Public Health 253 (2026) 106159

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Review Article

Global policy review to identify links between climate change and antimicrobial resistance

Alexander J. Thornton [a,*], Kerry Badger [b], Rufus F.S. Robinson [a], Kelly Moon [c], Bianca Van Bavel [d,e], Jennifer Israelsson [f], Aideen Carroll [g], Rhiannon Cordiner [f], Colin Brown [g,h], Prof Lea Berrang-Ford [e,f], Prof Rebecca King [b]

[a] School of Medicine, University of Leeds, Leeds, UK
[b] Nuffield Centre for International Health and Development, University of Leeds, Leeds, UK
[c] School of Civil Engineering, University of Leeds, Leeds, UK
[d] School of Health Sciences, Insight Research Ireland Centre for Data Analytics, University of Galway, Galway, Ireland
[e] Priestley Centre for Climate Futures, School of Earth and Environment, University of Leeds, Leeds, UK
[f] Centre for Climate and Health Security, UK Health Security Agency, 10 South Colonnade, Canary Wharf, London, UK
[g] Antimicrobial Resistance and Healthcare Associated Infections Division (AMR & HCAI), UK Health Security Agency, 10 South Colonnade, Canary Wharf, London, UK
[h] National Institute for Health and Care Research Health Protection Research Unit on Healthcare Associate Infections and Antimicrobial Resistance, University of Oxford, Oxford, UK

ARTICLE INFO

Keywords:
Climate change
Antimicrobial resistance
One Health
National Communications
National Action Plans

ABSTRACT

Objectives: To identify explicit reference to the interdependence between antimicrobial resistance (AMR) and climate change (CC) within global policy for AMR and CC.
Study design: This review uses the principles of systematic searching, qualitative evidence synthesis and framework analysis.
Methods: Two searches were conducted: (1) explicit AMR policy searching was conducted via searching country AMR National Action Plans (NAPs) on the World Health Organisation Website; and (2) CC policy searching was conducted by reviewing United Nations Framework Convention on Climate Change (UNFCCC) National Communication (NC) documents. Search and coding processes were conducted independently by two sets of researchers and discussions were held to resolve any discrepancies between findings.
Results: 155 NCs and 81 NAPs were included in the review. 10 (12 %) NAPs and 19 (12 %) NCs demonstrated reference to a relationship between CC and AMR. In most cases, these were limited to a single mention. The most common connection made was to "shared solutions" to the issues and to "CC driving AMR". The depth of the interconnection described is largely commentarial, lacking sufficient detail of modalities of interaction.
Conclusions: Most CC and AMR global policy documents do not reference interdependence between CC and AMR. Where references occur, these are simplistic and do not detail pathways of interactions. Most references are within descriptive text and lack targeted action. This review highlights inadequate focus within policy on this important intersection. This review should inform future global policy development that focuses on integrated approaches to CC and AMR across the One Health system.

1. Introduction

Climate change (CC) and antimicrobial resistance (AMR) are major global health emergencies. By 2050, CC and AMR are projected to cause 14.5 million and 10 million deaths annually.[1,2] Currently the global temperature is more than 1 °C warmer than the pre-industrial average and it is anticipated that current policies could lead to 2–3 °C of warming by mid-century,[3–5] leading to anticipated irreversible ecosystem impacts beyond 1.5 °C.[6] Similarly, though AMR occurs naturally, it is being rapidly accelerated by human behaviours, most notably via inappropriate use of antimicrobials and inadequate treatment, prevention, and control of infection.[2]

AMR and CC are complexly interdependent.[7,8] There are multiple pathways of interdependency. For example, CC exacerbates the spread

* Corresponding author.
E-mail address: alexander.thornton3@nhs.net (A.J. Thornton).

https://doi.org/10.1016/j.puhe.2026.106159
Received 11 July 2025; Received in revised form 18 December 2025; Accepted 13 January 2026
Available online 12 February 2026

and impact of AMR, solutions to AMR can benefit CC; and vice versa and there are harmful synergies where climate change worsens AMR and vice versa.[8,9] There is bidirectionality of interdependence, for example with CC driving AMR and vice versa.[2] For instance, CC is leading to increased frequency of severe weather events that can cause damage to sanitation infrastructure,[10] which has been demonstrated to lead to water contamination and environmental spread of AMR organisms.[7,8,11,12] Conversely, antimicrobial residues and the consequent residues of antimicrobial resistant genes in aquatic ecosystems are leading to alterations in carbon and nitrous cycles, impacting greenhouse gas emissions and subsequently the climate.[13,14] Our understanding of these complex interactions is evolving. However, it is evident that due to the interconnected nature of AMR and CC, solutions must aim to maximize benefits across both crises and minimise any potential trade-offs.[8]

CC and AMR are major global political concerns.[15] A timeline of major documents relating to climate change and antimicrobial resistance are shown in Fig. 1. The Paris Agreement (2015) established CC objectives for nations,[16] while the Global Action Plan on AMR set targets for ensuring infection treatment and prevention, with a focus on reducing AMR.[17] However, the interconnection between CC and AMR is largely overlooked in global policy.[18] This represents a missed opportunity to advance progress across AMR, CC, and the broader One Health ecosystem. Consequently, this paper seeks to highlight where global AMR and CC policies explicitly link CC and AMR, with the aim of highlighting overlooked opportunities for One Health progress in global policy.

2. Methods

This policy review aims to understand the links between CC and AMR in global policy, specifically the AMR NAPs and UNFCCC (United Nations Framework Convention on Climate Change) NCs using the principles of systematic searching, qualitative evidence synthesis and framework analysis.

Year	Policy Document / Event	Description
1985	Vienna Convention for the Protection of the Ozone Layer	First global framework to address ozone depletion; coordinated research and policy action.
1987	Montreal Protocol	Landmark treaty to phase out ozone depleting substances; widely considered highly successful.
1992	UN Framework Convention on Climate Change (UNFCCC)	Established the global framework for climate action and stabilising greenhouse gas concentrations.
1994–1997	First Meetings (AMR)	WHO convened working groups and meetings on emerging global health threats, where AMR is mentioned.
1997	Kyoto Protocol	Introduced legally binding emission reduction targets for developed nations; created carbon markets.
2001	Global Strategy for Containment of AMR	WHO released its first strategic document addressing AMR.
2009	Copenhagen Accord	Non-binding agreement recognising the need to limit warming to 2°C and committing to climate finance.
2015	Tripartite Approach on AMR / Paris Agreement	WHO, WOAH, and FAO adopted a tripartite approach to tackle AMR; Paris Agreement signed for Climate Change commitments.
2016	UNGA Declaration on AMR / IACG Established	Heads of State signed AMR declaration; UN convened Interagency Coordination Group on AMR.
2019	Inter-Agency Coordination Group AMR Recommendations Submitted	Recommendations delivered to the UN Secretary-General.
2020	One Health Global Leaders Group (GLG) on AMR	GLG established to promote One Health approach to AMR.
2021	AMR Multi-Partner Trust Fund / Glasgow Pact	AMR fund launched; Glasgow Pact strengthened climate commitments.
2023	First Global Stocktake	First formal assessment of global climate progress under the Paris Agreement.

Fig. 1. Global climate and antimicrobial resistance policy timeline.
Timeline highlights key global policy events and does not provide a comprehensive list of global policy. Blue and Orange represent Climate and AMR policy respectively. Green represents instances of both.

2.1. Search terms

Search terms were developed to identify explicit links between CC and AMR. See Appendix 1 for search terms.

Within AMR policy the aim was to identify references to CC. Therefore, CC search terms were developed from established CC related terms from a paper systematically mapping global research related to climate and health[19] and subsequently used in a systematic scoping review of intersections between CC and AMR.[8] These terms seek to identify explicit reference to CC, climate variability and climate related weather phenomena.

Within CC policy the aim was to identify references to AMR. Therefore, AMR search terms were derived from terms originally developed in a scoping review on drivers of AMR in communities in Nepal[20] and subsequently used in a recent scoping review.[8]

The search strings described were adjusted to enable searching in NVIVO software.

2.2. Inclusion and exclusion criteria

Only documents written in English were included. Superseded documents were excluded. Outdated documents were included if no more recent version was publishedA full list of documents included/excluded in the review are in Appendix 2.

2.3. Search location

Two searches were conducted: one to identify references to CC within AMR policy and a second to identify reference to AMR within CC policy.

AMR policy searching was conducted via searching AMR NAP documents available from the WHO website. All member countries must produce an AMR NAP for submission to the WHO.[21] NAPs are not written into law or statute but do set out commitments and goals for each country in response to AMR and represent major global documents in AMR.

CC policy searching was conducted by reviewing UNFCCC NC documents. These are documents that outline countries' efforts in tackling CC and provide transparency in progress made. These documents were chosen as they are detailed documents that provide exploration and explanation of CC actions, and are mandatory submissions ensuring inclusion of each UN member country. Notably Nationally Determined Contributions were not included in this review as whilst they represent commitment to action, they do not contain depth about how targets will be achieved and lack explanation of decisions.

AMR NAPs and CC NCs were uploaded into the analytical software programme NVIVO as PDF documents and searching was conducted within NVIVO. This was done using search terms described in Appendix 3 and using the "text search" query function. Searching was conducted by two independent researchers and conflicts resolved via discussion.

2.4. Coding

Results were analysed using open-axial-selective coding. This process enabled initial codes to capture complexity of text. Axial coding then grouped related codes into broader categories, and selective coding further refined these themes within an existing framework. Results have been aligned to six recognised types of interdependencies between AMR and CC demonstrated in a systematic review.[8] This framework was selected as it highlights the distinct relationships between AMR and CC and enables consideration of how current policy is targeting each relationship. During the coding process a further emergent code has been added to this framework. This code highlights where there has been a comparison made within the document between the scale of the issue of CC and AMR – "Issues of comparable scale". The seven categories of interdependence between AMR and CC coded are: (1) Harmful synergies; (2) Climate Change Drives AMR; (3) AMR influences Climate Change; (4) Shared Solutions; (5) Shared Drivers; (6) Trade-Offs; and (7) Issues of comparable scale. Codes are further described within the results section of this paper.

3. Results

3.1. Descriptive results

155 NCs and 81 NAPs were included (Fig. 2, with full list provided in Appendix 2). 10 (12 %) NAPs and 17 (11 %) NCs demonstrated reference to a relationship between CC and AMR. The countries with NAPs referencing CC were Ethiopia, Fiji, Iran, Ireland, Lao, Lebanon, Rwanda, Sri Lanka, Tuvalu and the UK. The countries where NCs contained references to AMR were Armenia, Bangladesh, Eritrea, Georgia, Jamaica, Jordan, Kazakhstan, Latvia, Maldives, Malta, Papua New Guinea, Portugal, Romania, Saint Lucia, Sierra Leone, Slovakia and Yemen. No country included references to a relationship between AMR and CC in both their NAP and NCs.

3.2. Descriptive code summary

3.2.1. AMR NAPS

There are 25 distinct references to links with CC from 10 NAPs. The most common references were CC driving AMR (5: Rwanda, Iran, Lao, Sri Lanka, UK) and to shared solutions for AMR and CC (5: Fiji, Tuvalu, Sri Lanka, Ireland, UK). One NAP linked harmful synergies between AMR and CC (UK). There was one reference to both shared drivers for AMR and CC (UK) and to AMR influencing CC (Rwanda). No references to trade-offs were identified. Two NAPs referred only to AMR and CC as issues of comparable scale, without further reference to mechanisms of linkage. (Fiji, Lebanon).

3.2.2. CC NCs

There are 20 distinct references to links with AMR from 19 NCs. Shared solutions for AMR and CC were the most common reference with 13 distinct references from 12 countries: Armenia, Bangladesh, Eritrea, Jamaica, Jordan, Maldives, Malta, Papua New Guinea, Portugal, Saint Lucia, Yemen. Three referred to harmful synergies between AMR and CC (Guyana, Sierra Leone and Tanzania). Two refer to CC as a driver of AMR (Kazakhstan and Latvia). One NC referred to interventions where there are potential trade-offs between climate and AMR impacts (Georgia). Two NCs referred to issues of comparable scale (Mozambique, Solomon Islands), without further reference to mechanisms of linkage.

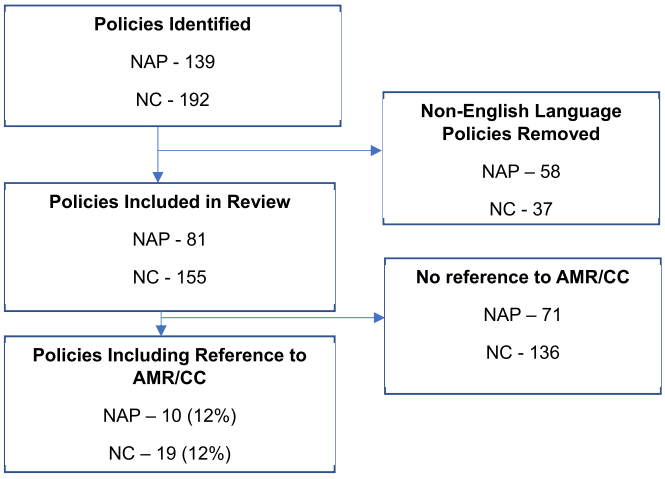

Fig. 2. Flow Diagram of article selection.

3.3. Qualitative code results

To enhance readability, we provide theme-specific interpretations alongside our results, with the overall interpretation in the discussion section.

3.3.1. Harmful synergies

Harmful synergies are defined as "where both CC and AMR exist independently and can interact synergistically resulting in negative outcomes".[8] There were five references to harmful synergies (see Table 1).

The UK NAP describes AMR and CC as "linked emergencies" and emphasises synergistic impacts of CC and AMR on infectious disease generally (Quote 1 – Table 2). Similarly, the Sierra Leone CC NC discusses the interacting impact of climate and AMR (alongside other changes) on infectious disease incidence (Quote 2 – Table 2).

Whilst positive that these documents interconnect CC and AMR, these general statements do not reflect the depth of understanding of harmful synergies reported in academic literature (e.g. the impact of sea level rises on human exposure to organisms with intrinsic resistance including *Vibrio vulnificus*. There is one example of focus on a specific disease, malaria, within the Guyana NAP (Quote 3 – Table 2).

Additionally, these references do not refer to the magnitude or relative importance of the "harmful synergies" between AMR and CC, nor mechanisms to redress these. This quantification of impacts is challenging and is currently under-described in the literature. This leaves general statements within policy documents that are difficult to translate into policy actions.

3.3.2. CC Drives AMR

CC driving AMR refers to "climate change having a *direct* influence on pathogen activity via changes in virulence and resistance expression or an *indirect* influence via changes in host-pathogen epidemiology".[8] For example, climate-related stresses on ecosystems via increasing water temperatures and levels of salinity in aquatic environments is recognised in research as a direct propagator of AMR through propagation of antimicrobial resistant gene (ARGs) prevalence. There were eight references to CC driving AMR.

This consideration was noted most within the AMR NAPs. (Quote 3 – Table 2). The UK NAP describes broad pathways through which CC drives AMR (Quote 5 – Table 2), but there are no documents that demonstrate specificity in how CC drives AMR. However, there is a call within one NC for further research into how CC facilitates AMR (Quote 4- Table 2). Within the NAPs there is limited country specific consideration of what CC will look like within their context, limiting consideration of potential impact of CC on AMR in their country.

Reference to CC driving AMR occurs in two NC documents. (Quote 4 – Table 2). This perhaps indicates a lower profile of consideration of AMR within CC policy.

Table 1
Inclusion criteria.

Source	AMR NAPs Climate Change NCs
Language	English
Dates	No date restriction
Geography	All countries included
Search within AMR NAPS	Contains at least one of the terms related to CC in full text AND clearly mentions how variability in climate is linked to AMR. Please refer to Appendix 3 for full description of how this was applied.
Search within CC NCs	Contains at least one of the terms related to AMR in full text AND clearly mentions how variability in climate is linked to AMR. Please refer to Appendix 3 for full description of how this was applied.

3.3.3. AMR influences CC

AMR influencing CC refers to directionality of impact in which AMR has an impact upon climatic changes. This is referenced once within the policies reviewed, within the Rwandan NAP. This wording used is general and such it is unclear whether the directionality of impact described is intentional (Quote 6 – Table 2).

The directionality of AMR influencing CC is less established in academic literature, with our scoping review showing that fewer than 1 % of records demonstrate this relationship.[8] Consequently, the limited focus in policy may reflect a lack of understanding of this process, leaving little room for policy action.

3.3.4. Shared Solutions and Positive Synergies

Shared solutions have been defined as "where evidence demonstrated positive synergies between approaches aimed at addressing CC (mitigation and adaptation) as well as interventions targeting the management and control of AMR".[8] This was the most common reference to a link between AMR and CC, likely due to the nature of policy documents being solution focused.

Within NCs there was focus on development of surveillance systems to identify emergence of AMR as a response to changing disease patterns (Quote 9 – Table 2). There were also examples of specific interventions that were currently in place and operate as shared solutions. For example, two European NCs (Slovakia and Romania) referenced the 'Farm to Fork' European legislation in this context. There was also one example of a specific shared solution in the Ireland NAP, which refers to interventions that reduce the prevalence of Bovine Viral Diarrhoea in livestock and states that this has resulted in "significant reduction in the use of antimicrobials to treat sick calves and in addition to be contributing to mitigating greenhouse gas outputs from the sector". There are no further examples of specific shared solutions.

These examples show that countries are not cohesively considering all "shared solutions" but are instead identifying individual elements in an ad hoc manner. In contrast, the UK NAP lists numerous broad categories of intervention that would mitigate both CC and AMR. These would be defined as shared solutions; however, no depth or explanation is given to these interventions. This is further described within Fig. 3 found in the discussion section of the paper.

Many documents highlighted the need to consider the other issue (AMR/CC) when developing strategy or policy but lacked depth regarding what this consideration would entail (Quote 7 – Table 2). Additionally, there were references to necessity for alignment between different government departments (Quote 8 – Table 2), without consideration of what value this collaboration adds.

3.3.5. Shared Drivers

Shared drivers refer to factors that have contributed to an increased burden of both CC and AMR. Within the documents reviewed there was limited consideration of shared drivers, with only one overarching statement made within the UK NAP, which positioned AMR as a component of a tripartite "planetary crisis", sharing drivers with "CC and pollution". Whilst this is explicit in its framing of AMR as a public health issue aligned with CC, it is non-specific and perhaps suggestive of uncertainty of the exact causative mechanisms (Quote 10 – Table 2).

3.3.6. Trade Offs

It is recognised that policies may benefit CC or AMR, whilst detrimentally impacting on the other crisis. This is referred to as a trade-off. There is one policy that demonstrated this relationship.

The Georgia NC suggests CC adaptation measures within livestock farming that include "removing/easing restrictions on antibiotics if any". Unregulated antibiotic use in agriculture is a known driver of AMR and therefore while this may have benefits through increased efficiency in meat production through avoidance of infection in livestock, there are clear trade-offs for AMR. Within the Georgia NC document there is no reference to this trade off.

Table 2
Example of Coded Quotations supporting theme-specific interpretations.

#	Country	Document	Year of Publication	Quote	Code
1	UK	AMR NAP	2023	Many infectious diseases are climate sensitive, and CC and AMR are linked emergencies. They are both One Health, global issues with the highest burden falling on LMICs.	Harmful Synergies
2	Sierra Leone	Climate NC	2018	CC is only one of several important factors influencing the incidence of infectious diseases. Other important considerations include human migration and transportation; drug resistance and nutrition; environmental influences such as deforestation; agricultural development; water projects; and urbanization	Harmful Synergies
3	Guyana	Climate NC	2012	Malaria incidence is influenced by a number of factors, among which climate factors are major drivers. Other factors are effectiveness of public health infrastructure, insecticide and drug resistance, human population growth, immunity, travel, and land-use change.	Harmful Synergies
4	Iran	AMR NAP	2016	In general, increased incidence of immunosuppressive diseases and subsequent incidence of opportunistic infections, changes in weather and climate patterns, increasing number of natural disasters, rapid growth of human population, and growing trends of trade and international exchanges are among the main causes of the spread of drug-resistant infections and microorganisms	CC drives AMR
5	Latvia	Climate NC	2022	Conduct studies on the carriers of infectious diseases facilitated by CC and their tendency to spread in order to better understand the epidemiology, emergence, prevalence and burden of infectious diseases, and also to further investigate how resistance develops and spreads, to improve early detection of infectious diseases and resistance development in the field of animal health	CC drives AMR
6	UK	AMR NAP	2023	There is evidence that CC might worsen the impacts of AMR. The climate is an important driver of patterns of infections, year-to-year variations in incidence (including epidemics) and longer-term shifts in populations at risk. Rising temperatures, water shortages, extreme weather and loss of biodiversity resulting from CC might all change the dynamics of the spread of infections and our ability to prevent them	CC drives AMR
7	Rwanda	AMR NAP	2022	Antimicrobial resistance (AMR) has been a growing challenge to the successful treatment of an ever increasing variety of bacterial, parasite, viral and fungal infections for the past few decades. This has made it hard, expensive or even difficult to treat patients. The scope of the issue is global and impacts on livestock, human health, the climate and, ultimately, the global economy, food and health security	AMR influences CC
8	Bangladesh	Climate NC	2018	Climate related adaptation strategies are not the only options to be considered. Population growth, poverty, sanitation, nutrition, misuse of antibiotics, pesticide resistance, demographic change, availability of health care, public health infrastructure, environmental degradation should also come into consideration while seeking to reduce the negative impacts and minimise the vulnerability of the population	Shared Solutions
9	Fiji	AMR NAP	2022	Human Health (HH) sector's strategic intent to 2025 strongly resonates with WHO and NDP commitments under Strategic Priorities 1 and 3; to Safeguard against environmental threats and public health emergencies and "ensuring better collaboration with other government departments on key health-related and SDG issues such as climate crisis and AMR."	Shared Solutions
10	Maldives	Climate NC	2016	It is only through robust surveillance, can we properly monitor progress of health indicators and take necessary public health action. Laboratory surveillance, surveillance for hospital acquired infections and antimicrobial resistance also needs to be developed	Shared Solutions
11	UK	AMR NAP	2023	AMR and the triple planetary crisis: AMR shares drivers with the main environmental issues of this century - CC, biodiversity loss and pollution and waste	Shared Drivers
12	Fiji	AMR NAP	2022	Apart from CC and NCs; AMR is a real threat to our island home	Issues of comparable scale

*This table does not include all quotes coded; this is available upon request.

3.3.7. Issues of comparable scale

CC and AMR are both global health problems that will have detrimental impacts to future global health. This is referred to as being issues of comparable scale – a theme conceptualised to address generic comparison between CC and AMR.

All references to these issues being similar in magnitude and required response – as 'existential' threats - are within AMR documents, where AMR is compared to CC (Quote 11 – Table 2). This perhaps reflects a perception of CC as a more established threat that AMR is aligned with to gain credibility.

4. Discussion

Most climate and AMR global policy documents do not reference the connections between CC and AMR. The results of this paper evidence that only 12 % of policy documents reviewed connect CC and AMR at all; and most commonly as a single mention within each policy. Where references have been made, these are cursory and largely commentarial, lacking detail of modalities of interaction.

One of the most common references within the policies reviewed is "shared solutions" for AMR and CC. Academic literature demonstrates numerous examples of shared solutions ranging from developing epigenetic techniques (used in AMR as well as climate adaptation[8,22–24]) to utilisation of biofuel which mitigates CC and also degrades antimicrobials potentially present in sewage thus reducing AMR potential.[8,25] Despite this, only the Ireland NAP explicitly described an intervention categorised as a shared solution. All further references simplistically refer to the requirement for consideration of both issues and for cross disciplinary working. The UK AMR NAP contained the most extensive discussion of interdependency. As outlined in Fig. 3 this provides a valuable foundation for future policy documents to build on.

Concerningly, the Georgia Climate NC references a "trade off" intervention, without explicit consideration of impact. "Removing/easing restrictions on antibiotics if any" is listed as a suggestion within "Adaptation Measures in Livestock Farming". This might have a positive effect on CC due to improved livestock efficiency (and therefore, potentially lower resource use and greenhouse gas emissions). However, it would have a profoundly negative impact on AMR through inappropriate antimicrobial use. Although this statement does not represent a commitment towards an action, its presence in the national policy document without appropriate consideration of the harmful impact on AMR is alarming. The role of agencies collecting these documents in ensuring there is appropriate review of submissions for impacts across the One Health System should be considered. Both the WHO and the UN advocate for integrated policy strategies to ensure alignment across related policy documents (for example, AMR, climate, and environmental policies). However, it is unclear how accountability and governance of this alignment is ensured.

The UK's second National Action Plan (NAP) on Antimicrobial Resistance (AMR) was published in 2024. This document leads the way in global policy by providing explicit reference to the links between AMR and CC as part of a case study on page 17.

"Case Study: AMR and Climate Change

Climate change may exacerbate the impacts of antimicrobial resistance (AMR). Climate is a significant factor influencing infection patterns, annual variations in incidence (including epidemics), and long-term shifts in populations at risk.

Rising temperatures, water shortages, extreme weather events, and biodiversity loss due to climate change can affect both the spread of infections and the ability to prevent them.

Key requirements for mitigating both climate change and AMR:

- Capacity building for local mitigation and adaptation
- Generation and dissemination of data
- Public-private partnerships for new technologies and practices
- Implementation research
- Increased institutional commitment, coordination, and alignment of strategies"

The inclusion of this case study as a text box within the UK AMR NAP effectively highlights some of the interactions between AMR and CC, emphasising their significance. However, in future policy integrating this information more fully into the main body of text could further reinforce its relevance within the broader policy discourse.

Additionally, the case study outlines various pathways of interaction and shared solutions between AMR and CC, demonstrating a broad scope of consideration. Future policy documents could refine this by providing more explicit descriptions of the mechanisms linking AMR and CC. Clearly delineating these relationships, and in particular proposing targeted strategies to mitigate their combined impacts, will strengthen the justification for coordinated action across AMR and CC, potentially shaping and informing future policy commitments.

Fig. 3. UK's national action plan (NAP) on antimicrobial resistance (AMR).

Overall, this paper demonstrates the siloed focus of global policy, with limited acknowledgement of the interconnections between CC and AMR. It underscores the need for integrated strategies that address microbial, behavioural, and societal intervention to mitigate and adapt to the direct and indirect impacts and drivers of CC and AMR.[7,8] A holistic, multi-disciplinary approach within the One Health System is essential, incorporating equity-focused frameworks to prevent exacerbating existing inequities.[26,27] This has been recently advanced by the publication of the Pandemic Accord.[28] Finally, identifying enablers and barriers to policy implementation is crucial to successful outcomes.

4.1. Limitations and future research directions

This review is limited to two types of policy documents and thus does not capture the entirety of the CC and AMR related policy landscape within included case studies. Consequently, it remains unclear to what extent reviewed policies reflect overall practice in such contexts.[29] Further study in this area should ideally expand the scope of document analysis, including adjacent implementation plans and evaluations to better assess policy coherence and subsequent coordinated action.

This review is focused on explicit acknowledgement of the interconnections between CC and AMR and as such in-depth analysis of Individual policy content sits outside the scope of this work. While this approach enabled a high-level overview across global policy documents with broadly standardised formats, the heterogeneity of each policy documents limits cross country comparison and extensive atomised analysis. Additionally, this search strategy did not utilise search terms related to all known shared solutions or trade-offs and therefore may not identify all relevant examples.Further study could address these issues by incorporating detailed policy analysis, expanding the search strategy to capture a broader range of shared interventions and trade-offs, and applying analytical frameworks that allow for greater systematic comparison across contexts.

This review was also restricted to documents published in the English language, which by necessity, excluded many countries and regions and limits the extent to which findings represent the global policy landscape. Additional systematic analysis of policy documentation not published in the English language, through translation strategies is therefore warranted and would provide a more inclusive assessment of CC-AMR policy integration.

Beyond document-based analysis, further research should conceptualise and examine the causal pathways underlying the complex interdependencies between CC and AMR. Developing conceptual models and facilitating quantitative assessments of these relationships would support stronger inference, will be key to evidencing future policy at both a national and global level.

Ethical statement

Ethical Approval was not required as this study was a review of publicly available policy documentation.

Funding

We received no specific funding for this study.

Declaration of competing interests

None Declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2026.106159.

References

1. World Economic Forum. *Quantifying the Impact of Climate Change on Human Health*. 2024.
2. Collaborators AR. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet*. 2022;399:629–655.
3. Climate Action Tracker. *Climate Action Tracker: Warming Projections Global Update - December 2023*. 2023.
4. United Nations Environment Programme. *Emissions Gap Report 2023: Broken Record – Temperatures Hit New Highs, yet World Fails to Cut Emissions (Again)*. 2023.
5. UNFCC. *UNFCC Synthesis Report*. 2023.
6. Schleussner C-F, Ganti G, Lejeune Q, et al. Overconfidence in climate overshoot. *Nature*. 2024;634:366–373.
7. Magnano San Lio R, Favara G, Maugeri A, Barchitta M, Agodi A. How antimicrobial resistance is linked to climate change: an overview of two intertwined global challenges. *Int J Environ Res Public Health*. 2023;20.
8. van Bavel B, Berrang-Ford L, Moon K, et al. Intersections between climate change and antimicrobial resistance: a systematic scoping review. *Lancet Planet Health*. 2024;8:e1118–e1128.
9. Burnham JP. Climate change and antibiotic resistance: a deadly combination. *Ther Adv Infect Dis*. 2021;8, 2049936121991374.
10. World Health Organization. *Addressing Climate Change: Supplement to the WHO Water, Sanitation and Hygiene Strategy 2018-2025*. 2023.
11. Furlan JPR, Sellera FP, Lincopan N, Debone D, Miraglia SGEK, Tavella RA. Catastrophic floods and antimicrobial resistance: interconnected threats with wide-ranging impacts. *One Health*. 2024;19, 100891.
12. Wong C. Antibiotic resistance is a growing threat-is climate change making it worse? *Nature*. 2024. https://doi.org/10.1038/d41586-023-04077-0.
13. Premke K, Wurzbacher C, Felsmann K, et al. Large-scale sampling of the freshwater microbiome suggests pollution-driven ecosystem changes. *Environmental Pollution*. 2022;308, 119627.
14. Xu H, Lu G, Xue C. Effects of sulfamethoxazole and 2-Ethylhexyl-4-Methoxycinnamate on the dissimilatory nitrate reduction processes and N(2)O release in sediments in the Yarlung Zangbo River. *Int J Environ Res Public Health*. 2020;17.
15. World Health Organization. One health [cited 2025 17 February,]; Available from: https://www.who.int/health-topics/one-health#tab=tab_1; 2025.
16. *United Nations Framework Convention on Climate Change. the Paris Agreement*. 2016.
17. World Health Organization. *Global Action Plan on Antimicrobial Resistance*. 2016.
18. World Meteorological Organization (WMO). *WMO Global Annual to Decadal Climate Update*. 2024.
19. Berrang-Ford L, Sietsma AJ, Callaghan M, et al. Systematic mapping of global research on climate and health: a machine learning review. *Lancet Planet Health*. 2021;5:e514–e525.
20. Parajuli A, Mitchell J, King N, et al. Drivers of antimicrobial resistance within the communities of Nepal from one health perspective: a scoping review. *Front Public Health*. 2024;12, 1384779.
21. Organization WH. *Global Action Plan on Antimicrobial Resistance*. 2016.
22. Dorado G, Gálvez S, Rosales TE, Vásquez VF, Hernández P. Analyzing modern biomolecules: the revolution of nucleic-acid sequencing - review. *Biomolecules*. 2021;11.
23. Gartland KM, Bruschi F, Dundar M, Gahan PB, Viola Magni M, Akbarova Y. Progress towards the 'Golden Age' of biotechnology. *Curr Opin Biotechnol*. 2013;24(Suppl 1): S6–S13.
24. Lange L, Agger JW, Meyer AS. Fungal biotechnology: unlocking the full potential of fungi for a more sustainable world. In: Nevalainen H, ed. *Grand Challenges in Fungal Biotechnology*. Cham: Springer International Publishing; 2020:3–32.
25. Korzeniewska E, Piekarska K, Harnisz M. Advances in energy systems and environmental engineering. *Sci Total Environ*. 2020;748, 141499.
26. Zimm C, Mintz-Woo K, Brutschin E, et al. Justice considerations in climate research. *Nat Clim Change*. 2024;14:22–30.
27. Harring N, Krockow EM. The social dilemmas of climate change and antibiotic resistance: an analytic comparison and discussion of policy implications. *Humanit Soc Sci Commun*. 2021;8:125.
28. O'Brien I. Who chief reveals action on pandemics, climate and Amr. *European Medical Journal*; 2025. https://www.emjreviews.com/emj-gold/news/who-chief-reveals-action-on-pandemics-climate-and-amr/. Accessed: July 2025.
29. Organization WH. *WHO Implementation Handbook for National Action Plans on Antimicrobial Resistance: Guidance for the Human Health Sector*. 2022.