Designing a system to monitor environmental change and human health on a changing planet — Planetary Health Watch

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Earlier this year an influential group of scientists voted to designate a new geological epoch, the Anthropocene, that reflects the commencement of significant human impact on the Earth's systems.[1] The scale of human impact is such that in many areas it threatens the functioning of the natural systems that sustain the health of human civilization. Rockström *et al* refer to a set of nine 'planetary boundaries', which, if transgressed (and several already are being transgressed), may lead to triggering non-linear, abrupt environmental change.[2,3] These boundaries relate to climate change, ocean acidification, stratospheric ozone depletion, biogeochemical flows, atmospheric aerosol loading, land-system changes, global freshwater use, biosphere integrity and novel entities.[2,3] Threats to these boundaries have the potential for major, but often imperfectly understood, risks to human health and well-being. Most of these risks are not clearly recognised or monitored, and remain invisible to the policy, market and social systems that are in a position to mitigate them.

There is therefore a pressing need to develop relevant integrated monitoring capabilities – a Planetary Health Watch (PHW) system – to improve the understanding of the risks and guide responses.[4] Key considerations for the design of such a system emerged from recent engagements with scientists, existing monitoring initiatives, policy and decision-makers (see acknowledgements).[5,6]

With regard to the scope of a PHW, a useful starting point is the Rockström *et al* 'planetary boundaries'. It would set the focus of monitoring on the major changes in the functioning of natural systems and allow for vigilance to expected or unexpected interactions, synergies, and trade-offs across these changes, leaving flexibility to include other issues if they become salient. Each boundary has multiple pathways connecting environmental change to human health of varying availability of data and evidence, magnitude of potential impact, and likelihood of a tipping point.[7] Trans-disciplinary efforts to understand these pathways would be important to ensuring that PHW is tailored to the most appropriate form of action on each pathway, including supporting research and decision making.

It is important that a PHW does not compete with existing monitoring initiatives, but engages with and leverages them. There are many initiatives that monitor either environmental changes or health outcomes separately (e.g. Global Observatory on Pollution and Health, UNEP World Conservation Monitoring Centre, Lancet Countdown on Health and Climate Change and the Sustainable Development Goal Indicators) but few initiatives that attempt to bring data together in ways that can allow assessment of attribution, causal associations and the impacts of actions.[3] Bringing together data from different disciplinary domains is likely to require overcoming barriers relating to differences in governance (e.g. data exchange, ethics, quality) and technical integration (e.g. standardization, interoperability, open source). The recently developed guidelines for data interoperability,[8] ethical principles for planetary health,[9] and an agreement on a unifying agenda for action on planetary health should help.

It will be useful to bring together data from both 'top-down' (global scale) and 'bottom-up' (local) approaches. There is potential to build on existing open data portals such as Resource Watch which provides open access to over 250 data sources, including 40 near-real time. Some of the monitoring would not be feasible or necessary to undertake at the global scale. Therefore, an important component of the system would be a network of sentinel sites representing 'hotspots' – areas of particular human vulnerability to adverse effects from multiple environmental stressors. Such sites can be accessed through existing health and demographic surveillance sites of the INDEPTH network and cohort studies in vulnerable locations. 'Opportunity sites' – would be selected from areas that have demonstrated political will for major policy change or where there are resources earmarked for implementation of sustainable technologies or other interventions which have the potential to improve health and sustainability. Examples include – sites in networks of cities which aim to rapidly transition to more sustainable economies (e.g. C40, Global Covenant of Mayors) and countries that committed to large scale landscape restoration (e.g. Africa100, LA 20x20).

Effective stakeholder engagement, especially with target users, is key to the adoption of the system and its ability to drive action for the protection of planetary health. In designing PHW, we need to identify who is in the position to influence planetary health, what information they require, what are their motivations or motivators, what messages and messengers matter most. Planetary challenges require developing capacity for systemic responses across multiple levels and sectors, including policy making, financial investments, community action, and public awareness, e.g. through effective transdisciplinary partnerships. Therefore, PHW should be tailored for research, surveillance, and decision-making purposes across sectors by engaging target users in its co-design, co-development, and co-roll out. Building on recent synthesis of advice for academics on how to influence policy,[10] there is a need for a synthesis of the best strategies for providing data to drive those actions that can leverage big course corrections in the way our society operates, triggering and sustaining transition to a low carbon, low environmental footprint economy within a safe operating space for humanity.[2]

An effective PHW is vital if we are to galvanize much needed action to address the growing threats to planetary health beyond those that are now increasingly recognised for climate change. Proposal for PHW presented at a side event at the UN High Level Political Forum on Sustainable Development generated considerable interest and enthusiasm from UN agencies.[11] We invite others to add their thoughts and support for a shared agenda and monitoring for planetary health.

Panel: Proposed components of a Planetary Health Watch system, as agreed at the expert and stakeholder engagement workshop held at the Wellcome Trust, July 2019[5]

A: A transdisciplinary community of experts and researchers that

- Coordinates input from existing monitoring/research networks and topic experts, catalysing collaboration
- Advances the understanding of links of environmental changes with health, and their interactions
- Coordinates the development of monitoring indicators following the Drivers-Pressures-States-Exposures-Effects-Action (DPSEEA) framework and criteria for indicator selection[12]
- Advances the science of attribution in complex systems
- Advances the use of big data, machine learning, and remote sensing for planetary health monitoring
- Coordinates a network of 'hotspots' and 'opportunity sites' integrating 'top-down' and 'bottom-up' monitoring

B: An integrated data system that provides

- Data interoperability guidelines, protocols, and formats
- Data repository/warehouse with curated and standardised metadata
- Open access to data and analytical outputs with linkage between health and environmental data
- User access to data in cloud computing environment for 'on-the-could' data processing and analysis

C: An action-oriented policy, industry, and public engagement programme that

- Identifies and engages target users of PHW into its co-design, co-creation, and co-roll out
- Identifies levers for the big course corrections towards a low carbon, low environmental footprint economy
- Mobilizes stakeholders and catalyses new partnerships through liaison with funding and UN agencies, urban networks, professional organisations, and the private sector
- Uses tailored data communication strategies, e.g., creative narratives, storytelling, scientific publications, policy reports, media communication channels, user-centric data visualisation platform and tailored apps

D: An open governance system that has

- An advisory group providing strategic direction
- Panels of scientific experts providing advice on technical matters and scientific interpretation ensuring rigour, decision-relevance and transparency of sources and methods

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Author contributions

All authors contributed to the conception and design of the work, granted final approval of the version to be published, and are accountable for all aspects of the work. KB prepared the full draft of the manuscript incorporating revisions and comments from all authors.

Declaration of interests

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References

1 Subramanian M. Anthropocene now: influential panel votes to recognize Earth's new epoch. *Nature* 2019; **21**. doi:10.1038/d41586-019-01641-5.

2 Rockström J, Steffen W, Noone K, *et al.* A safe operating space for humanity. *Nature* 2009; **461**: 472–475.

3 Steffen W, Richardson K, Rockström J, *et al.* Planetary boundaries: Guiding changing planet. *Science* 2015; **347**: 1–10.

4 Haines A, Hanson C, Ranganathan J. Planetary Health Watch: integrated monitoring in the Anthropocene epoch. *Lancet Planet Heal* 2018; **2**: e141–e143.

5 Belesova K, Haines A, Ranganathan J, Seddon J, Wilkinson P, Zou M. Designing a Planetary Health Watch: A system to integrate monitoring of health effects of, and responses to, environmental change. London, 2019 doi:10.17037/PUBS.4654610.

6 Belesova K, Frumkin H, Haines A, *et al.* Webinar: Planetary Health Watch. London Sch. Hyg. Trop. Med. 2019. https://www.lshtm.ac.uk/newsevents/events/planetary-health-watch (accessed 17 Oct 2019).

7 Whitmee S, Haines A, Beyrer C, *et al.* Safeguarding human health in the Anthropocene epoch: Report of the Rockefeller Foundation-Lancet Commission on planetary health. *Lancet* 2015; **386**: 1973–2028.

8 Morales LG, Orrell T. Data interoperability: A practitioner's guide to joining up data in the development sector. 2018 https://unstats.un.org/wiki/download/attachments/36143964/Guide to interoperability.pdf?version=1&modificationDate=1540074745180&api=v2 (accessed 17 Oct 2019).

9 Foster A, Cole J, Farlow A, Petrikova I. Planetary Health Ethics: Beyond First Principles. *Challenges* 2019; **10**: 14.

10 Oliver K, Cairney P. The dos and don'ts of influencing policy: a systematic review of advice to academics. *Palgrave Commun* 2019; 5: 1–11.

11 Pongsiri MJ, Bickersteth S, Colón C, DeFries R, Dhaliwal M, Georgeson L *et al.* Planetary health: from concept to decisive action. *Lancet Planet H* 2019; **3**: e402–e404.