend of all indicators is positive, such as the improvements in adaptation assessments at the provincial level and the increasing trend of urban greenness and health emergency management. However, the progress is in an initial stage, with a scarcity of multidepartmental collaboration, health risk and adaptation assessments, and localised planning.

Large regional inequalities are also observed, with lower adaptation abilities in inland provinces. Discrepancies also exist between provincial-level impacts and preparedness. For instance, Tibet, Guangxi, Guizhou, and Hainan all have four or five climate-related health risks growing by more than 10% from 2000 to 2020 (figure 2), but their health emergency management scores are much lower than the national average, with an absence of health adaptation plans and assessments. Clear timelines and goals to promote progress in these policy gaps should be incorporated in the National Climate Change Adaptation Strategy 2035, to be released in 2021. Furthermore, the climate-health perspective is currently absent from the annual Healthy China work priorities for 2021 that the Healthy China Action Promotion Committee has released.[52] Policy makers in health and climate fields, together with scientists, non-governmental organisations, and health professionals need to strengthen their cooperation.

Section 3: mitigation actions and health co-benefits

Chinese provinces are currently considering how to peak carbon emissions by 2030 and to become carbon neutral by 2060. At the Leaders Summit on Climate in April, 2021, China made the commitment to control coal consumption for the first time.[53] This commitment is important, as the coal phase-out, along with other measures of accelerated carbon mitigation, will not only help reduce air pollutants and achieve immediate health benefits but also restrict the temperature rise in the future and produce long-term health benefits (section 1). These benefits are important to the long-lasting prosperity of the economy and are in line with China's actions for a so-called ecological civilisation.[54,55] Even with a Paris Agreement compliant pathway, additional, and more ambitious, health-focused climate action plans in China could prevent millions of deaths from reducing air pollution, improving diet and increasing physical activity.[54] Therefore, choosing a health-responsive carbon neutrality pathway can facilitate a win–win future for climate and health.[56,57] This section tracks China's efforts in mitigating climate change, air pollution, and the associated health effects, with indicators falling into three linked domains: energy system and health (indicator 3.1), clean household energy (indicator 3.2), and air pollution (indicator 3.3). The effects of COVID-19 and its recovery on energy, emission, and health are discussed for each indicator.

Indicator 3.1: energy system and health

This indicator, which tracks mitigation within China's energy system, shows mixed progress this year. The carbon intensity and the coal share of China's total energy supply continued to decrease. In the power generation sector, which accounts for 44% of the country's carbon emissions, the electricity demand increased by 3·1% in 2020; however, wind-based electricity production increased by 15% and solar-based electricity production increased by 17% relative to 2019 levels. Although the COVID-19 lockdown (from Jan 23, 2020, to April 8, 2020) led to an 11% drop in carbon emissions in the first quarter, the overall carbon emissions increased by 1·28% in 2020 compared with 2019 emissions, because of the fast economic recovery in the following three-quarters of the year.[58,59] It indicates that China's carbon emissions grew at its fastest rate in more than a decade.[60] Coal use in 2020 even reached a new peak, with the highest increases seen in Shanxi, Inner Mongolia, and Shaanxi (appendix pp 71–78).[61]

Indicator 3.2: clean household energy

The use of inefficient fuels for cooking is estimated to cause more than 4 million deaths that are related to household air pollution annually around the world, with women and children bearing the greatest burden.[62] Increasing the proportion of clean energy use could directly benefit health and reduce greenhouse gas emissions.[63] The latest data for 2019 and 2020 are not yet available, but positive trends are emerging—eg, electricity is replacing coal burning in rural households, leading to a 17·9% reduction in rural residential coal use in 2018.[64] Per-capita consumption of household energy in 2020 has increased by 12% since 2019, much faster than the 7% annual average growth rate between 2000 and 2018. The main reason is that the COVID-19 lockdown led to more household energy consumption for cooking, entertainment, heating, cooling, and lighting.[65] Electrification is essential for household energy transition in the long term, and clean coal technologies could be used as a short-term substitution.[66] The centralised residence policy also could be applied to balance clean energy popularisation in rural areas (appendix pp 85–86).[67]

Indicator 3.3: air pollution, transport, and energy

From 2015 to 2019, efforts for cleaner air in China have led to a 28% decrease in ambient $PM_{2·5}$ concentration in cities, whereas the surface ozone concentration increased by 8%. In 2020, due to traffic limitations during the COVID-19 lockdown period,[68,69] ambient $PM_{2·5}$ concentrations declined by 9·9% and surface ozone concentrations declined by 6·3% from 2019. However, the limitation of rural-to-urban population migration increased the fraction of people exposed to household air pollution, especially in rural areas, which resulted in an overall estimated population-weighted $PM_{2·5}$ exposure increase of 5·7 μg/m³ during the national lockdown.[70] In this indicator, we use the greenhouse gas–air pollution interactions and synergies (GAINS) model[71] and Global Burden of Disease 2019[72] integrated exposure-response functions to estimate deaths attributable to $PM_{2·5}$ exposure (appendix pp 88–89) and we estimated that there were 243 700 fewer deaths in 2019 than in 2015 (figure 3). The agriculture and industrial sectors are responsible for 50·5% of China's deaths attributable to $PM_{2·5}$, followed by the residential sector (12·7%) and the transport sector (9·6%). Regionally, east China has the most deaths attributable to $PM_{2·5}$ (423 100), followed by south-central China (391 600). With a stringent emission standard in the transportation sector and rapid growth of green vehicle use, the nitrogen oxide, $PM_{2·5}$, hydrocarbon, and CO_2 emissions have reduced substantially.[33,73] Although successes have been seen in the 3-year action plan for cleaner air in 2020,[74] 40% of cities had annual average $PM_{2·5}$ pollution concentrations in 2020 that exceeded the WHO interim target 1 of 35 μg/m³ (an improvement from 52% cities of in 2019) and 98% of cities still have average annual $PM_{2·5}$ concentrations higher than the WHO recommended concentrations of 10 μg/m³.

Conclusion

The indicators in this section review China's progress on climate change mitigation and the associated health benefits from the abatement of air pollutant emissions. The COVID-19 lockdown resulted in short-term reductions in energy use and carbon emissions; however, the rebounds in overall coal consumption and carbon emissions in 2020 are concerning. Therefore, a reversal of this trend is urgently needed through a combination of macroeconomic planning and technological and financing policies, discussed in more detail in section 4, to control and reduce the coal consumption in line with commitments. When making the detailed pathways for limiting emissions and carbon neutrality, it is also necessary to take health into account so that the net-zero emission could be achieved with large health co-benefits.

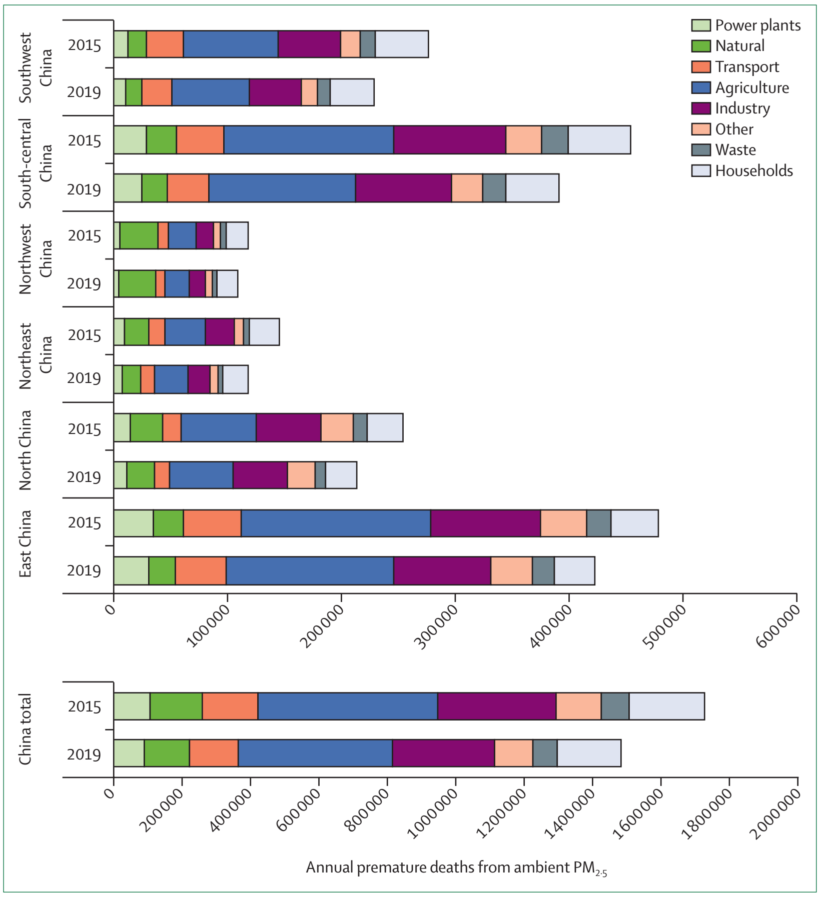

Figure 3: **Premature deaths attributable to $PM_{2·5}$ in 2015 and 2019 by key sources and regions in China**
$PM_{2·5}$=particulate matter with an aerodynamic diameter of 2·5 μm or less.

Section 4: economics and finance

According to the UN *World Economic Situation and Prospects 2021* report,[75] the global economy is expected to reduce by nearly US$8·5 trillion in output during 2020 and 2021 due to the COVID-19 pandemic. Importantly, some estimates[76] strongly suggest that the cost of climate inaction could be far more than that of the pandemic. Several studies have indicated that transitions to zero-carbon economies could be cost-effective. In China, the mitigation costs could be largely offset by the value of health co-benefits.[55,76,77] Thus, the seven indicators in this section are designed to track China's progress in two aspects: the health and economic costs of climate change (indicators 4.1.1–4.1.4), and the economics of the transition to zero-carbon economies (indicators 4.2.1–4.2.3). The data in this section are presented in the 2015 value of the US$, unless specified otherwise.

Indicator 4.1: health and economic costs of climate change and benefits from its mitigation

Indicator 4.1.1 economic costs of heatwave-related mortality

This indicator has been updated to unify the methods in indicator 4.1 and evaluates the economic costs of heatwave-related mortality of working-age people (ie, aged 15–64; taken from indicator 1.1.1) on the basis of the value of a statistical life, also presented in the appendix (pp 95–97). The direct costs from labour supply loss in a particular industry and indirect costs from interdependent relationships among industries were evaluated.[78] Overall economic costs of heatwave-related mortality in 2020 were $176 million, about 17 times higher than the costs in 2002. About 63% of the overall costs were due to indirect effects; the largest indirect costs were found in secondary industries (eg, manufacturing, construction, and mining; 69%), followed by tertiary industries (eg, catering, finance, and other services; 28%). With provincial-level data up to 2017, the three provinces with the greatest costs were Shandong ($23 million), Henan ($15 million), and Liaoning ($9 million).

Indicator 4.1.2: economic costs of heat-related labour productivity loss

This indicator estimates the economic costs of the heat-related labour productivity loss shown in indicator 1.1.2 with the methods shown in the appendix (pp 98–101). National economic costs of heat-related labour productivity loss in China have increased by 2·3 times from $75 billion (1·03% of gross domestic product [GDP]) in 2011 to $175 billion (1·36% of GDP) in 2020. The annual average cost for 2016–20 ($177 billion) was nearly double that of 2011–15 ($92 billion). The two provinces that had the greatest economic costs in 2017, relative to their GDP, were Hainan (6·75%) and Shanghai (3·78%).

Indicator 4.1.3: economic costs of air pollution-related mortality

This indicator estimates the economic costs of $PM_{2·5}$-related mortality in 2015 and 2019 (presented in indicator 3.3) with the methods described in the appendix (pp 101–102). Although the number of air pollution-related deaths decreased in 2019, the absolute national economic costs increased by 18% from $6·24 in 2015 to $7·36 billion in 2019 due to the increasing GDP of China. The relative costs of $PM_{2·5}$-related mortality as a proportion of China's GDP declined from 0·07% to 0·06%. Between 2015 and 2019, the share of the total costs in the secondary industries increased from 57% to 60%, the shares of primary industries (eg, agriculture, forestry, animal husbandry, and fishery) decreased from 12% to 10%, and the shares of tertiary industries decreased from 31% to 29%. The two provinces that had the greatest economic costs, in terms of regional GDP in 2015, were Chongqing (0·19%) and Shaanxi (0·14%).

Indicator 4.1.4: economic losses due to climate-related extreme events

In this report, indicator 4.1.4 uses a new dataset from the *Yearbook of Meteorological Disasters in China*,[79] which reports losses resulting from physical or direct damage, which recorded two to three times more data than were reported by Munich Re (used in the 2020 report [appendix pp 113–114]).[2] $1 of direct damage resulted in $0·23–0·32 of indirect loss through production disruptions nationwide between 2009 and 2018. The total economic losses due to climate-related extreme events have been fluctuating with a downward trend from $53 billion (0·88% of GDP in 2009) to $42 billion (0·35% of GDP in 2018) between 2009 and 2018, with substantial increases every 3 years. These data indicate that China has been increasingly economically resilient towards climate extremes, despite the growing frequency and intensity of these events. The primary industry sector was the most economically vulnerable to climate extremes, as it has higher indirect and direct loss ratios (1·95–2·79) than any other industry. The two provinces that had the greatest economic losses in 2017, relative to their GDP, were Jilin (3·18%) and Hunan (2·81%).

Indicator 4.2: the economics of the transition to zero-carbon economies

Indicator 4.2.1: investments in new coal and low-carbon energy and energy efficiency

This indicator uses the same methodology as described in 2020 report,[2] taking data from the Chinese National Energy Administration and the Wind Economic Database 2020.[80,81] Investment in new coal-fired power generation of China declined from $9·3 billion in 2019 to $7·94 billion in 2020.[76] Investment in renewable energy reached $75·8 billion in 2020, with wind power having the most investment with $37·6 billion and solar power reaching a new peak at $17·3 billion.[82] The ratio between investment in low-carbon energy (including hydro, wind, solar, and nuclear power) and new coal power has risen sharply from 1:1 in 2008 to 9:1 in 2019 and 9·5:1 in 2020. Provincial-level investment data have been derived from the national investment of new power generation facilities and the capacity of new provincial power generation facilities. The highest investments in renewable energy in 2020 were seen in Hebei ($5·94 billion), Shandong ($5·22 billion), Inner Mongolia ($4·95 billion), and Sichuan ($5·36 billion) provinces (appendix pp 119–120).[83] To support increased renewable energy development, investment in the overall power grid itself also continues to be high, with $75·6 billion in 2020. It is estimated that, to limit warming to below 2°C, the share of non-fossil fuel electricity generation needs to reach 92·1% in 2050, whereas the share of fossil-fuel generation should decline to 7·8%.[83] Therefore, to achieve the temperature limit goal and to realise the coal reduction and carbon neutrality pledges, China needs to ensure that any recovery packages do not go to coal-based projects and the investment in renewable energy should be accelerated in the coming years.

Indicator 4.2.2: employment in low-carbon and high-carbon industries

The data for indicator 4.2.2 are taken from the International Renewable Energy Agency Renewable Energy and Jobs Annual Review 2020, CEIC Data, and the Chinese National Bureau of Statistics.[33,84–86] In contrast to the decreasing trend of the total number of people employed in China (from 757·8 million in 2018 to 754·5 million in 2019), the number of people employed in the renewable energy sector is increasing (from 4·1 million in 2018 to 4·4 million in 2019, which is 1·1 million more than the number of people employed by fossil fuel extraction industries [appendix p 122]). The number of people employed in the renewable energy sector has been higher than in the fossil fuel extraction industries since 2017, and the number of people employed by fossil fuel extraction industries has decreased by 15% from 3·88 million in 2018 to 3·29 million in 2019. Employment in both renewables and fossil fuel extraction is likely to decrease in 2020–21, given the delays in construction during the COVID-19 lockdown. By taking a green recovery approach in the short term and pursuing carbon emissions reductions and neutrality goals in the long term, the country could provide new jobs in low-carbon industries.

Indicator 4.2.3: net value of fossil fuel subsidies and carbon prices

An effective price on carbon is essential to drive the transition into a zero-carbon economy; however, subsidies for fossil fuel consumption wrongly provide fossil fuels with a competitive advantage over clean energy and delay the process of fossil fuel phase-out. This indicator tracks the value of fossil fuel consumption subsidies in China and China's share of total global subsidies with data from the International Energy Agency[87] and tracks the coverage and strength of carbon pricing in China, with the data and methods described in the appendix (p 123). After 3 years of steady increase in subsidies, 2019 saw a substantial decline in fossil fuel consumption subsidies, from $47·7 billion in 2016 to $30·5 billion in 2019. Subsidies to oil products reached $18·1 billion in 2019, replacing electricity as the largest single component of total subsidies (appendix p 124). There are still huge gaps from the G20 commitment to phase out inefficient fossil fuel subsidies that encourage wasteful consumption.[88]

Carbon prices varied in the eight pilot carbon emissions trading markets in China, from $2·49 per total (t)$CO_2$ in Fujian to $12·53 per t$CO_2$ in Beijing in 2020. Although these prices were higher than in 2019, they were still much less than the price needed to realise the Paris Agreement goals ($40–80 per t$CO_2$ by 2020).[89] With the national emissions trading scheme in the power generation sector started in June 2021,[90] we plan to calculate the net value of fossil fuel subsidies and carbon prices in our 2022 report.

Conclusion

Despite the decreasing economic costs of air pollution and climate extreme events, the economic costs from heat-related health impacts have continued to grow. Among the four types of economic costs in section 4.1, the costs of heat-related labour productivity loss are the biggest and account for more than 78% of the total economic costs. Unfortunately, these huge economic costs have not received due attention from the government. With the aim of reducing these unnecessary costs and seizing the opportunity for green investment and employment in the post-COVID-19 pandemic era, the central and local governments in China need to speed up the reduction in fossil fuels subsidies, stop financing new coal activities, and invest more in low-carbon industries to achieve the carbon-neutral goal before 2060.

Section 5: public and political engagement

The outbreak of COVID-19 has drawn attention to public health. The indicators in this section explore whether this increase in attention has resulted in increased engagement in climate change and health. These indicators include media coverage from social media and newspapers (indicator 5.1), individuals (indicator 5.2), academia (indicator 5.3), and governments (indicator 5.4). The indicators covering newspaper coverage and government engagement are new for this year's report.

Indicator 5.1: media coverage of health and climate change

Indicator 5.1.1: coverage of health and climate change on social media

In this year's report, seven accounts on Weibo, the most influential social media platform in China, were assessed.[91,92] Four accounts (*Xinhuanet*, *Health Times*, *The Paper*, and *China Meteorological News*) were analysed in addition to the three accounts (*People's Daily*, The Beijing News, and *China Science Daily*) that were analysed in the 2020 report. From 2010 to 2020, there was an average of 1074 posts per year on climate change across all seven accounts, and 131 (12·2%) of these posts were also related to health (appendix p 130). 24% of all climate-related posts in 2020 occurred in July, mainly due to extreme weather events such as floods and droughts. The number of climate and health-related posts increased from 160 in 2019 to 427 in 2020—149 of these 427 referred to COVID-19, suggesting this substantial rise in engagement was not solely a result of the pandemic. The proportion of climate and health-related posts to only climate-related posts increased greatly to 25% in 2020. The growing attention on climate and health-related issues on social media was mainly driven by the health threats caused by heavy rain and mudslides in the summer, and the historical peak of climate and health-related posts in 2013 was mainly due to extreme weather events in the summer and air pollution.

Indicator 5.1.2: newspaper coverage of health and climate change

Despite the increase in new media and audience segmentations, newspapers still have a crucial role in public agenda setting and are an important channel of public engagement.[93] For the 2021 report, we selected the most influential newspaper in each of the 34 provinces to track their coverage on climate and health. From 2008 to 2020, an average of 23 377 newspaper articles per year were related to climate change, and about 6% (1301) of these articles per year were related to human health. The coverage of health in climate-related articles was highest in 2020, with 2766 articles, 2·6 times the number of articles in 2019 (appendix p 131). This increase was mainly attributed to COVID-19 and China's carbon neutrality goal. Coverage of climate change was highest in 2010, with the discussions on China's 12th Five-Year Plan being the major driving force, with local extreme weather events, such as severe floods, also contributing to the coverage increase in relevant provinces.

Indicator 5.2: individual engagement in health and climate change

This indicator tracks individual engagement in health and climate change, identified by search queries in China's most used search engine, Baidu. In this year's report, we improved the accuracy of the indicator by tracking the queries of different social groups and adding the keywords related to COVID-19 pandemic. See the appendix (pp 134–136) for more detail on the methods. The queries relating to health and climate change were still seldom co-searched by users—only 3·6 of 1000 climate change queries also had search keywords that were related to health in 2020. However, there is a notable rising trend in co-searched topics from 2019 to 2020, in which the climate change queries of 2020 increased by 54·9% since 2019 and the health and climate change co-searches of 2020 increased by 78·6%. The keywords search in headlines indicated that this growth was mainly driven by COVID-19. Generally, women, girls, and people in higher education had the highest number of climate change searches and health and climate change co-searches.

Indicator 5.3: coverage of health and climate change in scientific journals

This indicator tracks the engagement from Chinese scholars on health and climate change in scientific journals. In 2020, Chinese scholars published 3718 articles related to climate change, of which 1866 (50·2%) were in Chinese and 1852 (49·8%) were in English. Only 75 (2·0%) of these climate-related articles were related to health, of which eight (10·7%) were in Chinese and 67 (90·3%) were in English. The 75 articles represent a notable increase from the historical baseline in 2008 (17), outnumbering English articles published with authors from other countries in 2020 (eg, 58 in the UK and 46 in Germany); however, this number was still far behind the number of publications by authors in the USA (214 [appendix p 152]). Considering the health threats from climate change China is facing, the engagement from Chinese scholars on health and climate change topics is far from enough and requires more attention.

Indicator 5.4: government engagement of health and climate change

In this year's report, we introduce a new indicator to track government engagement in health and climate change through items (articles and policy files) published on the official websites of four departments related to climate change and health. These departments are the China Meteorological Administration, the National Development and Reform Commission, the National Health Commission of the People's Republic of China, and the Ministry of Ecology and Environment of the People's Republic of China. From 2008 to 2020, the number of articles related to climate change increased from 691 to 1212. 238 (34·4%) of the articles in 2008 and 315 (26·0%) in 2020 contained a reference to health. Government engagement in health and climate change was quite low and remained static over time. Compared with health and climate issues, the governments are more engaged in climate-only issues, especially in carbon mitigation and meteorological disasters. The China Meteorological Administration has many more relevant articles published on the official website than other relevant departments have, contributing 72·3% of the climate change articles and 83·2% of the health and climate change articles. The highest number of climate-related articles and climate health-related articles was in 2012, and these articles were mainly related to extreme weather events and scientific findings of climate change from provincial meteorological department websites (appendix p 155).

Conclusion

Progress in public and political engagements have been uneven. Media coverage and public engagement on climate and health issues witnessed a large growth in the past 5 years, which was especially evident in 2020. The growth in coverage on social media was mainly driven by emergent health risks of extreme weather events in the summer, indicating that social media accounts were more concerned with how climate change and health were related to everyday life; newspaper coverage was more concentrated on macro-level policies and more sustained and profound issues, such as COVID-19 and China's carbon neutrality goals; and individual searches were driven by COVID-19. The coverage of health and climate change from Chinese scholars and on government

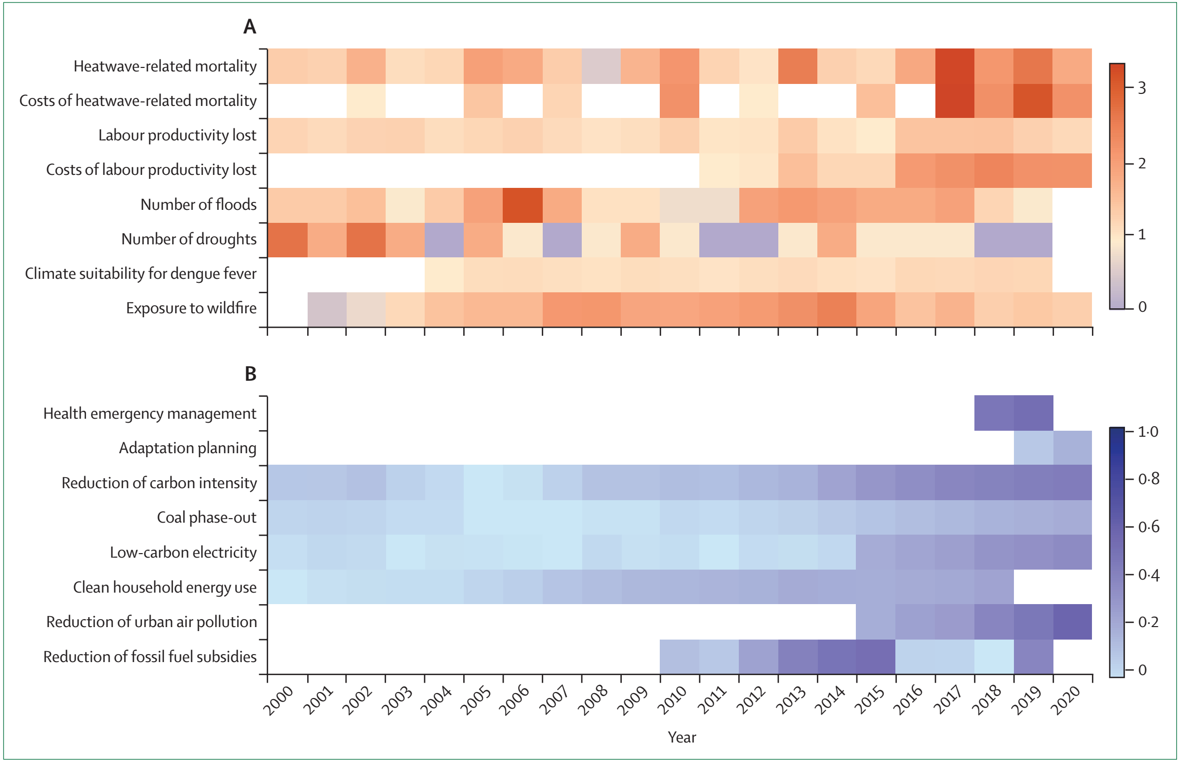

Figure 4: **An overview of impacts and responses tracked in the 2021 Chinese report of the *Lancet* Countdown**
(A) The change in indicators tracking impacts. A score of 1 represents the baseline value; a score of less than 1 represents an improved impact of the indicator compared with the baseline; and a score larger than 1 represents a worse impact compared with the baseline. (B) The change in indicators tracking responses. The value is indexed from 0 to 1, with 0 representing the worst actions in the past two decades, and 1 represents the best possible policy response. The standardisation method of indicator values is available in the appendix (pp 157–62).

websites was sparse, as was the engagement in key government departments, which calls for additional efforts in engagement. It is urgently needed that all stakeholders play their part to raise awareness on the linkages between climate and health.

Conclusions of the 2021 China report of the *Lancet* Countdown on health and climate change

This report is the first update of the assessment that comprehensively evaluates the health effects of climate change and the responses to these health effects in China.

Although lower in 2020 than in 2019, the impacts in every indicator within section 1 are higher than in their historical baseline (figure 4), suggesting the continuous increasing trend of health threats from climate change. In 2020, there were an estimated 14 540 heatwave-related deaths, of which 77% were senior citizens (ie, people older than 65 years). The intensity and frequency of flood and drought events have increased or remained unchanged during the past decades, while the affected population has continued to decrease, indicating progress in adaptation. Different regions have their unique health threats, such as the transmission of dengue fever through mosquitoes in the southwest region, wildfires in the northeast and northwest regions, and heat-related health impacts in the southeast region, which calls for tailored responses. Without timely actions, the health threats from changing climate are likely to worsen in the coming years and decades.

Despite the overall progress, there are still huge gaps to meet a response commensurate with the health threat of climate change (figure 4). In a year marked by COVID-19 and the carbon neutrality commitment, public health and climate change have each gained unprecedented, yet separate, attention in China, implying that public and political awareness of the linkages between health and climate needs to be improved. Mixed progress was seen in adaptation and mitigation responses to the health impacts of climate change. Among the 15 indicators that tracked response to health risks related to climate change during the 2 years of reporting, 12 indicators had an improving trend, two had a worsening trend, and one had a mixed change. On the adaptation side, there were some positive trends, with an increasing number of city-level and province-level health impact assessments, increasing levels of urban greenness, and better health emergency management. On the mitigation side, despite the steep reduction in energy consumption and carbon emissions during the COVID-19 lockdown, the rebounding coal consumption and carbon emissions in 2020 are worrying. A greener recovery package is urgently needed in China. Therefore, an acceleration of the investments in low-carbon industries is needed and fossil fuel subsidies in China should be gradually phased out to reverse the concerning trend in the post-COVID-19 pandemic era, so that the emissions pathway can be directed towards the carbon neutrality goal for better health.

Due to the reflections on COVID-19 and the new and existing climate ambitions, several key health, climate, and macroeconomic policies are being developed this year. If dialogue between these different decision makers is not promoted and, instead, isolated decisions continue to be made, society might fail to tackle climate change, which is probably a larger global public health threat than COVID-19 in the long term.[31] Alternatively, a recovery plan that damages health might be made and the opportunity to substantially improve health and wellbeing by choosing a carbon-neutral pathway that is health oriented might be missed. Either failure is something we do not want to experience in the future. It is crucial for society to seize the window of opportunity to pursue a win–win future for low-carbon development and public health.

Contributors

The 2021 China report of the *Lancet* Countdown on health and climate change is an academic collaboration that builds off the work of the 2015 *Lancet* Commission on health and climate change and the *Lancet* Countdown: tracking progress on health and climate change, specifically in the China context. This report is the annual update from the 2020 China report of the *Lancet* Countdown on health and climate change. The China report of the *Lancet* Countdown and the work for this paper were done by five working groups, which were responsible for the design, drafting, and review of their individual indicators and sections. All authors contributed to the overall paper structure and concepts and provided input and expertise to the relevant sections. Authors contributing to Working Group 1 were CH (as Working Group 1 lead), YB, JB, NC, HC, LC, QD, WeiD, YGa, YGu, JH, CLi, ZhaL, QL, YLi, XiaL, SLo, WM, YN, MX, YYu, JY, YYa, YZh, LZ, QZ, and ZheZ. Authors contributing to Working Group 2 were CR (as Working Group 2 lead), WenD, WF, XiaF, YGe, JH, CH, HH, RL, LL, BL, QW, LYa, and ZZhu. Authors contributing to Working Group 3 were SZ (as Working Group 3 lead), SA, BC, XC, XinF, TG, PK, GK, BL, HLin, ZhuL, HLiu, CLu, ZLu, ZR, WS, YS, TS, CZ, and ZhoZ. Authors contributing to Working Group 4 were HD (as Working Group 4 lead), WC, XC, DG, YH, XinL, YX, YZe, CZ, and MZ. Authors contributing to Working Group 5 were JS (as Working Group 5 lead), BD, DD, QJ, PL, SLi, SW, HX, JZhan, and JZhou. The coordination, strategic direction, and editorial support for this report were provided by WC, CZ, SZ, AM, IH, XJ, YLu, CW, BX, XY, LYu, JZhao, MF-CCF, and PG. WC had full access to all the data included in the paper. All authors had access to all data reported. WC, CZ, and SZ accessed and verified the data.

Declaration of interests

AM, PL, and IH were supported by the Wellcome Trust during this report. All other authors declare no conflicts of interests.

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