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Integrate health into decision-making to foster climate action

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Abstract

The COVID-19 pandemic reveals that societies place a high value on healthy lives. Leveraging this momentum to establish a more central role for human health in the policy process will provide further impetus to a sustainable transformation of energy and food systems.

The COVID-19 pandemic has put human health at the centre stage of public, media and political interest. While COVID-19 is demanding immediate government action around the world, the emergency puts the spotlight on the policy-health interface, providing a unique momentum to set up institutional frameworks that integrate human health considerations into the policy-making process in various domains. We argue here that a health-centred policy approach is consistent with ambitious climate policy, as human and planetary health outcomes largely overlap.

Recent work (Clark *et al* 2020a) highlights that the risk of severe COVID-19 increases with the prevalence of underlying health conditions, such as chronic respiratory disease, cardiovascular disease and diabetes. Air pollution and imbalanced diets are major risk factors associated with these diseases, and are responsible for 6 and 8 million premature deaths in 2019, respectively (Murray *et al* 2020). Addressing these risks will enhance resilience to future public health challenges. Conversely, rolling back environmental policies can make the population more vulnerable to disease outbreaks, and has increased the death toll of COVID-19 (Persico and Johnson 2021).

At the same time, air pollution and imbalanced diets are linked to planetary health. The majority of air pollution is caused by the burning of fossil fuels, also the largest driver of climate change. The agricultural sector underpinning imbalanced diets heavily relying on animal protein is responsible for about a third of all greenhouse gas emissions, and up to a fifth of global premature deaths due to outdoor air pollution (Lelieveld *et al* 2015). Climate change, in turn, is expected to exacerbate existing health conditions, for instance through an increased exposure to extreme heat events (Hsiang *et al* 2017) and through reduced crop yields that limit fruit and vegetable consumption (Springmann *et al* 2016a). These interactions give rise to a climate-air-food-health nexus and mutually reinforce the call for ambitious action.

1. Taking stock

Effectively harvesting the synergies in the climate-air-food-health nexus will require a good understanding of how underlying risk factors are interlinked. Clearly, health risk profiles differ substantially across regions (figure 1). Over the past decades, high-income regions like Europe and the US have experienced a steady decline of air pollutant emissions (with the exception of ammonia from agriculture) and the associated health burden. In many of these regions, limiting the spread of COVID-19 has proven to be challenging, resulting in a relatively high mortality burden from COVID-19. Deaths attributed to risks associated with red meat consumption tend to be higher in high-income countries, although dietary change has been unfolding rapidly in China in the

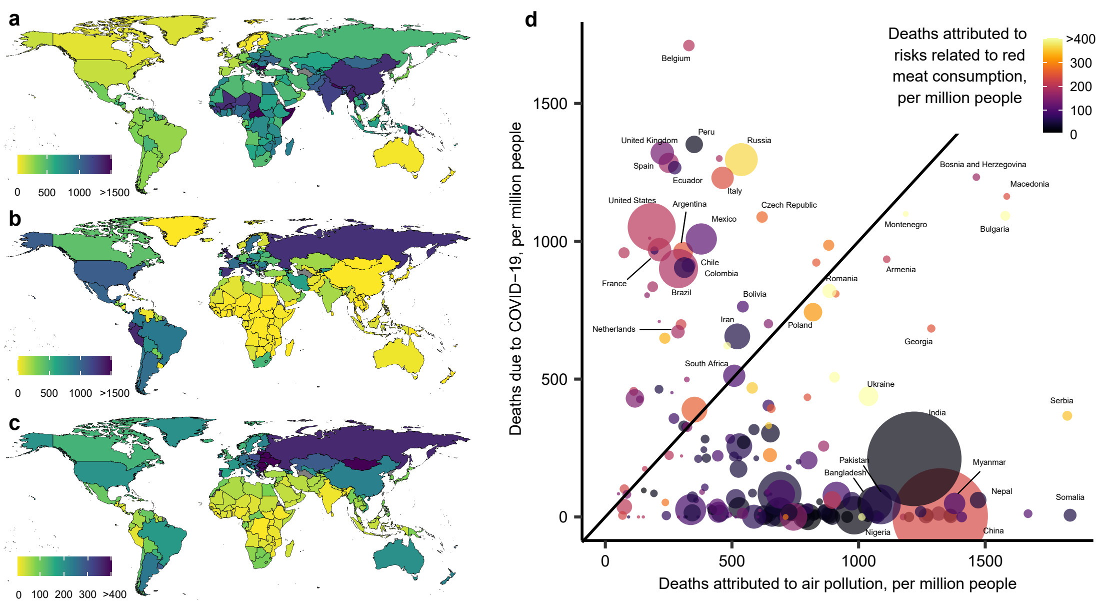

Figure 1. Mortality risks across regions. Global pattern of deaths per million people attributable to (a) air pollution in 2019, (b) COVID-19 in 2020, and (c) red meat consumption in 2019. (d) Premature deaths from air pollution in 2019 vs COVID-19 in 2020. Circle size is scaled to population in 2019. Source: Institute for Health Metrics and Evaluation: COVID-19 resources (Current Projection, extracted on 10 December 2020) and Global burden of disease 2019 results tool.

recent past—with corresponding environmental consequences (He *et al* 2018).

In other parts of the world, however, the number of annual deaths per million people attributable to air pollution substantially outweighs the reported deaths from COVID-19, particularly in Africa and Asia. The numbers displayed in figure 1 should be interpreted with caution, as both attribution of mortality to risk factors and reported deaths from COVID-19 come with some degree of uncertainty. Progress on air pollution health risks is mixed. Exposure risk from household air pollution from solid fuels has decreased since 2010 (Murray *et al* 2020), as both policy and economic development limit the use of traditional biomass and induce a shift towards clean cooking stoves. The Chinese Air Pollution Prevention and Control Action Plan has brought down emissions of fine particulate matter in recent years, and ambitious policies such as the China 6 vehicle standards are on the verge of implementation. In spite of these improvements, the remaining health burden of air pollution indicates a wide margin for additional progress. Risk exposure from ambient air pollution in regions with lower socio-demographic development has increased over the past decade (Murray *et al* 2020), and associated mortality could reach over 9 million deaths globally in 2050 (Lelieveld *et al* 2015) if no action is undertaken.

2. Health in policy evaluation

To make health considerations explicit in policy debates, health impacts should feature prominently in the assessments that evaluate and compare different policy options. While this applies to a wide range of policy domains, we illustrate here with a stylized benefit-cost analysis of non-pharmaceutical interventions (such as lockdowns and school closures) in response to the first wave of the COVID-19 pandemic in 11 European countries (table 1). We combine available evidence on the averted deaths (Flaxman *et al* 2020) with the projected costs in terms of GDP loss (OECD Economic Outlook, Interim Report September 2020). For a plausible range of parameters, central estimates of the benefit-cost ratios exceed 1 for all countries considered, indicating that the value of avoided mortality benefits outweighs the costs of the measures. To enable such a comparison, we calculate the cost of measures by dividing GDP losses by the number of deaths averted. On the benefit side, we value the reductions in health risks in monetary terms, reflecting the willingness to pay to reduce the probability of dying (see Viscusi 2020, for a discussion). Even ex post, this economic assessment remains fraught with uncertainties. Low and High estimates indicate a wide range around the central estimate, driven both by uncertainty in health impacts (averted deaths and an assumed 8, 10 or 12 life years lost per death) and by variation in economic valuation of a life year lost (50, 100 or 150 10^3 USD on an EU-wide average with country variation based on GDP per capita and an income elasticity of 0.8). Furthermore, this simplified example is presented here for illustrative purposes, as it comes with at least two caveats. First, it assumes that all of the GDP losses can be attributed entirely to government interventions, whereas a fair amount is likely due to the virus itself, and

Table 1. Benefits and costs of non-pharmaceutical interventions in response to COVID-19.

	Deaths averted			GDP	GDP	Cost per averted YLL			Benefit-cost ratio		
Country	Central (Thousands)	Low	High	2019 (10^9 USD)	Loss (%)	Central (10^3 USD)	High	Low	Central	Low	High
Austria	65	40	85	525	6	50	102	32	2.6	0.6	6.0
Belgium	110	86	130	626	9	51	81	36	2.4	0.8	5.1
Denmark	34	17	49	348	6	59	148	34	2.7	0.5	6.9
France	690	570	820	3315	10	46	69	32	2.5	0.8	5.4
Germany	560	370	770	4660	5	45	85	27	2.7	0.7	6.7
Italy	630	510	760	2665	11	44	69	31	2.2	0.7	4.7
Norway	12	3	23	357	6	179	838	78	1.2	0.1	4.0
Spain	450	360	540	1987	11	49	77	34	1.9	0.6	4.1
Sweden	26	12	46	574	7	148	401	70	1.0	0.2	3.1
Switzerland	52	34	71	609	8	90	172	55	2.1	0.6	5.2
UK	470	370	580	3255	10	70	111	47	1.6	0.5	3.6

YLL, year of life lost. GDP, gross domestic product. USD, United States dollars.

would have also occurred in the absence of measures. Accounting for this is not trivial, but would further raise benefit-cost ratios. Second, benefit-cost analyses with an explicit valuation of health risk reduction are useful for trading off various options. In the case of COVID-19, stopping the spread of the virus is the only acceptable option, and is furthermore a prerequisite for restoring economic activity. To avoid misinterpretation, we emphasize here that the example does not intend to suggest in any way that non-action was a viable alternative. New scientific evidence can narrow the uncertainties related to the health impacts and can direct policymakers to targeted interventions that put strong brakes on the spread of COVID-19 while keeping economic costs in check, raising benefit-cost ratios over those from the confinement measures in the first wave.

3. Health for climate

When it comes to the transition to a low-carbon society, a large body of literature is already available to guide policymakers towards measures with attractive benefit-cost ratios. Drawing on recent work on the interlinkages between health, air pollution, dietary changes and climate change mitigation, we synthesize four key messages and translate the insights into recommendations for an ambitious climate policy agenda in the COVID-19 recovery phase and the years to follow.

First, health benefits of proposed policy targets under (revisions of) the Nationally Determined Contributions and Long-Term Strategies submitted to the UNFCCC should be evaluated and communicated to the broader public. Recent work (Vandyck *et al* 2018, Markandya *et al* 2018, Rauner *et al* 2020a) highlights that the co-benefits of climate policy in terms of cleaner air more than offset the mitigation costs for many countries—benefit-cost ratios higher than 1—while facilitating progress towards the Sustainable Development Goal on Good Health and Well-being (SDG3). Likewise, the health co-benefits of adopting more plant-based dietary patterns that are lower in greenhouse gas emissions have been valued at up to 20% of global GDP (Springmann *et al* 2016b). Ensuring that these indirect health benefits are salient can improve acceptability of ambitious policy proposals.

Second, embedding health concerns in the policy process will favour a more encompassing definition of net zero targets in terms of greenhouse gas rather than CO_2 emissions. For instance, agricultural policies to mitigate shorter-lived climate forcers, such as methane and nitrous oxide, can address detrimental health impacts related to both air pollution (Van Dingenen *et al* 2018) and imbalanced diets (Springmann *et al* 2017). Measures to cut ammonia emissions can be justified on the basis of net gains due to air quality-related health benefits, while they reduce non-CO_2 greenhouse gases as well (Zhang *et al* 2020).

Third, accounting for localised health benefits can alter the optimal climate policy design and technology choices. Phasing out coal is a policy option with a benefit-cost ratio higher than 1 when local health and environmental benefits are brought into the picture (Rauner *et al* 2020b). However, other choices may be less clear-cut, and will require a careful balancing of trade-offs. Fully exploiting the economic potential of biomass for energy, for instance, lowers the cost of climate policy but at the same time limits the corresponding health co-benefits (Sampedro *et al* 2020). Negative emission technologies allow for an overshoot of temperature targets, but mortality impacts from air pollution cannot be undone by their deployment in future years. In these cases, reflecting health and other externalities in price signals—complemented by other regulations in a broader policy package—can be a useful way to steer private investments towards options with high benefit-cost ratios from a societal point of view. For instance, differentiating carbon prices to reflect that air quality co-benefits differ across sectors (Vandyck *et al* 2020) can raise benefit-cost ratios above those from uniform pricing schemes when health benefits are considered. Similarly, integrating the currently unaccounted health and environmental costs of imbalanced diets in the price of foods, whilst financially supporting low-income households, could incentivise dietary changes that improve health and mitigate climate change simultaneously (Springmann *et al* 2017).

Fourth, health concerns can catalyse behavioural changes that are crucial for sustainable development. A striking example is the widespread use of videoconferencing services in response to the outbreak of COVID-19, which can limit demand for long-distance travelling and the corresponding emissions. Public health awareness can lead to similar dynamics in dietary changes, which are a prerequisite to achieve the climate targets of the Paris Agreement (Clark *et al* 2020b) and can avoid more than 10 million deaths in 2030 (Willett *et al* 2019). Similarly, reduced energy demand (Grubler *et al* 2018) and other lifestyle changes (Van Vuuren *et al* 2018), such as active transport modes for urban mobility, can make key contributions to ambitious climate efforts, with synergistic effects for health and a multitude of other sustainability dimensions. Recent work shows that dietary change and enhanced physical activity can further raise the health gains of ambitious climate policies (Hamilton *et al* 2021). Facilitating behavioural change should therefore be a priority for public policy.

These four messages highlight opportunities to integrate health concerns in the evaluation, communication and design of policy measures. The COVID-19 pandemic reveals that societies place a high value on healthy lives. Leveraging this momentum to establish a more central role for human health in the policy process will provide further impetus to a sustainable transformation of energy and food systems. Furthermore, the generally broad acceptance of the far-reaching measures to limit the spread of COVID-19 reflects a high valuation of risk, particularly when looming death tolls are quantifiable and effects are local. However, health effects of public interventions are often not directly observable in a straightforward manner. Therefore, future research should aim to inform policies and the broader public debate by revealing and quantifying the impacts on health outcomes of processes and policy interventions that affect health in indirect and often complex ways.

4. Think local act global

The strong response to the COVID-19 pandemic has shown that local health impacts can be a powerful lever for policy action. Similarly, local health impacts can provide a strong motivation for ambitious climate policy. The majority of the interactions described above highlight that an integrated policy framework can bring localized near-term health gains while tackling climate change. Reconciling local incentives with global objectives is crucial to overcome political economy constraints and enhance acceptability of measures required to achieve a sustainable transformation. At the same time, the pandemic illustrates that an efficient policy response requires collaboration across country borders to complement local measures, as is the case for air pollution and climate change.

The economic impacts of the policies to limit the spread of COVID-19 are a stark reminder of the costs of drastic and disruptive measures that may be necessary when countries are ill-prepared and precise information is unavailable. The approach to tackling climate change, air pollution and dietary risks, in contrast, can build on a large and growing body of research, and should therefore be markedly different. Well-anticipated, integrated, informed and gradual but ambitious government action can curb emissions and improve health outcomes while ensuring economic prosperity, and is therefore the only remedy that guarantees a healthy planetary future.

Data availability statement

The data that support the findings of this study are openly available at the following URL/DOI: https://covid19.healthdata.org/.

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References

Clark A *et al* 2020a Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study *Lancet Glob. Health* **8** e1003–17

Clark M A, Domingo N G G, Colgan K, Thakrar S K, Tilman D, Lynch J, Azevedo I L and Hill J D 2020b Global food system emissions could preclude achieving the 1.5° and 2 °C climate change targets *Science* **370** 705–8

Flaxman S *et al* 2020 Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe *Nature* **584** 257–61
Grubler A *et al* 2018 A low energy demand scenario for meeting the 1.5 °C target and sustainable development goals without negative emission technologies *Nat. Energy* **3** 515–27
Hamilton I *et al* 2021 The public health implications of the Paris Agreement: a modelling study *Lancet Planet. Health* **5** e74–e83
He P, Baiocchi G, Hubacek K, Feng K and Yu Y 2018 The environmental impacts of rapidly changing diets and their nutritional quality in China *Nat. Sustain.* **1** 122–7
Hsiang S *et al* 2017 Estimating economic damage from climate change in the United States *Science* **356** 1362–9
Lelieveld J, Evans J S, Fnais M, Giannadaki D and Pozzer A 2015 The contribution of outdoor air pollution sources to premature mortality on a global scale *Nature* **525** 367–71
Markandya A, Sampedro J, Smith S J, Van Dingenen R, Pizarro-Irizar C, Arto I and González-Eguino M 2018 Health co-benefits from air pollution and mitigation costs of the Paris Agreement: a modelling study *Lancet Planet. Health* **2** e126–33
Murray C J *et al* 2020 Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the global burden of disease study 2019 *Lancet* **396** 1223–49
Persico C L and Johnson K R 2021 The effects of increased pollution on COVID-19 cases and deaths *J. Environ. Econ. Manage.* **107** 102431
Rauner S *et al* 2020a Air quality co-benefits of ratcheting up the NDCs *Clim. Change* **163** 1481–500
Rauner S, Bauer N, Dirnaichner A, Dingenen R V, Mutel C and Luderer G 2020b Coal-exit health and environmental damage reductions outweigh economic impacts *Nat. Clim. Change* **10** 308–12
Sampedro J, Smith S J, Arto I, González-Eguino M, Markandya A, Mulvaney K M, Pizarro-Irizar C and Van Dingenen R 2020 Health co-benefits and mitigation costs as per the Paris Agreement under different technological pathways for energy supply *Environ. Int.* **136** 105513
Springmann M, Mason-D'Croz D, Robinson S, Garnett T, Godfray H C J, Gollin D, Rayner M, Ballon P and Scarborough P 2016a Global and regional health effects of future food production under climate change: a modelling study *Lancet* **387** 1937–46
Springmann M, Godfray H C J, Rayner M and Scarborough P 2016b Analysis and valuation of the health and climate change cobenefits of dietary change *Proc. Natl Acad. Sci.* **113** 4146–51
Springmann M, Mason-D'Croz D, Robinson S, Wiebe K, Godfray H C J, Rayner M and Scarborough P 2017 Mitigation potential and global health impacts from emissions pricing of food commodities *Nat. Clim. Change* **7** 69–74
Van Dingenen R *et al* 2018 Global trends of methane emissions and their impacts on ozone concentrations *JRC Science for Policy Report* (https://doi.org/10.2760/820175)
Van Vuuren D P *et al* 2018 Alternative pathways to the 1.5 C target reduce the need for negative emission technologies *Nat. Clim. Change* **8** 391–7
Vandyck T *et al* 2020 Quantifying air quality co-benefits of climate policy across sectors and regions *Clim. Change* **163** 1501–17
Vandyck T, Keramidas K, Kitous A, Spadaro J V, Van Dingenen R, Holland M and Saveyn B 2018 Air quality co-benefits for human health and agriculture counterbalance costs to meet Paris Agreement pledges *Nat. Commun.* **9** 4939
Viscusi W K 2020 Pricing the global health risks of the COVID-19 pandemic *J. Risk Uncertain.* **61** 101–28
Willett W *et al* 2019 Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems *Lancet* **393** 447–92
Zhang X *et al* 2020 Societal benefits of halving agricultural ammonia emissions in China far exceed the abatement costs *Nat. Commun.* **11** 4357