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Climate change mitigation policy for planetary health equity? An automated content analysis of countries' nationally determined contribution reports

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Abstract

This study examines the extent to which national governments discuss the social determinants of planetary health equity (SDPHE) within their Nationally Determined Contribution reports (NDCs) to the UN Framework Convention on Climate Change. This is assessed relative to the frequency of discussion of economic factors and health outcomes, and how this varies between countries based on political, economic, and environmental factors. Using natural language processing, a dictionary-based automated content analysis was conducted of the frequency of terms within these reports. Correlation analyses examined the relationship between the frequency of dictionary categories and political, economic, and environmental variables to ascertain the role of contextual factors. Overall, NDCs were found to feature a greater proportion of economic language compared to health outcome and SDPHE terms. Among the SDPHE, equity- and gender-related terms occurred most frequently. Correlations were identified primarily among high-income countries, that suggest moderate positive associations between levels of CO_2 emissions per capita and per dollar of gross domestic product and the use of economic terms, and a negative association of economic language with levels of democracy. Democracy was also positively associated with language related to social norms such as equity and justice, indicating potential scope for impact through democratic pressures. The relatively frequent use of economic frames in NDCs suggests that economic issues may receive more attention compared to the SDPHE. This analysis identifies potential enabling and constraining country-level factors for greater attention to the SDPHE in NDCs and more progressive climate change mitigation policymaking.

1. Introduction

Climate change has been described by the World Health Organization (WHO) as the greatest contemporary threat to human health (World Health Organization 2018). It is a risk multiplier, intersecting with and compounding existing social inequities, further driving health inequities via the social determinants of health (SDH) (Friel 2022). The SDH are the factors of social stratification and people's daily living conditions that shape the inequitable distribution of health outcomes (Commission on the Social Determinants of Health 2008). Differences in climate change risk exposure, as well as people's daily living conditions, vary between social groups and across social, economic, political, and cultural systems, undermining planetary health equity (PHE)—the equitable enjoyment of good health in a stable Earth system (Friel 2019). The concept of PHE captures the ideal of health and social equity within a healthy environment. However, in the context of contemporary intersecting crises of climate change and social and health inequities, the inequitable outcomes of current systems are shaped by what we conceptualise in this study as the social determinants of PHE (SDPHE).

The causes and solutions related to the SDH are located across policy domains such as macroeconomics, trade, labour, housing, and education, among others. Given the intersections between climatic changes and inequitably distributed health impacts, this includes climate policy. In other words, climate policy is health equity-relevant policy. Climate change mitigation action provides not only an essential response to prevent further climatic changes, it is also a key preventative measure needed to avert planetary health inequities. Greater attention to the health implications of climate policy has been a long-standing demand in academic and global policy discourses (Costello *et al* 2009, Sauerborn *et al* 2009, Singh 2012, Workman *et al* 2018, WHO 2021, Dasandi *et al* 2021a, Sampedro *et al* 2023, Whitmee *et al* 2023a). Moreover, it has been argued that there is an urgent need to reorient policymaking to the inequitable health impacts of climate change (Dasandi *et al* 2022) and the structural causes of these inequities (Friel *et al* 2008, Masuda *et al* 2022). While health advocacy appears to be growing in global climate negotiations (Burki 2023, Laybourn-Langton 2023), to date there has been limited attention to health equity and the SDPHE in analyses of countries' policy commitments on climate change, despite acknowledgment of their importance (Rossa-Roccor *et al* 2021, Beagley *et al* 2022, Dasandi *et al* 2022, Whitmee *et al* 2023a).

An important policy opportunity exists to address PHE through national governments' climate change mitigation commitments made through Nationally Determined Contribution reports (NDCs) to the UN Framework Convention on Climate Change (UNFCCC) Secretariat (Laybourn-Langton 2023). NDCs emerged under the 2015 Paris Agreement, as the mechanism for countries that ratified the Agreement to communicate projected greenhouse gas emissions and domestic mitigation measures, as well as how these contribute to achieving the goals of the Agreement and how they are fair and ambitious in the context of national circumstances (UNFCCC Secretariat 2022). As stated by Jernnäs (2024, p 530), 'The Paris Agreement places states' NDCs at the center of global climate politics.' These reports are significant in informing the UNFCCC Secretariat's synthesis reports and global estimates of the state of anthropogenic emissions contributing to climate change, and progress in reducing these. As such, they are crucial documents that form the basis of international climate change negotiations and communicate national policies and plans to the global community. NDCs are influenced by political contexts and dynamics, and illuminate the politics of countries' positions on climate policy (Dasandi *et al* 2021b).

Given the significance of countries' NDCs in documenting their national commitments to climate change mitigation and communicating these on a global stage, these reports are key policy documents to understand the implications of government policies and actions at the intersection of climate change, social equity, and health equity. Historically, the evolution of NDCs has involved contestations among UNFCCC Member States about what their scope should be, as well as limited guidance for governments, contributing to considerable diversity between countries in the contents of their NDCs (Pauw and Klein 2020). Following challenging negotiations to reach agreement on the Katowice Climate Package in 2018, the guidance for NDC formulation that it provides includes an open-ended provision that governments 'may provide other information' additional to the required specification of mitigation contributions (Pauw and Klein 2020).

Pauw and Klein (2020) argue that NDCs should be designed to be coherent with development policy, highlighting that the Paris Agreement's preamble identifies the 'intrinsic relationship' between climate change mitigation and 'equitable access to sustainable development and eradication of poverty'. This approach is understood to be more efficient and effective, and reflects countries' aims to achieve balance between competing policy priorities (Pauw and Klein 2020). Others have similarly identified the important opportunity created by the NDCs for policy synergies, integration, and coherence across climate change, sustainable development, and a range of specific human needs (García *et al* 2016, Northrop *et al* 2016, Antwi-Agyei *et al* 2017, 2018, Scott *et al* 2018, Janetschek *et al* 2020, Paim *et al* 2020, Remteng *et al* 2021, Haryanto *et al* 2023, Mohan 2024). Höhne *et al* (2024) found that states increasingly link their climate actions to human rights norms within NDCs, including rights-based language related to children, Indigenous peoples, and gender, and other cross-cutting issues pertaining to the social impacts of climate change and mitigation. The authors highlight that a workshop in 2019 led to guidelines for integrating human rights into NDCs, and they argue that climate policy will likely increasingly be framed in relation to the protection of human rights (Höhne *et al* 2024). Moreover, in the 2023 summary report of their analysis of health inclusivity within NDCs, the WHO asserts that these reports 'are the primary policy instrument for protecting people's health in the face of climate change.' (WHO 2023, p vi). Building on this literature, we argue that the ideas represented in NDCs signal governments' preferences with respect to climate change mitigation and the SDPHE, which is important for understanding the potential for these commitments to promote sustainable and equitable climate and health outcomes.

The construction of government policy through frames provides a valuable avenue for insights into policy attention and commitments such as those

made in NDCs (Koon *et al* 2016). Frames capture underlying paradigms and 'deep core' norms (Rushton and Williams 2012). To date, climate change policy has arguably been dominated by economic paradigms—constructing the climate change problem and solutions in economic terms—at global (Workman *et al* 2018, Meckling and Allan 2020, Skovgaard 2021) and national levels (McDonald 2015, Rosewarne 2020, Stephenson and Allwood 2023). Moreover, the hegemonic biomedical model of health permeates policymaking related to climate change and health (Friel *et al* 2021), keeping a focus on behavioural and health care solutions and contributing to the neglect of SDH and health equity (Rossa-Roccor *et al* 2021, Buse *et al* 2022, Friel *et al* 2022, Masuda *et al* 2022).

Encouragingly, there is evidence of growing attention to health within NDCs. Existing analyses of health content within these reports provide insights into the degree of attention and variation between countries, however these studies have excluded or been limited in their analysis of SDH and equity (WHO 2020, Dasandi *et al* 2021a, 2021b, Beagley *et al* 2022, Romanello *et al* 2022, WHO 2023). Identifying the prevalence of ideas such as the SDH, health equity, and SDPHE in climate change policy such as the NDCs is important as it can identify where opportunities exist for greater advocacy and attention to government commitments and actions that address the intersecting crises that undermine PHE.

This study helps address this lack of analysis pertaining to the SDPHE by examining the social and health equity-related language content in recent NDCs. Its aim is to examine whether and to what extent NDCs include mentions of the SDPHE in their discussions of climate change mitigation. We assess this relative to the extent to which economic and health outcomes on average are mentioned. We also examine whether and how attention to these SDPHE varies between countries based on political, economic, and environmental factors.

2. Methods

To assess the extent of discussion of the SDPHE in NDCs, we employed a quantitative content analysis methodology. This approach involves assessment of the occurrence of words and phrases in a documentary unit of analysis, and has been used in health policy (Zardo and Collie 2014, Dasandi *et al* 2021a) and global politics research (Grimmer and Stewart 2013, Baturo *et al* 2017, Bunea *et al* 2017). This quantitative methodology also enables correlation analyses to assess relationships between documents' textual content and contextual factors (see Correlation Analysis section below).

We used a computer-assisted automated approach, which can amplify human coding and provide time and resource efficiencies (Grimmer and Stewart 2013), but is best for documents by similar organisations, in a focused policy domain, and that have a common function and language (Bunea *et al* 2017). These attributes are characteristic of the NDCs analysed in this study.

2.1. Data source and collection

NDC reports are publicly available through a registry on the UNFCCC website (UNFCCC n.d.), from which we downloaded reports available as of 6 June 2023. Documents in English were validated and included in the study ($n = 130$, 77%), while documents available only in French ($n = 21$), Spanish ($n = 17$), and Arabic ($n = 1$) were excluded. For the majority of countries, our analysis included only the most recent available report. In three cases (Democratic People's Republic of Korea, India, and Marshall Islands), when the most recent available document was a brief update on a previous full report, these were combined. Analyses were conducted on both the corpus of full reports, and a sub-corpus of the mitigation sections of each report. Given our central rationale of climate change mitigation as the most upstream preventative approach through which to target the social and health equity impacts of climate change, our analysis was primarily focused on the sub-corpus of sections of NDCs that discussed climate change mitigation commitments and their implications. Countries used different structures in their reports, therefore mitigation-related sections were identified through a manual review of each report. The sub-corpus of mitigation-relevant sections constituted 30% of the corpus of full reports.

2.2. Dictionary analysis

The specific type of automated content analysis chosen was a *dictionary* method, involving measurement of the frequency of key terms to identify categories of words within texts (Grimmer and Stewart 2013). Given our aim to assess the extent of SDPHE discussion, and given the large number of determinant factors, this method was optimal. Of the two types of dictionaries used in text analysis, off-the-shelf and organic (Hase 2021), we used an organic dictionary created to capture key SDPHE terms. These were synthesised from existing frameworks of wellbeing and of social, economic, and cultural determinants of health, and literature on environmental and climate change impacts on health and social equity (see supplementary file 1 for details). The dictionary includes 1047 SDPHE terms organised into three overarching categories: social norms, social categories, and life conditions, which each include several sub-categories, summarised in table 1. The dictionary also includes economic and health outcome categories for comparison.

Table 1. Dictionary of social determinants of planetary health equity (SDPHE) (see supplementary file 1 for the full dictionary).

Dictionary category	Dictionary sub-categories
Social norms	Equity-related terms; subjects of equity; SDH and wellbeing terms
Social categories	Age; caste; class; education; ethnicity/race; gender; income/wealth; Indigenous peoples; language; location; migration status; occupation; people with special needs; pre-existing health conditions; sexual orientation
Life conditions *(exposure, conditions, coverage, access, accessibility, availability, quality, affordability, acceptability, appropriate, adequate)*	Colonialism; cultural resources; discrimination; education; energy; food; health care; housing; labour; land; livelihoods; racism; safety; social cohesion; social protection; water, sanitation, and hygiene (WASH)
Health outcome terms	
Economic terms	

The R text-mining package 'quanteda' was used for the dictionary analysis (Benoit *et al* 2018). This generated frequency counts for each of the dictionary categories and sub-categories. Descriptive analyses were conducted using frequency tables and histograms to compare the total frequency of terms in dictionary categories and sub-categories (see supplementary file 2).

2.3. Correlation analysis

The relationship between the frequency of the dictionary categories and political, economic, and environmental variables was explored to ascertain the role of contextual factors. In their comprehensive review of variables shaping climate policy outcomes, Lamb and Minx (2020) identify democracy as an important driver of policy adoption, given incentives toward social provisioning due to a wide electorate. With respect to NDCs, as the policy instruments for global political cooperation on emissions reductions under the Paris Agreement (Keohane and Victor 2016), countries' emissions profiles constitute an important contextual dimension for their approach to these reports. Previous studies have also identified countries' income based on gross domestic product (GDP) per capita as a factor associated with varying health content of NDCs (Dasandi *et al* 2021a, 2021b).

Based on this literature, variables included in the analysis were: democracy, CO_2 emissions (metric tons per capita and emissions per dollar of GDP), and GDP per capita. The democracy variable was based on the Varieties of Democracy dataset (Coppedge *et al* 2023), while the CO_2 emissions and GDP per capita variables were drawn from the World Bank's World Development Indicators (with countries represented by 3 letter ISO 3166-1 alpha-3 codes) (see supplementary file 2 for all data, and supplementary file 1 for a table of country ISO codes) (World Development Indicators n.d.).

2.4. Limitations

NDCs are limited in that they do not necessarily capture a nation's entire climate policy commitments, since there may be more extensive national policy documents (Beagley *et al* 2022). Moreover, despite UNFCCC guidelines, reports vary in length and detail (Beagley *et al* 2022), as well as in the timing of submissions. However, NDCs reflect underlying national-level policies, they are the primary documents through which countries represent their mitigation commitments to the global community, and they are widely viewed as crucial texts illuminating the politics and health implications of climate policy, and as such, as a critical avenue for analysis (WHO 2020, Dasandi *et al* 2021b, Beagley *et al* 2022, WHO 2023). Further, they provide a comparable dataset for all UNFCCC-ratifying countries, enabling global assessment and country comparison. To adjust for differences in the lengths of mitigation-related sections, the frequency of SDPHE terms was weighted by the total number of words to determine proportional measures.

The depth of contextualised frame analysis possible through quantitative dictionary analysis methods is also limited. However, its strength lies in enabling timely analysis of multiple SDPHE factors across a large volume of textual data, and comparative correlation analyses. This provides an important foundation for further qualitative analysis to understand ideational drivers of social and political momentum in climate policy (Lamb and Minx 2020).

3. Results

3.1. Limited attention to the SDPHE

The most significant finding pertains to the high frequency of economic terms in NDCs relative to health outcome terms or SDPHE categories, both in the full reports and in mitigation-related sections. As demonstrated in figure 1 for NDC's mitigation sections, language relating to economic issues is much more prevalent, suggesting, perhaps unsurprisingly, a dominance of economic considerations in countries' climate policy commitments. Economic terms are 6.5 times more frequently used (7983 occurrences) than the most frequently occurring sub-category of SDPHE terms, equity (1226 occurrences).

Among the SDPHE, language pertaining to equity and gender (922 occurrences) are the only factors that are more often discussed than health outcome terms

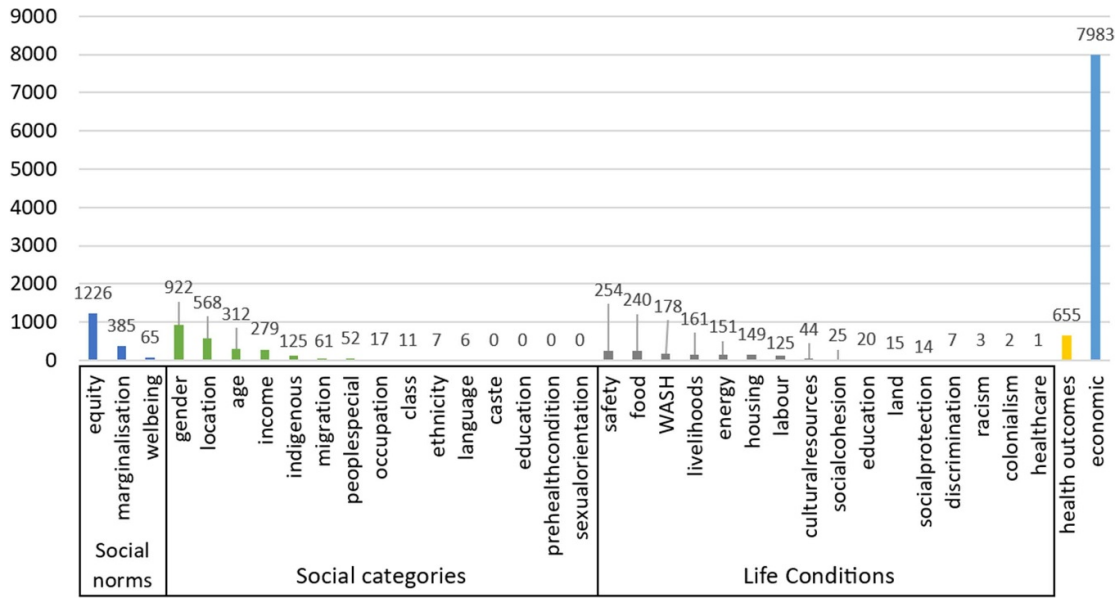

Figure 1. Frequency of social determinants of planetary health equity, health, and economic dictionary terms in Nationally Determined Contribution reports' mitigation sections.

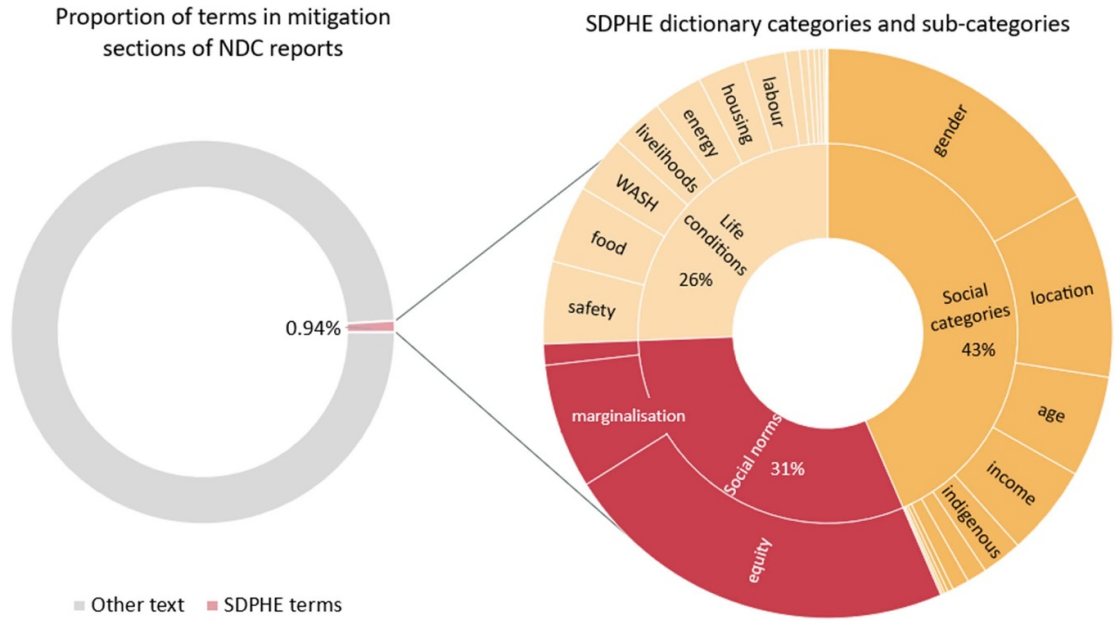

Figure 2. Sunburst chart of social determinants of planetary health equity dictionary terms in mitigation sections of Nationally Determined Contribution reports.

(655 occurrences). The category of health outcome-related terms is the only one to demonstrate much difference between the full corpus of NDCs (0.219% of overall words) and the corpus of mitigation sections of these reports (0.11% of overall words). This indicates that countries overall include less discussion of health outcomes in mitigation sections of their NDCs, while discussion of the SDPHE varies only marginally.

Looking exclusively at the SDPHE terms reveals the relative distribution of attention among these determinants (figure 2). Of the very small 0.94% of words in the mitigation sections of NDCs that pertain to the SDPHE, 1676 occurrences reflect norms such as equity (31%), 2360 occurrences reflect social categories that shape the social gradient of health equity (43%), and 1389 occurrences reflect health-determining conditions of daily life (26%). These findings occurred in similar proportion as within the corpus of full reports, which also contained a 0.94% frequency of SDPHE terms, and similar frequencies of the three categories of SDPHE (social norms, 30%; social categories, 44%; and life conditions, 26%). Within each of these overarching categories

Table 2. Spearman correlation coefficients (R^2) and p-values (p) for the relationship between contextual factors and the use of economic, social norms, and life conditions terms.

Contextual factors (high-income countries)	Economic terms		Social norms		Life conditions	
	R^2	p	R^2	p	R^2	p
Democracy	−0.58	<0.05	0.41	0.05	—	—
CO_2 Emissions (tons) per Capita	0.61	<0.05	—	—	—	—
Carbon intensity (CO_2 emissions per dollar of GDP)	0.66	<0.05	—	—	0.41	<0.05

(social norms, social categories, and life conditions), figure 2 shows the most frequently occurring sub-categories, giving an indication of the specific SDPHE factors that garner the most attention within NDCs' discussions of climate change mitigation.

Among the social categories mentioned in NDCs' mitigation sections, gender-related terms were the most frequent (922 occurrences), followed by location-related terms (e.g. 'rural', 'urban') (568), age-related terms (312), terms referring to income (e.g. poverty, wealth) (279), and references to Indigenous peoples (125). Some social categories received little mention, such as race/ethnicity, while others were not mentioned at all, including terms referring to caste, education level, and pre-existing health conditions.

Social norm-related terms were the second most frequent category in countries' mitigation discussions, primarily due to the frequency of equity- and justice-related terms (1226 occurrences). Terms designating population groups that are the subjects of equity and justice efforts (e.g. marginalisation, vulnerability, disadvantage, among others) was the second most commonly occurring sub-category of social norms (385 mentions), and SDH- and wellbeing-related language was relatively infrequent (65 mentions).

Finally, in the category of life conditions, which contains terminology relevant to daily living and working conditions and exposures that shape (in)equitable health outcomes, the highest frequency was of terms related to safety and security (254 mentions); food (240); water, sanitation, and hygiene (178); livelihoods (161); energy (151); housing (149); and labour (125). There was relatively little discussion of exposure to discrimination (7 mentions), racism (3), or colonialism (2), nor of healthcare accessibility, quality, affordability, etc (1).

This disaggregation of the frequency of language from the various sub-categories of the SDPHE provides an understanding of the relative attention within NDCs' mitigation-related discussions to the different factors that shape PHE.

3.2. Context and the inclusion of PHE considerations

Correlational analyses between contextual factors and the inclusion of terms in countries' climate change mitigation sections within NDCs enables exploration of potential political drivers of the use of certain frames in these policy documents. Disaggregated by income group, the scatterplots presented in figures 3–7 demonstrate the concentration of moderate and significant correlations among high-income countries (HICs), while countries within other income categories show mostly weak or non-existent relationships between textual content and contextual factors. We have summarised the correlation coefficients and p values of note for HICs in table 2.

For the level of democracy in a country, we found a moderate negative association with the occurrence of economic terms among HICs (table 2 and figure 3), and a positive association with the use of SDPHE language related to social norms, such as equity and justice (table 2 and figure 4). As stated above, however, both of these figures demonstrate the relative absence or weakness of statistically significant correlations among other country income groups. In line with the wider literature (Kang and Powell 2010, Glass and Newig 2019, Dahl 2020), these results suggest that high-income democracies may be more likely to be concerned with constituents' expectations for equity and justice relative to less democratic and weaker economies.

Countries' levels of CO_2 emissions per capita similarly shows a moderate positive association with the frequency of economic terms in NDCs' mitigations sections for HICs. This was particularly notable for fossil fuel exporting HICs (Bahrain, Canada, Kuwait, Oman, Qatar, Saudi Arabia, UAE, USA) relative to the European Union, Iceland, and Switzerland (figure 5). Figure 5 also reveals that two of central Asia's largest fossil-fuel exporters (Kazakhstan and Turkmenistan) employ more economic language than other lower-emission countries from the same income group.

Among HICs, the positive association between the frequency of economic terminology and CO_2 emissions per capita is echoed by a similar, slightly

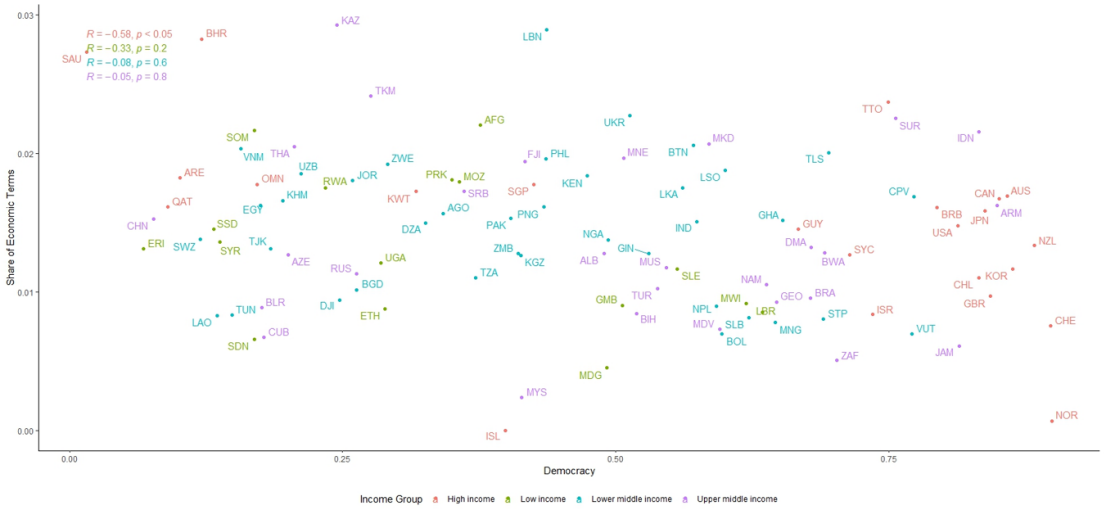

Figure 3. Scatterplot of the relationship between democracy and the use of economic terms in mitigation sections of Nationally Determined Contribution reports (based on Spearman correlation coefficients (R^2)).

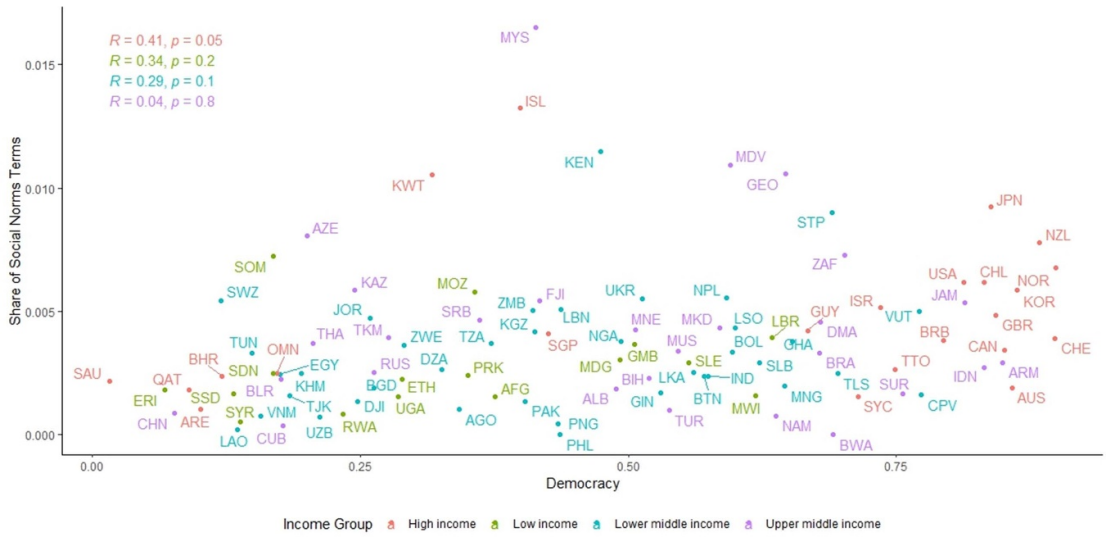

Figure 4. Scatterplot of the relationship between democracy and the use of social norms terms in mitigation sections of Nationally Determined Contribution reports (based on Spearman correlation coefficients (R^2)).

stronger, positive relationship of the former with carbon intensity, as captured by CO_2 emissions per dollar of GDP (figure 6). This suggests that the carbon intensity of an economy may help further qualify the relationship between emissions and economic frames in mitigation sections of NDCs, particularly for HICs.

Among the SDPHE, the use of terminology that captures life conditions shaping health outcomes was moderately positively associated with carbon intensity for HICs (figure 7). Therefore, high carbon intensity HICs may be more likely to discuss factors of living conditions that contribute to health equity outcomes related to climate change impacts.

Taken together, these findings reveal how certain contextual factors correlate with the use of SDPHE and economic terminology within the NDCs' mitigation sections, and how these vary by country income categories. While HICs were found to feature associations between a number of variables, other country income categories did not demonstrate similar strengths of relationships, suggesting greater diversity in textual content within low- and middle-income countries' NDCs.

4. Discussion

This study found a relative dominance of economic frames within the mitigation sections of NDCs, compared to health outcome-specific and SDPHE-related content, echoing other studies on health and climate policy discourses (Workman *et al* 2018, Rossa-Roccor

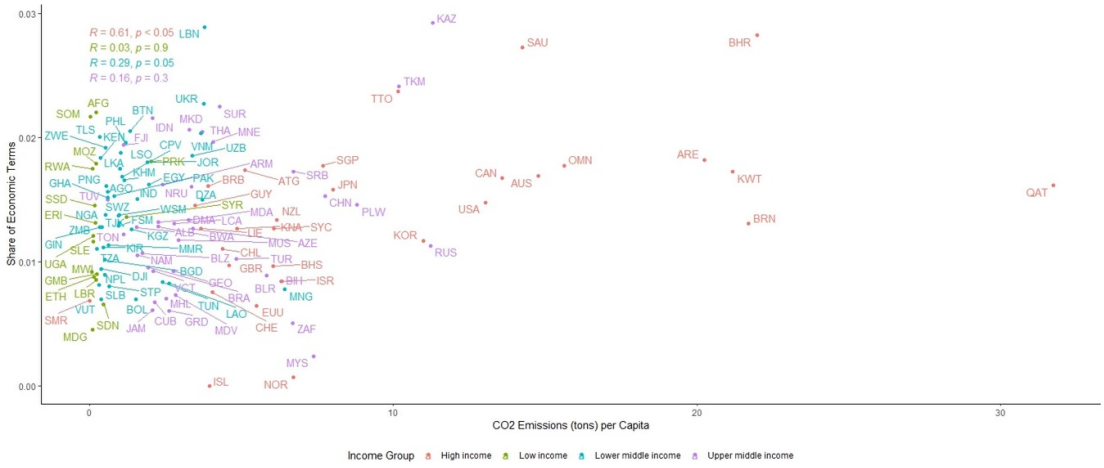

Figure 5. Scatterplot of the relationship between CO_2 emissions per capita and the use of economic terms in mitigation sections of Nationally Determined Contribution reports (based on Spearman correlation coefficients (R^2)).

Figure 6. Scatterplot of the relationship between carbon intensity (CO_2 emissions per dollar of GDP) and the use of economic terms in mitigation sections of Nationally Determined Contribution reports (based on Spearman correlation coefficients (R^2)).

et al 2021, Dasandi *et al* 2021a). This finding was consistent across analyses of full NDCs and of mitigation sub-sections of these reports, as was our finding that SDPHE-related terms occur in similar proportions within full reports and mitigation sections, indicating that economic and SDPHE factors are not more or less frequently discussed in the latter. This differs from health content, which was found to be less common in mitigation sections of NDCs, in our analysis and in previous analyses (Dasandi *et al* 2021a, Romanello *et al* 2022). Therefore, while there may be less explicit focus on health outcomes in countries' mitigation discussions, some of the wider SDPHE factors that shape health equity outcomes do seem to be receiving attention.

Among the SDPHE, equity- and gender-related language occurs most frequently. This may reflect the inclusion of these priorities in the Paris Agreement (Remteng *et al* 2021), and its wider equity framing of common but differentiated responsibilities (Zenghelis 2017). Our analysis does not reveal the precise nature of discussions of equity, however a related study of global climate change and biodiversity reports found that while many discuss global inequalities, few specifically discuss health inequalities (Dasandi *et al* 2022). We found that only one country, Namibia, explicitly mentions 'health equity' in their NDC.

The relatively frequent use of gender-related terms may also reflect its mainstreaming in wider UN and development discourses (Remteng *et al* 2021). This suggests the potential of mainstreaming other SDPHE-related factors into the NDC policy space, however gender-related content is still relatively marginal compared to economic considerations. Indeed, the flexible structure of NDCs provides scope for greater articulation of health and social equity implications of mitigation policies (Dasandi *et al* 2021a, Beagley *et al* 2022), both within countries and pertaining to global inequities.

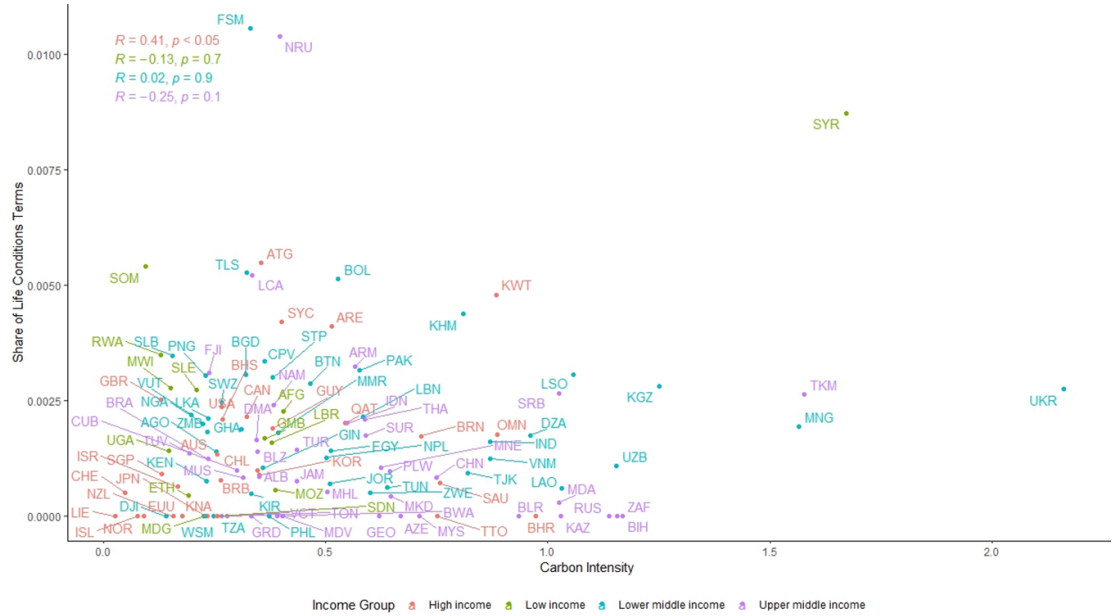

Figure 7. Scatterplot of the relationship between carbon intensity (CO_2 emissions per dollar of GDP) and the use of SDPHE life conditions terms in mitigation sections of Nationally Determined Contribution reports (based on Spearman correlation coefficients (R^2)).

Previous analysis of contextual factors related to variation between countries' health-related NDC content found that it could largely be explained by country income—those with higher GDP per capita were associated with less discussion of health and more likely to have a narrower focus on emissions, energy, and economic factors (Dasandi *et al* 2021a). Our study complements and builds on this analysis, illuminating how other country-level attributes may mediate the relationship between GDP per capita and the NDCs' textual content. For example, we found that HICs exhibit a moderate negative correlation between democracy and the use of economic terms. This is interesting in light of what others have found about the negative relationship between democracy and fossil fuel subsidies, and its positive relationship with the prevalence of climate laws (Lamb and Minx 2020). These findings make intuitive sense as high-income democracies may not face the same demands to deliver economic growth and development as their lower-income peers. Similarly, the fundamental characteristics of democracies lends them to more social provisioning and egalitarian outcomes relative to less democratic governance systems (Kang and Powell 2010, Glass and Newig 2019, Dahl 2020).

We also found positive correlations between the use of economic language and the carbon intensity of an economy among HICs. This suggests that higher-income, higher-emitting, and less carbon-efficient countries employ more economic frames in their discussions of climate change mitigation commitments within NDCs. Among HICs, a positive correlation was also identified between democracy and the frequency of SDPHE social norms terms such as equity and justice. This suggests that inclusive domestic governance could enable the inclusion of SDPHE considerations in NDCs' mitigation discussions.

Our findings concur with other authors' reflections on how NDCs and climate policy more broadly reflect divides in global political dynamics surrounding climate change (Keohane and Victor 2016, Lamb and Minx 2020), and deeper global inequalities (Dasandi *et al* 2021a). Silences on the SDPHE in high-income, high-emitting countries' NDCs can be interpreted, as with silences on health outcomes, as discussing climate change in a way that avoids the need for political action and redressing inequities (Dasandi *et al* 2021a). The political-economic determinants of climate policy, including attention to the SDPHE, are complex and intersecting with no single factor explaining policy outcomes (Lamb and Minx 2020). However, our analysis adds another layer of understanding how country contextual factors may relate to climate policymaking, particularly regarding attention to the SDPHE.

5. Conclusion

Given the deleterious effects of climate change for human health, and their inequitable distribution globally and within populations, there is an urgent need for all sectors of society to contribute toward integrated climate change mitigation policy (Whitmee *et al* 2023b). In terms of optimising government action for PHE, the analysis described above

may contribute to advocacy for coherent, integrated policy approaches by national governments to climate change mitigation commitments that recognise the structural and systemic foundations of the PHE crisis (Friel 2019, Masuda *et al* 2022). This could contribute to progressive climate policy commitments, given frequent claims in the literature that framing climate policy in relation to health and social outcomes may contribute to public and political support for transformative mitigation action, nationally and globally (Sauerborn *et al* 2009, Keohane and Victor 2016, Zenghelis 2017, Janetschek *et al* 2020, Lamb and Minx 2020, Rossa-Roccor *et al* 2021, Dasandi *et al* 2021a, Burki 2023, Laybourn-Langton 2023, Whitmee *et al* 2023a, Mohan 2024). The association that we identified between democracy and social norms may indicate scope for impact through democratic pressures, identifying NDCs as a potential tool for progressive global cooperation. Through their NDCs, therefore, individual countries can contribute to identifying and framing the implications of climate change mitigation in ways that advance PHE domestically and globally.

Data availability statement

All data that support the findings of this study are included within the article (and any supplementary files).

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References

Antwi-Agyei P, Dougill A J, Agyekum T P and Stringer L C, 2017 Identifying opportunities for coherence between the intended nationally determined contributions and the sustainable development goals: the case of ECOWAS member states (No. Paper No. 110) (Sustainability Research Institute, School of Earth and Environment, University of Leeds)

Antwi-Agyei P, Dougill A J, Agyekum T P and Stringer L C 2018 Alignment between nationally determined contributions and the sustainable development goals for West Africa *Clim. Policy* **18** 1296–312

Baturo A, Dasandi N and Mikhaylov S J 2017 Understanding state preferences with text as data: introducing the UN general debate corpus *Res. Polit.* **4** 2053168017712821

Beagley J, van Daalen K R, Castillo B P, Jung L, Wyns A, Mattijsen J C, Blom I M, Omrani O E and Miller J 2022 Assessing the inclusion of health in national climate commitments: towards accountability for planetary health *J. Clim. Change Health* **5** 100085

Benoit K, Watanabe K, Wang H, Nulty P, Obeng A, Müller S and Matsuo A 2018 quanteda: an R package for the quantitative analysis of textual data *J. Open Source Softw.* **3** 774

Bunea A, Ibenskas R and Binderkrantz A 2017 Estimating interest groups' policy positions through content analysis: a discussion of automated and human-coding text analysis techniques applied to studies of EU lobbying *Eur. Polit. Sci.* **16** 337–53

Burki T 2023 Health at COP28: three things to watch for *Lancet* **402** 1954

Buse K, Tomson G, Kuruvilla S, Mahmood J, Alden A, van der Meulen M, Ottersen O P and Haines A 2022 Tackling the politics of intersectoral action for the health of people and planet *BMJ* **376** e068124

Commission on the Social Determinants of Health 2008 Closing the gap in a generation: health equity through action on the social determinants of health—final report of the commission on the social determinants of health (World Health Organization)

Coppedge M *et al* 2023 V-Dem [Country-Year/Country-Date] Dataset (https://doi.org/10.23696/vdemds23)

Costello A *et al* 2009 Managing the health effects of climate change: lancet and university college london institute for global health commission *Lancet* **373** 1693–733

Dahl R A 2020 *On Democracy* (Yale University Press)

Dasandi N, Cai W, Friberg P, Jankin S, Kuylenstierna J and Nilsson M 2022 The inclusion of health in major global reports on climate change and biodiversity *BMJ Glob. Health* **7** e008731

Dasandi N, Graham H, Lampard P and Jankin Mikhaylov S 2021a Engagement with health in national climate change commitments under the Paris Agreement: a global mixed-methods analysis of the nationally determined contributions *Lancet Planet Health* **5** e93–e101

Dasandi N, Graham H, Lampard P and Jankin Mikhaylov S 2021b Intergovernmental engagement on health impacts of climate change *Bull. World Health Organ.* **99** 102–11B

Friel S 2019 *Climate Change and the People's Health* (Oxford University Press)

Friel S 2022 Climate change, society, and health inequities *Med. J. Aust.* **217** 466–8

Friel S, Arthur M and Frank N 2022 Power and the planetary health equity crisis *Lancet* **400** 1085–7

Friel S, Marmot M, McMichael A J, Kjellstrom T and Vågerö D 2008 Global health equity and climate stabilisation: a common agenda *Lancet* **372** 1677–83

Friel S, Townsend B, Fisher M, Harris P, Freeman T and Baum F 2021 Power and the people's health *Soc. Sci. Med.* **282** 114173

García M, Medina D and Witkowski K, Inter-American Institute for Cooperation on Agriculture (IICA), I.I. de C. para la, Escuela Tecnológica Instituto Técnico Central (ETIT), E.T.I. y, Programa de Cambio Climático, R.N. y G. de R.P. (PCRG), 2016. Intended Nationally Determined Contributions in the Caribbean: where does agriculture fit? Instituto Interamericano de Cooperación para la Agricultura (IICA)

Glass L-M and Newig J 2019 Governance for achieving the sustainable development goals: how important are participation, policy coherence, reflexivity, adaptation and democratic institutions? *Earth Syst. Gov.* **2** 100031

Grimmer J and Stewart B M 2013 Text as data: the promise and pitfalls of automatic content analysis methods for political texts *Polit. Anal.* **21** 267–97

Haryanto B, Supriatna J, Nurlambang T and Marsum 2023 Status of nationally determined contributions in indonesia: a review on climate change health impacts *Climate Change and Human Health Scenarios: International Case Studies* ed R Akhtar (Springer) pp 115–28

Hase V 2021 Text as data methods in R—applications for automated analyses of news content (available at: https://bookdown.org/valerie_hase/TextasData_HS2021/) (Accessed 13 November 2023)

Höhne C, Kahmann C and Lohaus M 2024 Continuity and change in norm translations after the paris agreement: from first to second nationally determined contributions *Glob. Environ. Polit.* **24** 69–97
Janetschek H, Brandi C, Dzebo A and Hackmann B 2020 The 2030 agenda and the paris agreement: voluntary contributions towards thematic policy coherence *Clim. Policy* **20** 430–42
Jernnäs M 2024 Governing through the nationally determined contribution (NDC): five functions to steer states' climate conduct *Environ. Polit.* **33** 530–51
Kang S-G and Powell G B 2010 Representation and policy responsiveness: the median voter, election rules, and redistributive welfare spending *J. Polit.* **72** 1014–28
Keohane R O and Victor D G 2016 Cooperation and discord in global climate policy *Nat. Clim. Change* **6** 570–5
Koon A D, Hawkins B and Mayhew S H 2016 Framing and the health policy process: a scoping review *Health Policy Plan.* **31** czv128
Lamb W F and Minx J C 2020 The political economy of national climate policy: architectures of constraint and a typology of countries *Energy Res. Soc. Sci.* **64** 101429
Laybourn-Langton L 2023 Success, failure, and the imperative for justice in climate negotiations *Bull. World Health Organ.* **101** 155–7
Masuda J, McLaren L and Poland B 2022 COP26: what is the message for public health? *Can. J. Public Health* **113** 1–5
McDonald M 2015 Climate security and economic security: the limits to climate change action in Australia? *Int. Politec.* **52** 484–501
Meckling J and Allan B B 2020 The evolution of ideas in global climate policy *Nat. Clim. Change* **10** 434–8
Mohan P 2024 Health engagement in national climate commitments of small island developing states: a content analysis of Caribbean nationally determined contributions *J. Clim. Change Health* **18** 100322
Northrop E, Biru H, Lima S, Bouye M and Song R 2016 Examining the alignment between the intended nationally determined contributions and sustainable development goals (World Resources Institute)
Paim M-A, Salas P, Lindner S, Pollitt H, Mercure J-F, Edwards N R and Viñuales J E 2020 Mainstreaming the water-energy-food nexus through nationally determined contributions (NDCs): the case of Brazil *Clim. Policy* **20** 163–78
Pauw W P and Klein R J T 2020 Beyond ambition: increasing the transparency, coherence and implementability of nationally determined contributions *Clim. Policy* **20** 405–14
Remteng C, Nkem J, Mofor L and Murombedzi J 2021 Gender in the nationally determined contributions of African countries: a way forward for effective implementation of adaptation and mitigation strategies *Ecofeminism Clim. Change* **3** 2–22
Romanello M *et al* 2022 The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels *Lancet* **400** 1619–54
Rosewarne S 2020 Meeting the challenge of climate change: the poverty of the dominant economic narrative and market solutions as subterfuge *J. Aust. Polit. Econ.* 17–50
Rossa-Roccor V, Giang A and Kershaw P 2021 Framing climate change as a human health issue: enough to tip the scale in climate policy? *Lancet Planet. Health* **5** e553–9
Rushton S and Williams O D 2012 Frames, paradigms and power: global health policy-making under neoliberalism *Glob. Soc.* **26** 147–67
Sampedro J, Markandya A, Rodés-Bachs C and de Ven D-J V 2023 Short-term health co-benefits of existing climate policies: the need for more ambitious and integrated policy action *Lancet Planet. Health* **7** e540–1
Sauerborn R, Kjellstrom T and Nilsson M 2009 Health as a crucial driver for climate policy *Glob. Health Action* **2** 2104
Scott A, Worrall L and Sejal P 2018 *Aligning Energy Development and Climate Objectives in Nationally Determined Contributions* (Climate & Development Knowledge Network; Overseas Development Institute)
Singh J A 2012 Why human health and health ethics must be central to climate change deliberations *PLOS Med.* **9** e1001229
Skovgaard J 2021 *The Economisation of Climate Change: How the G20, the OECD and the IMF Address Fossil Fuel Subsidies and Climate Finance* (Cambridge University Press)
Stephenson S D and Allwood J M 2023 The role of narratives and ideas in constructing limits to climate policy: a case study of UK policymakers (https://doi.org/10.2139/ssrn.4422027)
UNFCCC Secretariat 2022 *Nationally determined contributions under the Paris Agreement* (Synthesis Report by the Secretariat)
UNFCCC n.d. NDC Registry *Natl. Determined Contrib. Regist* (available at: https://unfccc.int/NDCREG) (Accessed 6 June 2023)
Whitmee S *et al* 2023b Pathways to a healthy net-zero future: report of the lancet pathfinder commission *The Lancet* **403** 67–110
Whitmee S, Anton B and Haines A 2023a Accountability for carbon emissions and health equity *World Health Organ. Bull. World Health Organ.* **101** 83,83A
WHO 2020 *Health in the Nationally Determined Contributions (Ndcs): A WHO Review* (World Health Organization)
WHO 2021 The health argument for climate action: COP26 special report on climate change and health (World Health Organization)
WHO 2023 *2023 WHO Review of Health in Nationally Determined Contributions and Long-term Strategies: Health at the Heart of the Paris Agreement* (Geneva: World Health Organization)
Workman A, Blashki G, Bowen K J, Karoly D J and Wiseman J 2018 The political economy of health co-benefits: embedding health in the climate change agenda *Int. J. Environ. Res. Public Health* **15** 674
World Development Indicators n.d. The World Bank
World Health Organization 2018 COP24 special report: health and climate change (World Health Organization)
Zardo P and Collie A 2014 Measuring use of research evidence in public health policy: a policy content analysis *BMC Public Health* **14** 496
Zenghelis D 2017 Equity and national mitigation *Nat. Clim. Change* **7** 9–10