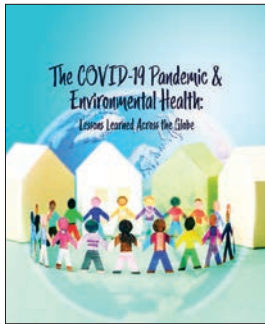


▶ INTERNATIONAL PERSPECTIVES



The COVID-19 Pandemic and Environmental Health: Lessons Learned

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Abstract Environmental health is historically an overlooked and underrated discipline. The COVID-19 pandemic highlighted the value of environmental health and environmental health professionals (EHPs). EHPs have a unique set of skills and knowledge that were, or could have been, significant in controlling the pandemic. This skill set includes a thorough understanding of legislation and regulations; the ability to conduct human health risk assessment and implement effective risk-control measures; enforcement, communication, and education skills; and a significant understanding of their own local communities. The opportunities for applying the skills of EHPs vary across the world depending on several factors, including legislative and regulatory frameworks in each jurisdiction. Here we present our early evaluation of the unique skills and knowledge base of EHPs and lessons that can be learned from EHP engagement in public health protection. We also argue that local knowledge and engagement need to be recognized as valuable tools in emergency preparedness. In our increasingly globalized world, mechanisms to maintain and value local knowledge are needed, which could be achieved by embedding the “value of local” into policy to ensure that the importance and value of local knowledge are captured. We also advocate for raising awareness of the value of public health, and specifically, environmental health.

Introduction

The World Health Organization (WHO, 2019) definition of environmental health is comprehensive:

Environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors. It encompasses the assessment and

control of those environmental factors that can potentially affect health. It is targeted toward preventing disease and creating health-supportive environments.

According to this definition, environmental health is critical to ensure the safety and health of populations. As a profession, however, environmental health has been over-

looked and underrated (Brooks et al., 2019; Whitley et al., 2019).

In countries around the world, the COVID-19 pandemic highlighted that environmental health professionals (EHPs), as an army of workers, can be mobilized quickly and provide significant public health protection (Rodrigues et al., 2021; Ryan et al., 2020). EHPs were able to establish and implement public health measures rapidly and successfully due, in part, to the profession having significant local knowledge and networks, plus a range of key transferable skills. Examples of the application of environmental health and local knowledge are presented in this article. We explore the significance of these examples and we argue that the “value of local” should not be overlooked and should, in fact, be protected and

enhanced through both policy creation and increased funding.

Our early evaluation presents the unique skills and knowledge base of EHPs as well as lessons that can be learned from EHP engagement in public health protection. This article provides an inventory for countries to assess their own utilization of the competent, multi-skilled environmental workforce.

Methods

We followed methods described in an earlier article examining the role of EHPs during the pandemic (Rodrigues et al., 2021). In summary, to collate and assess the skills and activities of EHPs around the world, a community of practice (CoP) made up of environmental health academics and practitioners from the U.S., UK, Portugal, and Australia was formed. Recruitment to the CoP was undertaken using exponential nondiscriminative snowball sampling through our existing contacts (Etikan et al., 2016; Goodman, 1961). To identify this information, members of CoP consulted with other practitioners, professional associations, reports, gray and formal literature, and media articles published in their respective countries. Further details can be found in Rodrigues et al. (2021).

Results and Discussion

There were two dominant themes that arose from the CoP discussions:

1. The local nature of environmental health.
2. The development of new roles with the environmental health profession and the transferability of skills.

Lessons for the future were explored and are presented in this article.

The Local Nature of Environmental Health

The environmental health workforce represents a significant portion of the human capital that comprises the public health workforce. While global workforce numbers are unclear, the National Association of County and City Health Officials (NACCHO, 2019) routinely assesses workforce composition within the U.S. government. The nursing profession is the largest professional component (18%) of the U.S. public health workforce, while environmental health is the second largest (12%). In the authors' experience, this ratio approximates workforce distributions in many countries throughout

the world. In Portugal, EHPs make up the largest portion of the human capital in the public health workforce (Ministério da Saúde, 2017). In England, EHPs make up the third-largest portion of the public health workforce (18%) (Centre for Workforce Intelligence, 2014). Much of the environmental health workforce is deployed locally; in fact, the profession uses the phrase “profoundly local” to describe and characterize its work and influence (Dyjack, 2017; Poprish & Tate, 2018).

Environmental health practice primarily is done at the local level. Regulatory responsibilities of EHPs include, for example, inspecting food premises, housing, tattooing and body piercing premises, public swimming pools and spas, and cooling tower and onsite wastewater systems (Frumkin, 2016; Yassi et al., 2001). This breadth means that EHPs have a comprehensive and intimate knowledge of the people and places within their own communities. It also means they have relationships with other levels of government including health, environmental protection, family services, and emergency services. During the pandemic, EHPs were in a strong position to provide advice based on knowledge of their local communities. Understanding community structure and community resources has been useful in the COVID-19 response and recovery, as the profession brings its community-based orientation to the larger public health discussion.

The importance of “local” can be illustrated by considering the role of contact tracing as a tool to understanding the route of transmission and break the chain of infection for outbreaks (Kretzschmar et al., 2021; MacIntyre, 2020). Lewis (2020) notes that while countries acknowledge this fact, countries, particularly those in the West, have struggled to implement effective systems. In contrast, countries such as Vietnam that have adopted a “boots-on-the-ground” approach have been much more successful in contact tracing.

The ineffectiveness of national track and trace systems is also highlighted by Briggs (2020), who states that in October 2020 the UK's national system was reaching only 54% of contacts within 24 hr. The impact of delays in contact tracing was modeled by Kretzschmar et al. (2020), who showed that even short delays (<24 hr) can have significant effects on disease spread. Local teams are far more successful at being able

to reach contacts than the national systems. Lewis (2020) reports that this local success goes beyond simple databases with more accurate, local contact numbers but encompasses a range of factors including people's willingness to answer calls with a local telephone code; the ability and capacity of local teams to visit people at home (echoing the approaches in Vietnam and elsewhere); and having local people who understand their local populations and speak their language.

While it is easy to overlook this point, it was found in the UK that contact tracers who spoke with a local accent were able to elicit more comprehensive responses from interviewees compared with contact tracers who had nonlocal accents. Trust in local accents has been well described (Dahlbäck et al., 2007; Roessel et al., 2018); however, the need to establish community trust implicit in contact tracers was often overlooked. Malheiro et al. (2020) showed that local measures during the COVID-19 pandemic were “effective at reducing the number of high-risk cases.” Above all, the advantage local track and trace teams have is their emphasis on what they can do to support local people and vice versa, the receptiveness of the local community to local EHPs.

The Development of New Roles and the Transferability of Skills

The unprecedented nature and impact of the COVID-19 pandemic meant that EHPs were required to undertake activities in some countries that they had never or seldom undertaken before, including infection control evaluation and enforcement; contact tracing; and other forms of education, engagement, and enforcement.

In the U.S., a national rapid needs assessment was undertaken, followed by monitoring of that assessment to track changes over time. A series of “just-in-time training” was designed and delivered in a nimble fashion to meet the needs articulated by the workforce (National Environmental Health Association [NEHA], 2020a). Subjects such as farmers markets safe operations, food labeling, and communication were addressed in short video formats. In the UK, the Chartered Institute of Environmental Health (2020) put in place a series of weekly online COVID-19 Conversations and short training sessions run by EHPs. These shared best practices explored solutions to common problems and provided guidance on issues that

were being faced by EHPs responding to the pandemic in all areas of environmental health. In the UK, an Environmental Health Together register of EHPs was formed to collect details of EHPs who were willing to contribute toward measures to tackle the pandemic that were beyond their existing working requirements. This register could be used to match skill sets to specific needs and deploy resources into key areas as the need arose.

In Wales, EHPs were connected with care centers for older adults and worked with nursing staff at these centers to prevent infection from entering facilities and to implement quarantine procedures when suspected cases of COVID-19 occurred. EHPs were deployed to assist and enforce safety protocols when businesses were reopening following lockdowns; they also took part in controlling the migration of urban populations to vacation destinations, specifically recreational vehicle parks, and rural locations where health infrastructure was unable to cope with increased demand for healthcare.

In Portugal, EHPs worked in epidemiological investigations and contact tracing—tasks that in the past were limited to clinical staff. They are also involved in several other activities, depending on the region, such as assessing and monitoring sanitary conditions; supporting the development and implementation of contingency plans and assessing their effectiveness; providing training and support to care workers in facilities for older adults; and supporting the reopening of schools and other facilities. Other tasks included the authorization of events or activities and the selection of facilities used for vaccination sites.

Environmental health as a profession was able to manage these changes because the skill set of EHPs was transferable and applicable across a range of different situations. This ability was particularly important when looking to communicate key public health messages. According to Parvis (2001), communication—and especially public speaking—is something that is vital to the environmental health profession and should be encouraged. In England, for example, the cycle of lockdown and relaxation of restrictions led to confusion around the public health messages the government wanted to send and what people were allowed to do. In the UK, although television frequently featured clinicians, regular opportunities arose on local radio for EHPs to provide timely, accurate

advice and raise the profile of environmental health at the same time. Broadcasters were keen to support their listeners and address uncertainty around the COVID-19 pandemic. The ability of EHPs to communicate effectively and provide expert advice was popular with local communities and media broadcasters alike.

The ability of EHPs to adapt to new roles and the field to produce professionals with a wide range of transferable skills has not happened by chance. To practice as an EHP, the workforce has considerable accreditation and continuing professional development requirements. These requirements, their execution, and their examinations differ across the world; however, all have the same exacting requirements and standards (e.g., www.neha.org/credentials, www.eh.org.au/workforce/course-accreditation-policy, www.cieh.org/professional-development/our-professional-standards).

The environmental health profession also has a strong culture of support within its ranks and strong national professional organizations. In countries from our CoP, these organizations include the National Environmental Health Association (U.S.), the Chartered Institute of Environmental Health (UK), the Royal Environmental Health Institute of Scotland, Environmental Health Australia, Environmental Health Professionals Australia, the Portuguese Society of Environmental Health, and the Portuguese Environmental Health Association (APSAi). These organizations are member supported, active, and engaged.

Almost all of these national bodies are also full members of the International Federation of Environmental Health (2020), which has developed and maintained an excellent online platform for “sharing of information and resources between EH professionals relating to the ongoing coronavirus (COVID-19) pandemic,” with links to authoritative information and a platform for sharing experiences and resources.

Both at a national and international level, environmental health truly fulfills the definition outlined by the Australian Council of Professions (2003):

A profession is a disciplined group of individuals who adhere to ethical standards and who hold themselves out as, and are accepted by the public as, possessing special knowledge and skills in a widely recognised body of learning

derived from research, education and training at a high level and who are prepared to apply this knowledge and exercise these skills in the interest of others.

EHPs have an understanding of a variety of disciplines, including epidemiology, toxicology, microbiology, occupational health and safety, legislation and regulations, and policy development and implementation (Cromar et al., 2005). They also hold a host of other professional skills, including the capacity to communicate with a wide range of audiences (e.g., the community, other health professionals, academics); prioritization skills; analytical skills; the ability work within compliance frameworks; and risk assessment. Their knowledge and skills mean that EHPs can contribute to the full menu of nonclinical public health needs as they arise.

In view of this broad skill set, EHPs are involved in several activities including:

- Monitoring the health status of the population.
- General health protection.
- Fighting against means and agents of disease transmission (e.g., water surveillance).
- Specific health protection and the fight against pollution-related risk factors.
- Hygiene and promotion of urban and rural health (e.g., surveillance of sanitary conditions).
- Epidemiological surveillance and investigation.
- Risk-control systems (e.g., contingency plans, vector control, health promotion and protection).

The October 2020 survey ($N = 765$) of the U.S. environmental health workforce affirms the central role of environmental health and its contributions across the public health enterprise. EHPs in the U.S. reported being called on to engage in a broad menu of activities in which they partnered with law enforcement, epidemiologists, logisticians, public relations personnel, and other personnel in organization outside their tradition work areas (NEHA, 2020b).

Lessons for the Future

Raise Awareness of the Impact of Public Health (and Increase Funding)

While the focus of “health” is traditionally on hospitals, doctors, nurses, and emergency

services, practitioners of public and environmental health have long recognized that clinical care is not the primary determinant of health. Callahan and Jennings (2002) noted that the “health of populations is a function more of good public health measures and socioeconomic conditions than of biomedical advances, a neglected truth by most outside the field.” The COVID-19 pandemic disproportionately affected disadvantaged communities, even in countries with good national healthcare (Burström & Tao, 2020; Mikolai et al., 2020; Patel et al., 2020).

It is not possible to separate environmental health funding from public health funding in most countries, but as noted by Rodrigues et al. (2021), public health funding in most developed countries has decreased significantly over the past decades. In Portugal, for example, legislation decrees 1 EHP per 15,000 people (Diário da República, 2009), a ratio that is far from being achieved. Maani and Galea (2020) showed clearly that underfunding in public health in the U.S. made it “uniquely susceptible to the illness.” In the UK, central government austerity measures have seen the national health service funding prioritized over local authority public health grants for over one decade, leading to a real-terms cut in funding to a point where an additional £1 billion (approximately US\$1.4 billion [USD]) annual public health grant would be required to keep pace with population growth and inflation (Buck, 2020). In the UK, environmental health services can be delivered for an average of £7.82 (approximately \$10 USD) per person served (Chartered Institute of Environmental Health, 2015).

Cost benefit analyses of environmental health work have demonstrated the savings that EHP activity provides for healthcare costs and the societal burden of factors EHPs seek to address. For example, in the UK, improvements to housing have an average 6-month repayment period when compared with savings to society. Improving warmth in vulnerable housing saves £4 (\$5.50 USD) of healthcare treatment costs for every £1 (\$1.35 USD) spent on heating and insulation. Home adaptations carried out by EHPs can generate £7.50 (\$10 USD) of health and social care costs for every £1 (\$1.35 USD) spent (Watson et al., 2019). It has been estimated that in the UK, an additional £1 billion (\$1.4 billion USD) of public health funding is required to keep pace with population growth and inflation (Buck,

2020). We must advocate for better public health policies and a return to substantial funding of public and environmental health.

Quantifying the economic value—specifically, the return on investment—of environmental health is a valuable exercise and its replication across different areas of the profession and in different countries would help in advocating for a profession whose success is often defined by the absence of something rather than its presence. A safe, healthy environment typically is taken for granted by the general public; however, there does exist an army of EHPs who constantly work to ensure the health and safety of the public (Whiley et al., 2019).

Raise Awareness of the Value and Impact of Environmental Health

The profile of environmental health needs to be raised in the general community. Studies have consistently shown that people do not know what environmental health is or what EHPs do (Dhesi, 2019; Whiley et al., 2019). EHPs currently are in what could be described as a “teachable moment” (Ruby-Cisneros, 2020) and they need to rise to the challenge of communicating who they are, what they do, and what they can offer.

This need extends to university recruitment of more environmental health students to address the predicted workforce shortage in many countries (Hilliard & Boulton, 2012; Selvey et al., 2014).

Create National and International Registers of Environmental Health Professionals

As noted previously, in the UK, the Chartered Institute of Environmental Health has developed a register of EHPs to “enable local authorities to access the skills and experience they need in the fight against COVID-19.” The International Federation of Environmental Health has established an online platform to share links, experiences, and resources. These initiatives are to be commended and could be used as a framework to create more national (and international) registers of EHPs that include specialized skills, mentoring, volunteering, and media relations opportunities.

Celebrate the “Value of Local”

The need for local knowledge and engagement is nothing new when dealing with outbreaks. Describing the work of John Snow in his groundbreaking investigation into the

cholera outbreak in 1854, Johnson (2008) emphasized the fact that Snow’s local connection was not only vital in obtaining information but also in giving meaning to his famous map: it transcended being simply marks on a page and became a reflection of a community’s struggle and suffering.

Local knowledge and engagement must be recognized as a valuable tool in emergency preparedness. In our increasingly globalized world, mechanisms to maintain and value local knowledge are needed, which might be achieved by embedding the “value of local” in government policy to ensure that the importance and value of this local knowledge is captured. The COVID-19 pandemic reinforces why we need a strong environmental health workforce at the local government level. Their valuable work should not be minimized and should not be performed by outside consultants who do not hold strong links with the local community, which have been shown to be essential. We need local and national action to support and develop the environmental health profession via government policies, professional organization policies, and memoranda of understanding between universities.

Conclusion

EHPs possess a range of skills that were directly transferable that could be utilized to protect public health during the COVID-19 pandemic. Local knowledge and understanding of their communities are significant attributes of EHPs. To protect public health in the future, it is imperative that public health policies recognize the value of EHPs and the “value of local,” and that funding is directed to ensure a strong environmental health workforce in the future. 🐼

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- Australian Council of Professions. (2003). *What is a profession?* <https://www.professions.org.au/what-is-a-professional/>
- Briggs, A. (2020). What can be done to improve NHS Test and Trace? The role of local contact tracing. *The BMJ Opinion*. <https://blogs.bmj.com/bmj/2020/10/28/adam-briggs-what-can-be-done-to-improve-nhs-test-and-trace-the-role-of-local-contact-tracing/>
- Brooks, B.W., Gerding, J.A., Landeen, E., Bradley, E., Callahan, T., Cushing, S., Hailu, F., Hall, N., Hatch, T., Jurries, S., Kalis, M.A., Kelly, K.R., Laco, J.P., Lemin, N., McInnes, C., Olsen, G., Stratman, R., White, C., Wille, S., & Sarisky, J. (2019). Environmental health practice challenges and research needs for U.S. health departments. *Environmental Health Perspectives*, 127(12), 1–11. <https://ehp.niehs.nih.gov/doi/10.1289/EHP5161>
- Buck, D. (2020). *The English local government public health reforms: An independent assessment*. https://www.kingsfund.org.uk/sites/default/files/2020-01/The_English_local_government_public_health_reforms_assessment_January_2020.pdf
- Burström, B., & Tao, W. (2020). Social determinants of health and inequalities in COVID-19. *European Journal of Public Health*, 30(4), 617–618. <https://doi.org/10.1093/eurpub/ckaa095>
- Callahan, D., & Jennings, B. (2002). Ethics and public health: Forging a strong relationship. *American Journal of Public Health*, 92(2), 169–176. <https://doi.org/10.2105/AJPH.92.2.169>
- Centre for Workforce Intelligence. (2014). *Mapping the core public health workforce: Final report*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/507518/CfWI_Mapping_the_core_public_health_workforce.pdf
- Chartered Institute of Environmental Health. (2015). *Environmental health workforce survey 2014/15*. https://www.cieh.org/media/1262/environmental-health-workforce-survey-2014_15.pdf
- Chartered Institute of Environmental Health. (2020). *Webinars: View recordings of our Covid-Conversations webinars*. <https://www.cieh.org/policy/coronavirus-covid-19/webinars/>
- Cromar, N., Cameron, S., & Fallowfield, H. (2005). *Environmental health in Australia and New Zealand* (1st ed.). Oxford University Press.
- Dahlbäck, N., Wang, Q.Y., Nass, C., & Alwin, J. (2007, April 28–May 3). *Similarity is more important than expertise: Accent effects in speech interfaces* [Conference presentation]. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, San Jose, CA. <https://doi.org/10.1145/1240624.1240859>
- Dhesi, S.K. (2019). *Tackling health inequalities: Reinventing the role of environmental health* (1st ed.). Routledge.
- Diário da República National Printing House, Ministry of Health. (2009). Decree-law no. 81/2009 [Decree in Portuguese]. *Diário da República*, 65, Series I 2009-04-02. <https://dre.pt/dre/detalhe/lei/81-2009-488301>
- Dyjack, D. (2017). Professional (dis) association. *Journal of Environmental Health*, 80(1), 53–54. <https://www.neha.org/sites/default/files/jeh/JEH7-8.17-DirecTalk-Professional-dis-Association.pdf>
- Etikan, I., Alkassim, R., & Abubakar, S. (2016). Comparison of snowball sampling and sequential sampling technique. *Biometrics and Biostatistics International Journal*, 3(1), 55. <https://dx.doi.org/10.15406/bbij.2016.03.00055>
- Frumkin, H. (Ed.) (2016). *Environmental health: From global to local* (3rd ed.). Jossey-Bass.
- Goodman, L.A. (1961). Snowball sampling. *Annals of Mathematical Statistics*, 32(1), 148–170. <https://doi.org/10.1214/aoms/1177705148>
- Hilliard, T.M., & Boulton, M.L. (2012). Public health workforce research in review: A 25-year retrospective. *American Journal of Preventive Medicine*, 42(5, Suppl. 1), S17–S28. <https://doi.org/10.1016/j.amepre.2012.01.031>
- International Federation of Environmental Health. (2020). *Coronavirus COVID-19 pandemic*. <https://www.ifeh.org/covid19/index.html>
- Johnson, S. (2008). *The Ghost map: A street, an epidemic and the hidden power of urban networks*. Penguin.
- Kretzschmar, M.E., Rozhnova, G., Bootsma, M.C., van Boven, M., van de Wijgert, J.H., & Bonten, M.J. (2020). Impact of delays on effectiveness of contact tracing strategies for COVID-19: A modelling study. *The Lancet Public Health*, 5(8), e452–e459. [https://doi.org/10.1016/S2468-2667\(20\)30157-2](https://doi.org/10.1016/S2468-2667(20)30157-2)
- Kretzschmar, M., Rozhnova, G., & van Boven, M. (2021). Isolation and contact tracing can tip the scale to containment of COVID-19 in populations with social distancing. *Frontiers in Physics*, 8, Article 622485. <https://dx.doi.org/10.3389/fphy.2020.622485>
- Lewis, D. (2020). Where COVID contact-tracing went wrong. *Nature*, 588, 384–387. <https://media.nature.com/original/magazine-assets/d41586-020-03518-4/d41586-020-03518-4.pdf>
- Maani, N., & Galea, S. (2020). COVID-19 and underinvestment in the public health infrastructure of the United States. *The Milbank Quarterly*, 98(2), 250–259. <https://doi.org/10.1111/1468-0009.12463>
- MacIntyre, C.R. (2020). Case isolation, contact tracing, and physical distancing are pillars of COVID-19 pandemic control, not optional choices. *The Lancet Infectious Diseases*, 20(10), 1105–1106. [https://doi.org/10.1016/S1473-3099\(20\)30512-0](https://doi.org/10.1016/S1473-3099(20)30512-0)
- Malheiro, R., Figueiredo, A.L., Magalhães, J.P., Teixeira, P., Moita, I., Moutinho, M.C., Mansilha, R.B., Gonçalves, L.M., & Ferreira, E. (2020). Effectiveness of contact tracing and quarantine on reducing COVID-19 transmission: A retrospective cohort study. *Public Health*, 189, 54–59. <https://doi.org/10.1016/j.puhe.2020.09.012>
- Mikolai, J., Keenan, K., & Kulu, H. (2020). Intersecting household-level health and socio-economic vulnerabilities and the COVID-19 crisis: An analysis from the UK. *SSM-Population Health*, 12, Article 100628. <https://doi.org/10.1016/j.ssmph.2020.100628>
- Ministério da Saúde. (2017). *Ponto de situação, decorridos 3 meses sobre a catástrofe dos incêndios no Pinhal Interior, sobre a evolução da resposta dos Serviços de Saúde após a fase aguda, de 1 de julho a 15 de setembro de 2017 [Relatório no 16 CD ARS Centro]*. Portugal: ARS Centro, Ministério da Saúde [Text in Portuguese]. <https://>

References

- www.sns.gov.pt/wp-content/uploads/2018/06/A5_Relat_ARSC_final.pdf
- National Association of County and City Health Officials. (2019). *Workforce composition*. <https://www.naccho.org/profile-report-dashboard/workforce-composition>
- National Environmental Health Association. (2020a). *Just in time from NEHA*. <https://www.neha.org/just-time>
- National Environmental Health Association. (2020b). *COVID-19 environmental health workforce needs assessment II report*. <https://emergency-neha.org/covid19/wp-content/uploads/2020/11/COVID-19-EH-Workforce-Needs-Assessment-II-Report.pdf>
- Parvis, L.F. (2001). The importance of communication and public-speaking skills. *Journal of Environmental Health*, 63(9), 44.
- Patel, J.A., Nielsen, F., Badiani, A.A., Assi, S., Unadkat, V.A., Patel, B., Ravindrane, R., & Wardle, H. (2020). Poverty, inequality and COVID-19: The forgotten vulnerable. *Public Health*, 183, 110–111.
- Poprish, S., & Tate, C. (2018). Using data to improve environmental health—Part 2: Available informatics resources. *Journal of Environmental Health*, 80(8), 42–43. <https://www.neha.org/sites/default/files/jeh/JEH4.18-Using-Data-to-Improve-Environmental-Health-Part-2.pdf>
- Rodrigues, M.A., Silva, M.V., Errett, N.A., Davis, G., Lynch, Z., Dhese, S., Hannelly, T., Mitchell, G., Dyjack, D., & Ross, K.E. (2021). How can environmental health practitioners contribute to ensure population safety and health during the COVID-19 pandemic? *Safety Science*, 136, Article 105136. <https://doi.org/10.1016/j.ssci.2020.105136>
- Roessel, J., Schoel, C., & Stahlberg, D. (2018). What's in an accent? General spontaneous biases against nonnative accents: An investigation with conceptual and auditory IATs. *European Journal of Social Psychology*, 48(4), 535–550. <https://doi.org/10.1002/ejsp.2339>
- Ruby-Cisneros, K. (2020). NEHA's COVID-19 response and resources. *Journal of Environmental Health*, 82(9), 52. <https://www.neha.org/sites/default/files/jeh/JEH5.20-NEHA-News.pdf>
- Ryan, B.J., Swinton, R., Harris, C., & James, J.J. (2020). Environmental health workforce—Essential for interdisciplinary solutions to the COVID-19 pandemic. *Disaster Medicine and Public Health Preparedness*, 15(2) e1–e3. <https://doi.org/10.1017/dmp.2020.242>
- Selvey, L.A., Rutherford, S., Dodds, J., Dwyer, S., & Robinson, S.M. (2014). The impact of climate-related extreme events on public health workforce and infrastructure—How can we be better prepared? *Australian and New Zealand Journal of Public Health*, 38(3), 208–210. <https://doi.org/10.1111/1753-6405.12219>
- Watson, I., MacKenzie, F., Woodfine, L., & Azam, S. (2019). *Making a difference. Housing and health: A case for investment*. Public Health Wales. <https://phw.nhs.wales/files/housing-and-health-reports/a-case-for-investment-report/>
- Whiley, H., Willis, E., Smith, J., & Ross, K. (2019). Environmental health in Australia: Overlooked and underrated. *Journal of Public Health*, 41(3), 470–475. <https://doi.org/10.1093/pubmed/fdy156>
- World Health Organization. (2019, April 18). *Health, environment and climate change: Draft WHO global strategy on health, environment and climate change: The transformation needed to improve lives and well-being sustainably through healthy environments (A72/15)*. <https://www.who.int/docs/default-source/climate-change/who-global-strategy-on-health-environment-and-climate-change-a72-15.pdf>
- Yassi, A., Kjellström, T., de Kok, T., & Guidotti, T.L. (2001). *Basic environmental health*. Oxford University Press.



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