

Review Article

A Beacon for Dark Times: Rethinking Scientific Evidence for Environmental and Public Health Action in the Coronavirus Diseases 2019 Era.

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Abstract

As the COVID-19 pandemic emergence progresses and overwhelming healthcare systems, countries are reviewing their policies to protect those at increased risk of severe disease. These can be policies aimed at suppressing transmission in the wider population, vaccination (if vaccine becomes available) as the world anxiously awaits an effective COVID-19 vaccine that can be readily distributed. Until then, the priority is to reenergize countries to act rather than react. Even as the uncertainties of the COVID-19 crisis multiply, the aim must be to rebuild for the long-term protection i.e., explicit measures to protect people at increased risk by reducing interactions amongst people in danger, etc. The spread of the SARS-CoV-2 pandemic has forced us to realize the fact that progress towards Sustainable Development Goals is threatened and fragile, as the numbers of people heading into poverty are now at increased risk of setbacks. It also stresses the need to strengthen the relationship between scientific evidence to protect the environment and public health. This requires an understanding of the importance of the interventions to address structural inequity, global health care and coverage, and comprehensive social protection schemes as part of the response.

It is time to recognize that not all of us are at equal risk of severe outcomes from COVID-19 and to work with stakeholders to formulate an effective response. This study presents evidence from studies informing policymakers about the number of individuals that might be at increased risk or high risk of severe COVID-19 in different nations. Therefore, there is a need to develop scientific evidence for rapid assessments of environmental and public health action in the era of coronavirus diseases, which should focus on different policies guidelines to prevent those at increased risk. Estimating the number of people at high risk of severe COVID-19 is important to help countries to design more effective interventions to protect vulnerable individuals and reduce strain on health systems. This information can provide and inform a comprehensive assessment of the health, social, and economic consequences of shielding different groups, suggesting the need to develop a longer-term Covid-19 management strategy.

Keywords: *Scientific evidence, Effective response, SARS-CoV-2 pandemic, Sustainable Development Goals, Universal health coverage, social protection.*

Introduction

Since the 2019 coronavirus disease (COVID-19) has triggered seismic economic and societal changes which grapple with an uncertain future, that has consumed and changed our lives, the COVID-19 crisis also revealed that the country is deteriorating in terms of environmental/public health readiness. As COVID-19 has become an imminent emerging, rapidly evolving situation of environmental/public health concern with 'threat multiplier to health in the 21st century. As confusion, disorientation, agitation and even psychosis have been associated with symptoms of COVID-19. The body of research is linking infection as a result of virus and neurological symptoms. The number of publicly reported deaths rate of the population due to the coronavirus disease 2019 (COVID-19) may underestimate the pandemic's death toll. These estimates are based on provisional data that are often incomplete and may rule out unreported deaths from COVID-19.

Besides, the restrictions imposed by the pandemic (for example, stay-at-home orders, school closures, quarantine measures, personal hygiene, social distancing measures used to contain the spread of the virus) may claim lives indirectly through delayed care for acute emergencies, exacerbations of chronic diseases, and psychological distress (for instance, drug overdoses). As a result, the burden of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic continues to rise, both due to morbidity and mortality from the pandemic itself and the impact of mitigation strategies (Nicola et al., 2020). Tailoring policies based on emerging evidence on the conditions associated with the severity of COVID-19 is essential to informing the actions of both decision-makers and individuals. This means moving from generalised population-based mitigation strategies to focusing on people exposed to the risk of severe outcomes from COVID-19.

Too often, Jenicek (1997) defined evidence-based public health (EBPH) as the "conscientious, explicit, and judicious use of current best evidence in making decisions about the care of communities and populations in the domain of health protection, disease prevention, health maintenance and improvement (health promotion)." Similarly, a concise definition emerged from Kohatsu (2004): "Evidence-based public health is the process of integrating science-based interventions with community preferences to improve the health of populations" (p. 419). While, public health has successfully addressed many challenges, yet nearly every success story is a two-edged sword.

Programs and policies have been implemented and, in some cases, positive results have been reported that show improvements in population health. Yet some populations suffer health disparities and social inequalities. This leads to questions such as, are there ways to take the lessons learned from successful interventions and apply them to other issues and settings? Are we applying the evidence that is well established in scientific studies? How do we foster greater political will that supports evidence-based decision making? How do we develop incentives so practitioners will make better use of evidence?

Just as evidence-based public health has become a topic of conversation both practitioners and policymakers, it is so fundamental to our notion of justice, it is equally important for public health. Therefore, it should inform all of our decisions on how the intervention will be implemented, and in what populations, when and how to assess both the positive and sometimes negative impact of those interventions. Our commitment to justice also bears the responsibility of finding effective ways to reduce health disparities between groups existing in virtually all geopolitical units. For environmental and public health professionals, evidence is a type of data that includes epidemiologic (quantitative) data, program results or policy evaluations, and the qualitative data to be used in establishing judgments or decisions (Chamber and Kerner, 2007) (see **Figure 1** below).

Public health evidence is often the result of a complex concepts of observation, theory, and experiment (McQueen and Anderson, 2001; Rimer et al., 2001). However, the value of evidence remains in the eye of the beholder (e.g., the value of evidence may differ from a stakeholder type) (Kerner, 2008). Medical evidence includes not only research, but also patient characteristics, patient's readiness to undergo a therapy, and society's values (Mulrow and Lohr, 2001). Decision-makers seek distributional consequences (i.e., who pays, how much and who benefits) (Sturm, 2002), and in practice, settings anecdotes sometimes provide detailed empirical data (Brownson et al., 2006). The evidence is typically imperfect and, as Muir Gray note (Muir, 1997), "The absence of excellent evidence does not make evidence-based decision making impossible; what is needed is the best available evidence, not the best evidence possible."

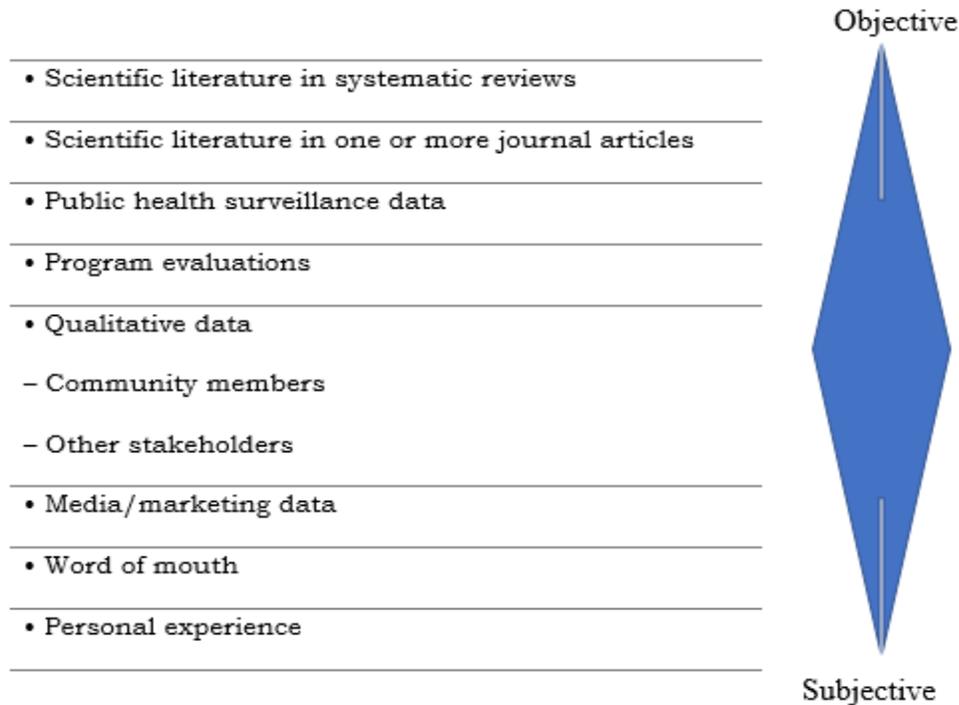


Figure 1. Different forms of evidence.

Source: Adapted from Chambers and Kerner (2007)

In the environment and public health, there are four prime user groups for evidence namely: environmental and public health practitioners and their partners, who want to know the scope and quality of evidence for certain strategies (for example, programs, policies). In practice, however, environmental and public health practitioners frequently have a relatively narrow selection process options. Funds from federal, state, or local sources are usually earmarked for a specific purpose [e.g., surveillance and treatment of sexually transmitted diseases (Raimi and Ochayi, 2017), an inspection of retail food establishments (Sawyer et al., 2018; Raimi et al., 2019)]. However, there is an opportunity for environmental and public health professionals, including the obligation, to carefully examine the evidence to find alternative ways to achieve required health goals (Raimi et al., 2019). The next-generation user group consists of decision-makers at local, regional, state, national, and international levels (deciding at the macro level how to allocate public resources for which they have been elected stewards (Olalekan et al., 2020; Raimi et al., 2020; Adedoyin et al., 2020; Olalekan et al., 2020)).

This group has additional responsibility for formulating policies for complex and controversial public issues), Stakeholders (This group consists of many non-government organizations whose missions focus on or incorporate health improvement, directly or through improving the social and physical milieus that are key population health determinants for example whether the community water supply should be fluoridated, dumpsite should be sited in a community cemetery or burial ground) and researchers on population health issues (They develop and use evidence to explore research hypotheses. Some are primarily interested in the methods used to determine the quality and implications of research on population-based interventions).

Both enhance and use the evidence to answer research questions. However, the additional increased benefits of evidence-based environmental/public health (EBE/PH) has numerous direct and indirect benefits, comprising access to more and higher-quality information on what has been shown to improve the environmental/public's health, a higher likelihood of successful programs and policies being implemented, greater workforce productivity, and more efficient use of public and private resources (Brownson et al., 2003; Kahn et al., 2002; Kohatsu and Melton, 2000). Therefore, decisions about when to intervene and what program or policy to implement is not simple and straightforward in most areas of environmental, public health and clinical practice.

These decisions are generally based on three fundamental questions:

1. Should environmental/public health action be taken to address a particular environmental/ public health issue (Type 1, etiologic evidence or evidence of behavioral knowledge)?
2. What measures or actions must be taken (Type 2, intervention evidence, or proof of intervention)?
3. How can a particular program or policy most effectively be implemented at the local setting (Type 3, contextual evidence)?

Table 1 presents a range of scientific evidence for environmental/public health practice (Brownson et al., 1999; Brownson et al., 2003; Rychetnik et al., 2004).

- Type 1 evidence assesses the causes of the diseases and its magnitude, severity, and preventability of risk factors and diseases.

- Type 2 evidence describes the relative effects of specific interventions that may or may not improve health.
- Type 3 evidence comes from the context of the intervention and specifies the five overlapping domains (Table 2).

Table 1. Comparison of the Types of Scientific Evidence

S/N	Characteristic	Type 1	Type 2	Type 3
1	Typical data/relationship	Size and strength of preventable risk - disease relationship (measures of burden, etiologic research)	Relative effectiveness of public health intervention	Information on the adaptation and translation of an effective intervention
2.	Common setting	Clinic or controlled community setting	Socially intact groups or community-wide	Socially intact groups or community-wide
3.	Example	Smoking causes lung cancer.	Price increases with a targeted media campaign reduce smoking rates.	Understanding the political challenges of price increases or targeting media messages to particular audience segments
4.	Quantity	More	Less	Less
5.	Action	Something should be done.	This particular intervention should be implemented.	How an intervention should be implemented

Source: Adapted from Pawson *et al.*, (2005); Brownson *et al.*, (2011).

Table 2. Contextual Variables for Intervention Design, Implementation, and Adaptation

Category	Examples
Individual	Education level Basic human needs Personal health history
Interpersonal	Family health history Support from peers Social capital
Organizational	Staff composition Staff expertise Physical infrastructure Organizational culture
Sociocultural	Social norms Values Cultural traditions History
Political and economic	Political will Political ideology Lobbying and special interests Costs and benefits

Basic human needs include food, shelter, warmth, and safety.

Source: Adapted from Pawson *et al.*, (2005); Brownson *et al.*, (2011)

First, there are characteristics of the population for an intervention such for instance level of education and health history (Maslov, 1943). Besides, interpersonal variables provide an important context. For instance, a person with a family history of cancer might be more likely to undergo cancer screening. Third, organizational variables should be considered. For instance, whether an agency is successful in implementing an evidence-based program may be influenced by its capacity (e.g., professional workforce, agency leadership) (Brownson *et al.*, 2003;

Dreisinger *et al.*, 2008). Fourth, it is argued that social norms and cultural norms cause and shape a lot of health behaviors. Finally, more political and economic forces affect context. For instance, the occurrence of a high rate for a certain disease like the recent COVID-19 pandemic has claimed far too many lives worldwide. Fortunately, as environmental health officers and doctors continue to gain more experience at monitoring, contact tracing, communicating and treating COVID-19 patients, and many people hospitalized eventually recover, this may influence a state's political will to address the issue in a meaningful, logical and systematic way (Gift and Olalekan, 2020; Samson *et al.*, 2020; Gift *et al.*, 2020).

Particularly because of the high-risk and understudied populations, there is a great need for evidence on contextual variables and ways of adapting programs and policies across settings and population subgroups. Contextual issues are being addressed in detail in the new “realist review,” which is a systematic review process that seeks to examine not only whether an intervention works but also how interventions work in real-world settings (Pawson *et al.*, 2005). Several concepts are fundamental for achieving a more evidence-based approach to environmental and public health practice. First, scientific knowledge is required on the programs and policies that are most likely to be effective in promoting health (i.e., undertake evaluation research to generate sound evidence) (Brownson *et al.*, 2003; Kahn *et al.*, 2002; Black *et al.*, 2005; Curry *et al.*, 2003).

Second, to translate science into scientifically sound practice, there is a need to marry information on evidence-based interventions from the peer-reviewed literature with the realities of a specific real-world milieu (Brownson *et al.*, 2003; Kohatsu *et al.*, 2004; Green, 2006). To achieve this, there is a need to better define decision-making processes that must be evidence-based. Finally, wide-scale dissemination of interventions of proven effectiveness must occur more consistently at state and local levels (Kerner *et al.*, 2005).

Therefore, the main characteristics of evidence-based features of environmental/public health decision making comprise:

1. Decision-making based on the best available peer-reviewed evidence (both quantitative and qualitative research): A starting point is the scientific literature and guidelines developed by expert panels advice. Additionally, preliminary findings from researchers and practitioners are often presented at regional, national, and international professional conferences.

2. Systematically using data and information systems: Data are being developed more for local-level issues and a few early efforts are underway to improve the environmental/public health policy surveillance systems. For instance, a group of federal and voluntary agencies has recently developed policy surveillance systems for tobacco, alcohol, and, more recently, school-based nutrition and physical education (Chriqui *et al.*, 2006; Abdulraheem *et al.*, 2018; Raimi *et al.*, 2019; Funmilayo *et al.*, 2019).

3. Developing and applying an intensive program planning framework (which regularly have a foundation in behavioral science theory): For instance, ecological, or systems, models are increasingly used in which “appropriate cultural changes in the social environment will produce individual’s changes, and the individuals support in a population is considered critical for implementing environmental changes” (McLenroy *et al.*, 1988). These models emphasize the need to solve important problems at multiple levels and stress the interaction and integration of factors within and between all levels of individual, interpersonal, community, organizational, and governmental. The aim is to create a healthy community environment that offers health-promoting information and social support to help people live healthier lifestyles (Stokols, 1996). Effective interventions are most often grounded in the health-behavior theory (Rimer *et al.*, 2001; Glanz and Bishop, 2010).

4. Community engagement in assessment and policymaking: Community-based approaches include community members in research and intervention projects and demonstrates progress made in improving population health and addressing health disparities (Cargo and Mercer, 2008; Israel *et al.*, 1998). Practitioners, academicians, and community members collaboratively define issues of concern, develop strategies for intervention, and evaluate the outcomes. This approach relies on “stakeholder” input (Green and Mercer, 2001), builds on existing resources, facilitates collaboration between all parties, and integrates knowledge and action that seek to lead to a fair distribution of the benefits of intervention for all partners (Israel *et al.*, 1998; Leung *et al.*, 2004).

5. Conducting sound evaluation: In most cases in public health, programs and policies are conducted without fully focusing on a systematic evaluation. Additionally, even when programs are ineffective, they are sometimes continued because of historical or political considerations. Evaluation criteria should be based on early program development and should include both formative and outcome evaluation. For instance, an injury control program was appropriately discontinued after its effectiveness was evaluated. This program evaluation also demonstrates the use of both critical qualitative and quantitative data in framing an evaluation model (Land *et al.*, 1997).

6. Disseminating what is learned to key stakeholders and policymakers: If a program or policy is implemented, or if final results are known, other public health such as community medicine, social medicine, community health and preventive medicine (environmental health) can draw on their research findings to enhance their use of evidence, while making a decision. It can be disseminated to health professionals through the scientific literature, to the general public through the media, to decision-makers through personal meetings, and to public health professionals through training courses. Effective interventions are required in a variety of settings, comprising schools, worksites, health care settings, and broader community environments, etc.

Accomplishing these activities in EBE/PH is likely to require a synthesis of scientific skills, enhanced communication, common sense, and political acumen. However, many factors influence decision making in environmental/public health (Savitz, 2003; Bero and Jadad, 1998; Anderson *et al.*, 2005) (see table 3 below). Some of these factors are under the control of the environmental/public health practitioners, whereas others are nearly impossible to modify.

Table 3. Factors Influencing Decision Making among Public Health Administrators, Policy Makers, and the General Public.

Category	Influential Factor
Information	<ul style="list-style-type: none"> •Sound scientific basis, including knowledge of causality •Source (e.g., professional organization, government, mass media, friends)
Clarity of contents	<ul style="list-style-type: none"> •Formatting and framing •Perceived validity •Perceived relevance •Cost of intervention •Strength of the message (i.e., vividness)

Perceived values, preferences, beliefs	<ul style="list-style-type: none"> •Role of the decision maker •Economic background •Previous education •Personal experience or involvement •Political affiliation •Willingness to adopt innovations •Willingness to accept uncertainty •Willingness to accept risk •Ethical aspect of the decision
Context	<ul style="list-style-type: none"> •Culture •Politics •Timing •Media attention •Financial or political constraints

Source: Adapted from Bero & Jadad, (1998) and Anderson *et al.* (2005); Brownson *et al.*, (2011).

Also, there are at least four ways in which environmental/public health program or policy may not reach stated goals for success:

1. Choosing an intervention approach whose effectiveness is not established in the scientific literature.
2. Selecting a potentially effective program or policy yet achieving only weak, incomplete implementation or “reach,” thereby failing to attain objectives (some call this Type III error)
3. Conducting an inadequate or incorrect evaluation that results in a lack of generalizable knowledge on the effectiveness of a program or policy
4. Paying inadequate attention to adapting an intervention to the population and context of interest.

However, part of the reason that environmental/public health-policy officials have struggled in the face of the COVID-19, is that it’s very difficult to identify appropriate interventions that might inspire people to change their behaviors given reasons. For instance, do people who won’t wear masks think the virus isn’t risky, since they don’t think masks work, or just as others aren’t wearing them? To make matters worse, surveys or studies often represent only a portion of the

population leaving those most at risk underrepresented. “Data can be instructive, but it does not speak for itself, as data access remains one of the primary hurdles to advancing science”. “Behind every data, a point is a person. And with something like the coronavirus, where people are so deeply affected, there is a need to think about the ethics of intervening in people’s lives.”

Overall, to enhance evidence-based practice, all four possibilities must attempt to provide practical guidance on how to select, carry out, and evaluate evidence-based programs and policies in public health settings. It also begins to address the need for a highly trained environmental/public health workforce and expand available technology, Hence, the successful implementation of EBE/PH in environmental/public health practice is both a science and an art. Science is based on epidemiologic, behavioral, and policy research that reflects the size and scope of environmental/public health problems and which interventions are likely to be effective in solving the problem. The art of decision-making experience usually involves knowing what information is significant to a specific stakeholder at the right time.

Remarkable decisions in environmental/public health must balance science and art because rational, evidence-based decision making often involves choosing an option from among a set of rational choices. By using the outlined concepts in EBE/PH above, decision making is ultimately improving the environmental/public health practice; this is especially important in a time when environmental/public health practitioners should be incentivized, not disincentivized, to provide remote and long-term care and if successfully implemented and continued in the post COVID era, these efforts could enjoy the welcome consequence of cost savings and efficiency (Olalekan, 2020; Olalekan *et al.*, 2020). These efforts can help in tailoring efficacious interventions for improving the COVID-19 pandemic response.

Furthermore, there is a need to fund evidence-based projects that will focus on identifying a health or disease condition for which there is a need for intervention and community support and engagement to address the problem, articulate a process for ensuring cultural appropriateness and recognizing community strengths and resiliencies, advancing knowledge toward addressing the health or disease condition through etiologic research, prevention research, treatment or recovery research, or dissemination and implementation research and accounting for sustainability in test communities and dissemination and scale up to other communities as indicated. Hence, real-world evidence could significantly improve public health (social medicine, preventive medicine, community health and community medicine) decisions across the health system and ultimately improve environmental health. Expanding its use, however, will require multi-stakeholder action on several priorities, as well as country-specific

campaigns. Therefore, the broad environmental/public health community is best equipped to make progress towards addressing individual behaviors, social conditions, or environmental conditions related to a disease or disorder. Thereby, making progress on these goals will help establish the kind of culture where evidence-based innovation will flourish, while ensuring that necessary, complementary capabilities exist to support traditional research and development (R&D) activities.

Competing Interests

We affirm that we have no conflict of interest that may be alleged as prejudicing the impartiality of the study reported. This researcher did not receive special assistance from the government, not-for-profit sectors, or commercial institutions.

Consent

All the authors announced that they had received written notice from the participants.

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