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Chapter

‘Silent Pandemic’: Evidence-Based Environmental and Public Health Practices to Respond to the COVID-19 Crisis

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Abstract

Given the unprecedented novel nature and scale of coronavirus and the global nature of this public health crisis, which upended many public/environmental research norms almost overnight. However, with further waves of the virus expected and more pandemics anticipated. The COVID-19 pandemic of 2020 opened our eyes to the ever-changing conditions and uncertainty that exists in our world today, particularly with regards to environmental and public health practices disruption. This paper explores environmental and public health evidence-based practices toward responding to Covid-19. A literature review tried to do a deep dive through the use of various search engines such as Mendeley, Research Gate, CAB Abstract, Google Scholar, Summon, PubMed, Scopus, Hinari, Dimension, OARE Abstract, SSRN, Academia search strategy toward retrieving research publications, “gray literature” as well as reports from expert working groups. To achieve enhanced population health, it is recommended to adopt widespread evidence-based strategies, particularly in this uncertain time. As only together can evidence-informed decision-making (EIDM) can become a reality which include effective policies and practices, transparency and accountability of decisions, and equity outcomes; these are all more relevant in resource-constrained contexts, such as Nigeria. Effective and ethical EIDM though requires the production as well as use of high-quality evidence that are timely, appropriate and structured. One way to do so is through co-production. Co-production (or co-creation or co-design) of environmental/public health evidence considered as a key tool for addressing complex global crises such as the high risk of severe COVID-19 in different nations. A significant evidence-based component of environmental/public health (EBEPH) consist of decisions making based on best accessible, evidence that is peer-reviewed; using data as well as systematic information systems; community engagement in policy making; conducting sound evaluation; do a thorough program-planning frameworks; as well as disseminating what is being learned. As researchers, scientists, statisticians, journal editors, practitioners, as well as decision makers strive to improve population health, having a natural tendency toward scrutinizing the scientific literature aimed at novel research findings serving as the foundation for intervention as well as prevention programs. The main inspiration behind conducting research ought to be toward stimulating and collaborating appropriately on

public/environmental health action. Hence, there is need for a “Plan B” of effective behavioral, environmental, social as well as systems interventions (BESSI) toward reducing transmission.

Keywords: Interprofessionalism, Living’ reviews, Collective learning, Evidence-informed decision, COVID-19 pandemic, Environmental policy process, Team-based care, Credibility/trust, Timeliness, Systems thinking, Nigeria

1. Introduction

For each complicated challenges, there are simple, neat, as well as discreet solutions. It is therefore regularly obligatory toward making a decision on sufficient evidence for action, but then deficient toward satisfying the intellect. In this COVID-19 pandemic era where the public and the mass media attention are about serious health issues, it is important to explain why taking action should not be based on the basis of research study conducted individually, even though it remained prudently designed, effectively conducted, as well as appropriately interpreted and evaluated, which need to be highlighted. COVID-19 pandemic has been identified as a generation-defining, impacting economic shocks, families, communities and other unforeseen events in any country in the world, and has led to long-term economic financial conditions that have beset as well as create an “extinction-level event” which has cast an eerie shadow around the world long after the COVID-19 pandemic is behind us. Just over eighteen months ago, the flu-like news of a deadly virus affecting central China region started making headlines around the world. It was the start of what become a worldwide news and press conference; one that will constitute an exceptional problem for the environmental and public health practices and pose a series of lethal threats to environmental/public health. However, it is becoming increasingly “clear that the peril is not only in the form of a deadly virus”. While the COVID-19 pandemic is likewise being used through maligning forces as an opportunity toward disrupting unforeseen as well as unprecedented circumstances, to sabotage and even to prevent the free flow of trusted, independent information toward the impact of the COVID-19 pandemic, which present an acute case of reliability. The highly contagious COVID-19 pandemic has been weaponised to undermine freedom of expression and has offer valid reason toward ushering in a series of reporting limitations on a descending severity scale from limiting data access, right through toward corrective legislation and even life threatening [1–3]. Additionally, the persistent disinformation onslaught as well as misinformation piercing platforms like the social media has formed a physical obstacle to COVID-19 truth-telling. Indeed, COVID-19 vaccines offer much-needed protection from disease, but there has so far been no evidence of whether they also curb transmission. Recently, around the world, concern is growing about the impact the new, fast spreading SARS-CoV-2 variants will have on the pandemic. Most countries are facing a widespread variant of SARS-CoV-2 known as B.1.351 and B.1.1.7, which appears to somewhat decrease the efficacy of some vaccines and have raised increasing apprehensions around the degree toward which their mutations are likely to aid them in evading present antibody treatments as well as extremely active vaccines. The news heightens concerns about B.1.351 and B.1.1.7, nonetheless researchers remain hopeful that the vaccine prevents severe disease and death. However, the chance of dying is around 35% higher for people who are confirmed to be infected with the new variant. Although, the data are preliminary, and it is not clear whether the variant is deadlier than previous strains or is spreading to more people who are vulnerable to severe disease. In fact, the COVID-19 vaccine

might offer the necessary protection against some of these novel variants, current outcomes have recommended that the AstraZeneca vaccine might not offer much needed defense against that of South African variant, while there's still sufficient defense in most other existing vaccines toward preventing hospitalization, serious illness, as well as death. At the moment, the public health emergence of this novel variants ought to inspire us all toward taking steps to reduce SARS-CoV-2 spread. Meaning the three W's must be strictly followed: Wash your hands, watch your distance, wear a mask regularly. This likewise means we have to wrap up our sleeves toward getting vaccinated once the opportunity arises. Hence, the global health, economic, and social events that rattled series of activities around the world in 2020 have kicked off a new, uncertain era of environmental/public health practices, and it may take a long time for such uncertainty to ease. As many environmental/public health experts are predicting that it could even outlast the pandemic itself. While the world remains alarmed to panic at the grip of the demonic novel COVID-19 infection, there is still plenty of bearish perception as 2020 will certainly and no doubt be etched in the minds of health-care professionals, including environmental health officers all over the globe for several years to come which is unprecedented in the modern health care setting [4–6]. While, the national response toward COVID-19 varies, from the swift and most proactive to haphazard and negligent to the worst. That nations have already managed the spread of the pandemic in a different way is expected, nonetheless COVID-19 pushes all health systems toward their limits, thereby revealing serious gaps in environmental/public health structure, even in countries that are acclaimed as the popular centers for readiness. Thus, the response toward COVID-19 shows a glaring lack of social health determinants as well as meaningful collective learning, community participation and engagement on important issues in a health emergency. The outbreak of COVID-19 triggered severe acute respiratory syndrome of coronavirus 2 (SARSCoV-2) and has adversely affected social, economic events that rattled businesses as well as environmental health determinants and has challenged health professionals such as doctors, nurses, health workers, researchers, decision-makers and many others working in the health sector in many ways, while suspending the usual daily businesses [7].

2. How SARS-CoV-2 infects cells

To better understand SARS-life CoV-2's cycle and how it evades detection, as well as what makes the Delta variant so hazardous, scientists are working to unravel the virus's life cycle (**Figure 1**). Researchers have identified crucial modifications that enable viruses infect and hide inside of human cells with remarkable force. SARS-CoV-2 then performs a key processing phase as it exits the cells, preparing its particles to infect even more human cells.

Accordingly, COVID-19 pandemic has presented an acute case and also tested and assesses the national capacity of health systems toward withstanding health shocks while maintaining routine functions in many ways [9–11]. Hence routine reopening of service/activities toward approaching normalcy could continue for months or else years, but some positive results have been emerged and achieved in its wake. At the same time, global effort is being made to develop relevant international technologies, resources as well as available information that would create and accelerate data-driven results for all facets of this coronavirus pandemic. The coronavirus crisis is a global changing phenomenon and has become a top priority for our healthcare system, halting patient care processes which ranges from disrupting childhood vaccination as well as campaigns on polio eradication [12], maternal and child mortality are projected toward rising sharply, and health of young people

LIFE CYCLE OF THE PANDEMIC CORONAVIRUS

A simplified account of how SARS-CoV-2 enters and exits cells.

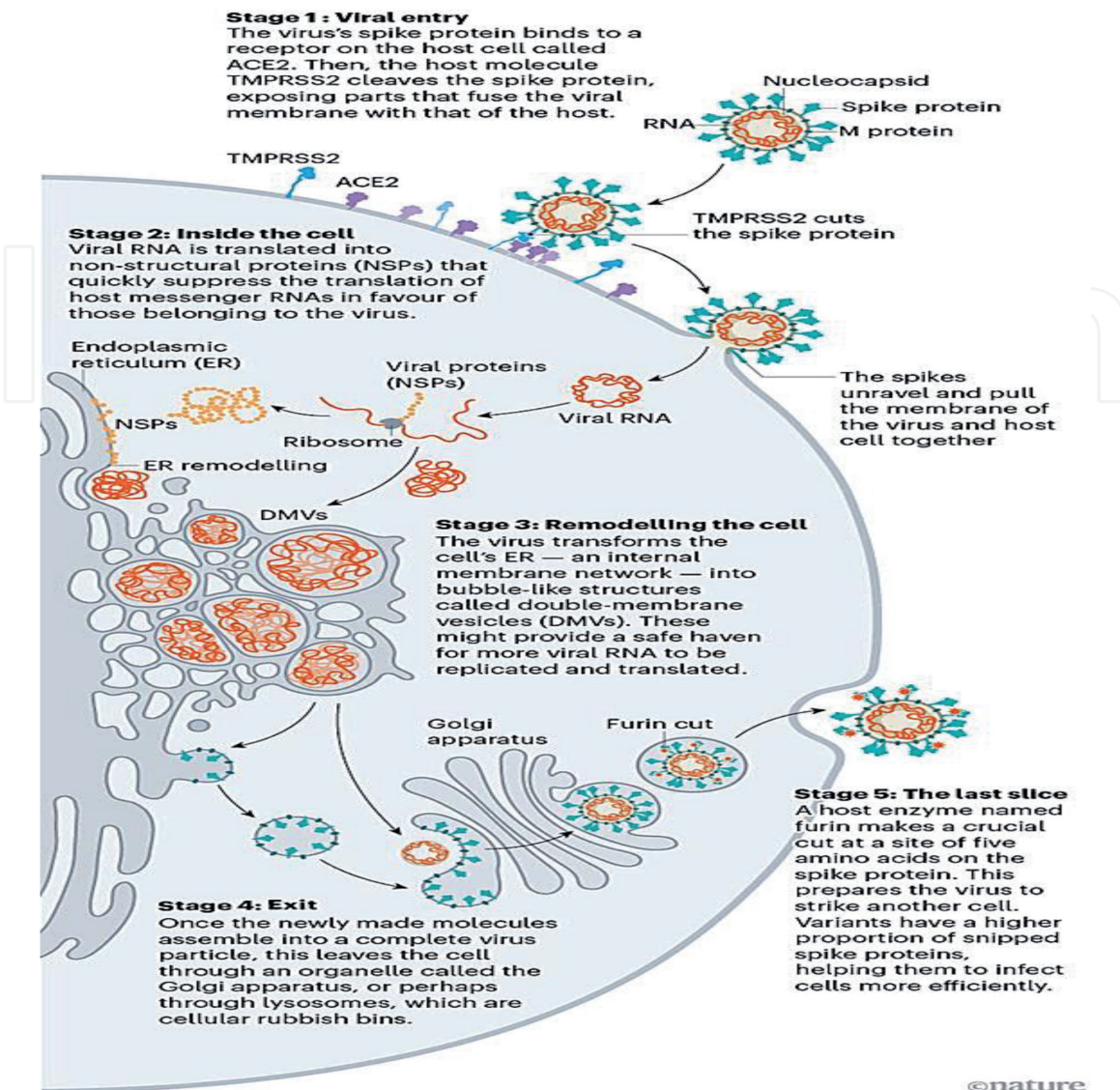


Figure 1.

Life cycle of the pandemic coronavirus: a simplified account of how SARS-CoV-2 enters and exists cells. Source: Adapted from [8].

to injuries, non-communicable diseases, as well as universal health coverage, despite unleashing enormous social, economic and health crises that threaten the world with antimicrobial resistance which threatens our ability to treat common infections, disrupting many research activities as well as overwhelmingly impacting medical education in various research activities. The coronavirus pandemic is not the first and foremost serious health challenge facing the world, nevertheless its long-term achievement will largely depend on rapid data synthesizing and information, appropriately AND responsibly into comprehensive public and environmental health policies both national and international. In the face of great uncertainty around Covid-19 pandemic future, epidemiologic models become an important planning tools for decision makers, clinicians as well as public health practitioners [1–3]. COVID-19 has made visible major global weaknesses, vulnerabilities and highlighted the necessity for health reforms toward promoting global access toward affordable care. At the same time, countries are examining their different policies toward protecting people at increased severe risk of disease. It may be the policies intended at preventing transmission in the general population, immunization (as the Oxford AstraZeneca vaccine and Pfizer BioNTech COVID vaccine has turn out

to be available) because the world has received the Oxford AstraZeneca vaccine and Pfizer BioNTech COVID vaccine and has been roll-out to millions of people in the United States of America (USA), India, United Kingdom (UK), Ghana, Cote d'Ivoire and Nigeria, also its distribution and immunization has commenced without political, religious or ethnic affiliation. Up until now, the seemingly bulletproof important priority is to rebuild and reenergize the country toward acting rather than reacting. As uncertainty around the peril of COVID-19 calamity grows continuously and geometrically, long-term protection policies need to be developed such as specific public safety measures toward protecting vulnerable populations at increased risk through reducing contacts between individuals in danger, etc. Recognizing that promoting sustainable development is risky, difficult and exhausting, particularly as the spread of SARS-CoV-2 pandemic increased geometrically, as those living in poverty which is leading to growing anger and frustration are currently at increased peril of setbacks with more than thirteen (13) million children out of school [1, 3, 9, 10, 13]. This stresses the importance of linking the results of environmental research with human health has mentioned. This necessitates understanding of the significance of interventions toward addressing system inequalities, universal health care as well as coverage issues, and wide-ranging public protection schemes as being part of response.

Now is the time toward realizing that we are not at equal peril of severe COVID-19 consequences and that there is need to work with stakeholders and development partners toward developing and improving effective response as well as solutions [3, 14–19]. This paper offers research evidence to inform decision makers about people that could remain at increased peril or severe high risk of COVID-19 pandemic in diverse countries. Hence, scientific research evidence is required to investigate the environmental as well as public health practices in the coronavirus diseases era, which ought to place emphasis on diverse policies guidelines toward preventing those that are vulnerable and at increased risk. It is imperative toward comparing those individuals at high peril of severe COVID-19 pandemic toward helping nations to design as well as develop improved interventions measures toward protecting vulnerable populations as well as reducing straining on health complications as well as health systems [1–3, 10, 19]. These evidences can offer as well as advise a wide-ranging health assessment, social, as well as economic significances of protecting diverse groups [9, 16–18, 20–22], highlighting the prerequisite toward developing and providing a long-term Covid-19 management policy as well as given the unprecedented scale of policy-makers', scientific evidence require large-scale partnership as well as collective learning in the scientific evidence synthesis community. Henceforth, outcomes improvement across countries can be attained through successful high-quality evidence certification that is properly implemented. To accomplish this, national systems, policies as well as political milieus require to be hospitable toward evidence informed methods, besides there is prerequisite toward fostering partnership, facilitate negotiation, promote as well as advance scientific evidence-informed decision-making (SEIDM) in Sub-Saharan Africa as well as the world at large toward achieving effective greater performance and worldwide sustainable implementation.

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 global 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 [11, 23, 24]. As confusion, disorientation, agitation and even psychosis have been associated with symptoms of COVID-19. The body of research is making the link among infection

as a result of virus and neurological symptoms. The number of publicly reported deaths rate of the population due to the 2019 coronavirus disease (COVID-19) might underrate the death toll from the pandemics. These estimates are based on provisional data that are frequently incomplete as well as might rule out unreported COVID-19 deaths. In addition, the pandemic restrictions imposed (for example, stay-at-home orders, school closures, quarantine measures, personal hygiene, physical distancing measures used to contain the spread of the virus) may possibly and indirectly claim lives through delayed care for acute emergencies, exacerbations of chronic diseases, as well as psychological distress (for instance, drug overdoses). As a result, the severe burden of acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic remains to rise, both due to morbidity as well as pandemic mortality along with the impact of mitigation strategies [2, 3, 9, 10, 25]. Tailoring policies based on emerging evidence on the conditions associated with the severity of COVID-19 is essential toward actions informing of both decision-makers as well as individuals. Meaning moving from generalized population-based mitigation strategies toward focusing on people exposed to the risk of severe COVID-19 outcomes [16–18, 20–22].

Too often, Jenicek [26] has repeatedly described evidence-based environmental/public health (EBEPH) as “the conscientious, explicit, as well as judicious usage of available evidence in decisions making process towards communities care as well as populations in the realm of health maintenance and protection, disease prevention and development (health promotion).” Similarly, a succinct definition arisen from Kohatsu [27]: “Evidence-based public health is the process of integrating science-based interventions with community preferences to improve populations health”. While, public health has succeeded in solving numerous problems, but almost all successes have a double-edged sword. Programs as well as policies have remained enacted as well as, in most cases, results that are positive which shows an increase in the improvement number of population health. However, some people suffer from health disparities as well as social inequalities. This raises such questions like, is there a way to approach the lessons learned directly from successful interventions as well as applies them toward other topics and situations? Are we using evidence that is based on scientific research/evidence? How can we greatly foster political will toward supporting evidence-based policy making? How do we promote and influence inducements so that practitioners can make effective evidence usage? Just as evidence-based environmental/public health has turn out to be a topic of conversation for both practitioners and policymakers, it is so fundamental toward people concept of justice, it is likewise important for environmental/public health. Therefore, it ought to notify our decisions on how the intervention will be implemented, and in what populations, when as well as how to assess both the negative and occasionally positive impact of such interventions. Justice commitment also bears the obligation of finding effective approaches toward reducing disparities in health between groups existing in practically entirely geopolitical units. For environmental and public health professionals, evidence is a type of data that includes (quantitative) epidemiologic data, program policy evaluations or outcomes, as well as the qualitative data to be used in establishing decisions or judgments [2, 3, 28, 29] (see **Figure 2**). Indeed, Brownson and colleagues identify a (6) six-stage procedure through which environmental and public health practitioners remain able toward taken an approach that is evidence-based toward policy making, with the community members perspectives, fostering an added population-centered method, which seems toward a combination of consensus that are of scientific evidence, along with resources, values, as well as contexts, ought to cross the threshold of policy making. Hence, “Evidence-based public/environmental health is the process of integrating science-based interventions with community preferences

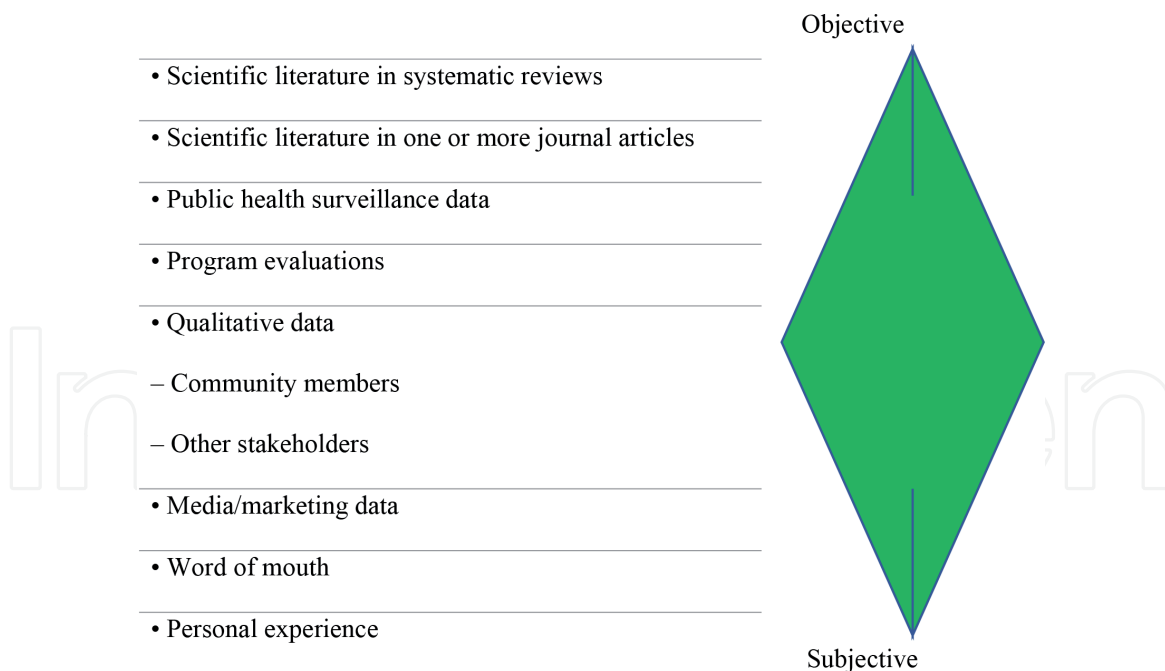


Figure 2. Different forms of evidence. Source: Adapted from chambers and Kerner [28] and Raimi et al., [2].

toward improving populations health” or it involves “the available body of facts or information indicating whether a belief or proposition is true or valid.” [2, 30].

Evidence in public and environmental health is often the outcome of a complicated concepts of theory, observation, as well as experiment [3, 31]. The evidence value, on the other hand, remains in the beholder eyes (for example, the value of evidence might differ from a stakeholder type) [2, 3, 32]. Research not only encompasses medical evidence, then also patient characteristics, readiness of patients toward undergoing a therapy, as well as society’s values [33]. Decision-makers pursue distributional penalties (i.e., who pays, how much as well as who profits) [34, 35], and practically, settings anecdotes and occasionally provide detailed experimental data [2, 3, 36]. The evidence is typically imperfect, as Gray Muir note [37], “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.” Some authors describe diverse types of scientific evidence for public health practice [38, 39] (see **Table 1**). Evidence from Type 1 identifies the diseases causes as well as the degree, severity, as well as risk factors preventability associated with the diseases. They suggest that a specific disease or risk factor needs to be done. Evidence from Type 2 establishes the absolute effects of a particular actions that cause or do not advance health, with the caveat that, “In particular, this must be done” [39]. The situation has remained observed that strict adherence toward regulatory study designs guidelines can strengthen an “inverse (see **Figure 2**) evidence law” through which most probable toward influencing the public interventions (e.g., change in policy) remain least appreciated from an evidence matrix highlighting randomized designs [29, 40–45]. In comparison to descriptive/epidemiologic research (Type 1), a recent study showed a paucity of research intervention (Type 2). In a randomized controlled trial of cigarette use, alcohol consumption [46–48], as well as insufficient physical activity, the team discovered that in 2005–2006, 14.9 percent of subjects reported an intervention, while, 78.5 percent of research articles reported remained descriptive or epidemiologic. Less research is probable published on Type 3 evidence showing in what way as well as beneath what circumstantial interventions conditions remained implemented, as well as by what method they remained received, indicating “how it

| 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 results in lung cancer. | Price upsurges from a targeted media campaign decrease the rates of smoking. | Comprehending the political problems of increase in price or aiming at media messages toward specific audience segments |
| 4. | Quantity | More | Less | Less |
| 5. | Action | Something must be done. | These specific priorities must be implemented. | How can this intervention be implemented |

Source: Adapted from Brownson et al., [39] and Raimi et al., [2].

Table 1.
Comparison of the types of scientific evidence.

should be done” [38]. So far, research has focused on internal validity (for examples, well-controlled trials efficacy) with external validity while receiving sparse consideration (e.g., adaptation of scientific knowledge to a different context) [2, 3, 49, 50].

3. Comprehending the framework for evidence

Evidence of type 3 from an intervention context [38]. While many scholars have written around the context role it plays in providing information on the subject of evidence-based practice [32, 38, 51], there is not much consensus on its meaning. Context turn into more unknown as well as unpredictable, variable, and multifaceted as we move from scientific interventions toward population-level as well as policy interventions. Relevant definitions to the context highlight’s evidence required toward modifying as well as implementing an information-based intervention in a specific population or context [38]. There are five overlapping domains in the conditions for Type 3 evidence (see **Table 2**). First, there are features of the intervention targeting demographic, for instance educational attainment as well as medical history. This is the reason why interpersonal variables provide the most important context. People with cancer history, for example, may be more susceptible toward getting cancer screening. Finally, organizational variables must be taken into account. For instance, if an organization succeeds in implementing an evidence - based program in which it is influenced through capacity (for example, agency leadership, a trained personnel) [51, 52]. Fourth, it is known that social norms and cultural traits are closely linked toward shaping several health behaviors. Ultimately, the greatest political as well as economic forces will influence the context. For example, large-scale measures of certain disease can impact a state’s political will toward addressing the problems in a logical as well as methodical way. There is an urgent evidence need for contextual determinants as well as approaches

| Category | Examples |
|------------------------|--|
| Individual | Personal/Individual health history Education level Basic human needs ^a |
| Interpersonal | History of family health Social capital Peers support |
| Organizational | Organizational culture Staff expertise Staff configuration Physical infrastructure |
| Sociocultural | Values Social norms History Cultural traditions |
| Economic and political | Political ideology Political will Lobbying as well as special interests costs and benefits |

^aBasic human needs include food, shelter, warmth, and safety.
 Source: Adapted from Brownson et al., [39] and Raimi et al., [2].

Table 2.
 Contextual variables for intervention design, implementation, and adaptation.

toward adapting programs as well as policies across contexts as well as demographic subgroups. Predominantly aimed at high-risk as well as understudied populations. Circumstantial COVID-19 pandemic questions remain being addressed in novel “realist review,” which remains a systematic review procedure that not only examines if the recent intervention is working effectively but then again, in what manner interventions actually work in real-world contexts [53].

4. Related challenges toward public/environmental health evidence

Evidence on public and environmental health has been described as underpopulated, dispersed, as well as varied. The situation remains underpopulated since there are comparatively limited well-done appraisals of how public/environmental health impacts interventions (Type 2 evidence) while applying across varied cultural groups (Type 3 evidence). The criteria for making public/environmental health decision are much more varied than the clinical interventions evidence. Health impact evidence on built milieu, for instance, could be discovered in transportation planning. Lastly, evidence in public and environmental health is varied, in part since much of the interventions base science remains obtained from “natural experiments” or nonrandomized designs.

5. Triangulating evidence

Triangulation is the process of combining multiple evidence from various sources toward gaining understanding into a specific topic as well as typically includes both qualitative as well as quantitative data [39]. It often entails the application of several ways of data collection as well as analysis toward determining disagreement or commonality points. Due to the corresponding nature of evidence

from varied sources, triangulation is generally useful. Even though quantitative data offer an outstanding opportunity toward determining by what method, variables are made in the lives of many individuals, these data does not provide much insight into why such associations exist. Qualitative data, on the other hand, can aid in providing information toward explaining quantitative results, or what is known as “illuminating meaning”. Many instances of the application of qualitative as well as quantitative data triangulation toward evaluating health programs as well as policies, together with AIDS & HIV prevention programs [54], policies as well as programs on occupational health [35], and programs in community settings toward chronic disease prevention [2, 55].

6. Geographic and cultural differences

The concept of EBPEH was developed largely by a context of Western, European American [56]. The epistemologic grounds of logical positivism, which discovers meaning by a rigorous observation as well as measurement, are revealed in the reality through the conceptual method. This is apparent in a professional preference aimed at randomized controlled trial between clinicians designed for research designs. Additionally, most research in the EBPEH literature are academic research, typically through well-established investigators receiving external financial support. In dissimilarity, even if the problem scope might be huge, the information base aimed at how best toward addressing mutual public/environmental health glitches is generally limited in emerging countries as well as some impoverished areas of affluent countries, Cavill and colleagues [57] likened interventions that are evidence-based across European countries, demonstrating that considerable evidence base is restricted toward experimental observations in various domains. Even in nations that remain developed (such as United States), much of peer-reviewed published information in journals or data made available by websites as well as government agencies might not sufficiently epitomize entirely interested populations. There are (4) four prime user evidence groups in environment and public health, namely: practitioners of environmental and public health as well as their partners, who are likely to recognize the scope as well as quality of evidence in certain strategies (for example, policies, programs)? In actual fact, nevertheless, practitioners of environmental and public health often possess a comparatively narrow selection process option. Funds resulting from local, state and federal sources are usually earmarked for definite purpose [for example, sexually transmitted diseases as well as surveillance treatment [54], establishments of retail food inspection [58–60]. However, there is an opportunity for environmental and public health professionals, including the responsibility, toward cautiously examining the evidence to find alternative methods toward achieving required health goals [3, 15, 35, 61, 62]. Decision-makers at regional, state, local, national, as well as international levels (deciding at the macro level in what way toward allocating public resources aimed at which they have remained nominated stewards [2, 16–18, 20–22, 63] make up the next generation user group. This group is also in charge of extra responsibility for formulating policies for complex and controversial public issues), Stakeholders (This group consist of many development partners i.e., NGOs whose missions’ emphasis on or incorporate health improvement, either directly or by improving the social as well as physical milieus that remain significant demographic 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 create as well as apply exploring research hypotheses using evidence. Some remain principally interested in used methodologies toward

determining the quality as well as research implications on population-based interventions studies). Both enhance and use the evidence to answer research questions. However, the additional increased benefits of evidence-based environmental/public health (EBE/PH) have many indirect as well as direct benefits, including access toward a more as well as better quality evidence toward improving public's/ environmental health, an effective and efficient probability of successful policies as well as programs implemented, better workforce productivity, as well as greater efficient usage of private as well as public resources [10, 64]. Therefore, in most areas of environmental, public health as well as clinical practice, decisions about when to intercede as well as what policy or program to execute remain not simple as well as straightforward. These choices are generally based on (3) three essential questions: (1) Should public and environmental health intervention remain taken toward addressing a specific environmental/public health concern (Type 1, etiologic information or evidence of behavioral knowledge)? (2) What measures or action must be taken (Type 2, intervention evidence or proof of intervention)? (3) In what manner can a specific policy or program remain implemented most effectively at the local setting (Type 3, contextual evidence)? **Table 1** presents a range of systematic evidence aimed at public and environmental health practice [2, 38, 64]. Evidence from Type 1 assesses the diseases causes as well as its severity, magnitude, and risk factors preventability as well as diseases. Also, evidence from Type 2 describes the comparative effects of specific interventions that may or may not advance health and evidence from Type 3 comes from the context of the intervention and specifies the five (5) overlapping domains (**Table 2**).

Firstly, there are features of the number of populations for intervention like, for instance education level as well as health history. In addition, interpersonal variables make available an important context. For instance, an individual with cancer family history might be more probable toward undergoing screening of cancer. Thirdly, institutional variables ought to remain considered. For instance, whether an organization is successfully implementing an evidence-based program that may remain influenced through the aforementioned capacity (example, professional workforce, organizational leadership) [1, 2, 7, 64].

Fourth, it is argued that social norms and cultural norms cause and shape a lot of health behaviors. Lastly, more economic as well as political forces tend to affect context. For instance, the occurrence of high rate aimed at certain disease like the recent COVID-19 pandemic, has claimed far too many lives worldwide. Fortunately, as environmental health officers and doctors continue to gained more experience at monitoring, contact tracing, communicating and treating COVID-19 patients, and many people hospitalized eventually recover, this might impact a state's political will toward addressing the problem meaningfully, logically as well as in a systematic method [1–3, 9, 10, 19]. Particularly because of the understudied populations at high-risk, there is a great requirement for more evidence between contextual variables as well as process toward adapting program change as well as policies in context as well as population subgroups. Problem-solving questions are addressed in novel detail known as “realist review,” which remains a systematic assessment procedure that explores not only how intervention works, but then again by what method, interventions measures work in a real-world situation [1–3, 53, 65, 66]. Numerous ideas are important in achieving a greater evidence-based method toward the practice of public and environmental health. Essentially, scientific knowledge is required on programs as well as policies that can be effective toward promoting and improving health (i.e., conducting evaluation research toward generating sound evidence) [2, 3, 64, 67]. Second, in order to transform science into scientifically sound practice, there is a necessity toward marrying evidence-based interventions information from peer-reviewed literature through the realities of a

definite real-world milieu [2, 3, 64]. To achieve this, there is prerequisite to properly define decision making procedures that must be evidence-based. Lastly, widespread dissemination of proven effectiveness interventions must arise more constantly at levels of state as well as local [3, 35, 68, 69]. Therefore, the main characteristics of evidence-based features of public and environmental health decision making comprise:

- i. Making Decision founded on the most up-to-date peer-reviewed evidence (both research on qualitative and quantitative): The scientific literature as well as guidelines issued through expert panels serve as a starting point of advice. Additionally, researchers as well as practitioners are frequently presenting preliminary findings in national, regional, as well as international professional conferences.
- ii. Using data and information systems systematically: Data remain being created more for issues at local level and a few initial efforts to improve the public and environmental health policy surveillance systems are under way. For instance, policy surveillance systems for alcohol, tobacco, and more recently, school-based nutrition as well as physical education have currently developed by a consortium of federal as well as voluntary agencies [46–48].
- iii. Developing and application of robust program planning frameworks (which is often rooted in behavioral science theory): For instance, ecological models or systems are progressively used where “appropriate cultural changes take place in the social milieu brings about individual’s changes, and support population considered critical to the implementation of changes in the environment” [11, 61–63, 65, 66, 70–73]. These models emphasize the need toward solving remarkable multiple levels problems as well as emphasize the interaction as well as integration of elements within and between inter-personal, individual, organizational, community and governmental levels. The aim is toward creating a healthy positive community milieu that offers information that enhances health-promotion as well as social support toward helping the population live healthier and better lifestyles. Interventions that are effective are most frequently grounded on the principles of health-behavior theory [31].
- iv. Community assessment involvement and decision-making: Community-based methods include research community members as well as projects intervention and demonstrates progress made toward improving public health as well as addressing disparities in health. Academicians, practitioners, as well as members of the community who collaboratively highlight key concern issues, develop intervention strategies, as well as evaluate outcomes. This method integrates knowledge as well as action that seek toward leading a fair distribution of the benefits of an intervention for all partners, builds on data from “stakeholder” input [2, 3, 74], while also, building on existing resources and facilitates collaboration between all partners.
- v. Conducting sound and appropriate evaluation: In most cases in population health, programs as well as policies are implemented without fully focusing on methodical evaluation. Additionally, even if the programs are not effective, sometimes, they are sustained due to political or historical reasons. Evaluation criteria should be based on the development of early program as well as had better consist of both formative as well as result evaluation.

For instance, the injury management program remained properly discontinued after evaluating its effectiveness. This program evaluation demonstrates the usage of both multiple critical quantitative as well as qualitative data toward framing the evaluation model.

- vi. Disseminating what is being taught to key stakeholders in decision-makers: If a policy or program is implemented, or if final outcomes is recognized, other public and environmental health such as community medicine, social medicine, community health and preventive medicine (environmental health) can draw on their research findings toward enhancing their own evidence use, while making decision. It can be disseminated or communicated to health practitioners through scientific literature, toward overall public through the media, toward decision-makers through individual meetings, as well as toward training public/environmental health professionals. In many settings, effective interventions remain required, comprising worksites, health care settings, schools, as well as wide-ranging community environments etc. Hence, accomplishing these activities in EBE/PH is likely to require a synthesis of scientific skills, enhanced communication, common sense, and political acumen.

7. Systematic techniques and methods to enhance environmental/public health evidence-based uptake

Several tools as well as planning methods can help practitioners in environmental/public health in responding to questions like: What are the magnitude of the environmental/human health challenges relating to COVID-19 pandemic; If there is an effective priorities aimed at resolving the challenges; What about the local environmental information as well as specific intervention that is useful in determining its possible use in relation to the current state of affairs at hand (Covid-19 pandemic); Is it that a specific program is policy worth having or worth doing (i.e., is it better than having substitutes), as well as will it yield suitable investment return, measured in terms of monetary or health consequences? These tools include:

8. Public/environmental health surveillance

According to the public/environmental health adage, which state that “what gets measured, gets done.” This measurement often begins with public/environmental health monitoring, the continuing systematic collection, analysis, interpretation, as well as distribution of COVID-19 pandemic health data with the aim of preventing as well as managing illness, injury, along with other health snags. Public/environmental health monitoring is an important instrument for those using EBEPH. It includes building a systematic analysis, collection as well as routinely interpreting detailed health information/data, and combining the strengths and weaknesses of disseminating data over time toward those accountable for prevention as well as disease control or injury [3]. Public/Environmental health monitoring systems must have the ability toward collecting as well as data analyzing, disseminating data toward human health programs, as well as frequently appraise the efficiency of the usage of disseminated data [2, 3, 75]. For instance, the ongoing prevalence of COVID-19 pandemic documentation as a justification for eliminating COVID-19 spread along with documenting the impacts of such actions [2, 3, 10, 19]. In substance use control in the core Niger Delta region of Nigeria, a common

agreement metric for substance use across Bayelsa states was recognized [46–48]. While, systems of surveillance are supported at local, state as well as federal levels and could be used toward determining the diseases frequency as well as other conditions of health in a defined population. At minimum, five main objectives of the surveillance systems could be stated: (1) health assessment and monitoring status as well as general health risks; (2) to provide a disease-specific understanding of events as well as trends; (3) planning, implementation, monitoring, as well as appraising health policies and programs; (4) put in place financial management as well as information monitoring; and (5) conduct research in environmental/public health [1–3]. Some systems of surveillance presently existing can now offer deaths, births, birth defects, cancers, infectious diseases as well as health behaviors information. Individual system frequently has enough information toward assessing the prevalence or incidence rates as well as toward describing diseases frequency or condition of health through a person, place, as well as time. Even the surveillance systems data could be used toward obtaining a baseline as well as follow-up measurements aimed at specific populations.

9. Systematic reviews and evidence-based processes

Systematic reviews involve comprehensive syntheses of collections of databases on specific topic. Good review reading may remain one of the utmost resourceful ways toward getting acquainted with advanced research as well as practice on several precise environmental/public health topics [76, 77]. The usage of explicit and consistent systematic methods (i.e., decision-making rules) in reviews decrease bias as well as decrease's chance impacts, hence providing a more trustworthy outcomes on which decisions are made [78]. One utmost important critique for public/environmental interventions in health is the “Guide toward Community Preventive Practices” (the Community Guide), providing a synopsis of contemporary scientific literature using a well-defined and rigorous approach where existing important research are units of analytical analysis [79, 80]. The Public Guide offers to addressed (1) What interventions statements are been considered or evaluated as well as what are their implications? (2) What interventions aspects could support clients in choosing between proven interventions set that are effective? (3) How much does this intervention cost, as well as how much does it costs in relation to probable impacts on health? A respectable systematic critique should enable professionals to comprehend local contextual situations required for fruitful implementation [81].

10. Economic evaluation

The costs-benefits comparison to establish the most effective allocation of scarce resources is known as economic evaluation. We always carry out economic evaluations, albeit we rarely openly think about the process. It is a key component of evidence-based practice [82]. It could make available evidence toward evaluating the absolute alternative value of expenditures provided to the public/environmental health programs as well as policies. In cost-benefit analysis, all decision options based on costs as well as consequences remain valued in economic terms. Most frequently, placement on financial investment is related to an intervention likened to its effects on health, for instance, cases of disease prevented or saved life years. The absolute worth of some alternative interventions (for instance, health return on euro/dollars invested) may show this method of cost-effectiveness analysis (CEA), [82].

Cost-effectiveness analysis (CEA) has turned out to be an increasingly essential instrument for academics, practitioners, as well as policy makers. Nevertheless, appropriate data toward supporting this analysis type are not permanently accessible, particularly in the context of potential public policies considered in health improvement [3, 36, 83, 84]. While, four (4) related kinds of economic assessment namely: cost utility analysis (CUA), cost-effectiveness analysis (CEA), cost-benefit analysis (CBA), as well as cost-minimization analysis (CMA). The four techniques vary chiefly in the mode of how benefits are measured. The cost-benefit analysis (CBA) measures the benefit in economic units (e.g., euros, dollars), while the cost-effectiveness analysis (CEA) measures the benefits in the relevant health unit (e.g., saved lives). Cost utility analysis (CUA) is a form of cost-effectiveness analysis (CEA) in which the benefits (such as life expectancy) are adjusted for life quality as well as quantified through a measure of health utility (typically quality-adjusted life years [QALYs]). Cost-minimization analysis (CMA) remain used once the two benefits interventions are the same, so the benefits measurement remains not a problem. Since cost-benefit analysis (CBA) uses the utmost "generic" outcome measure (several factors could remain measured through currency, together with the value of public health projects as well as educational interventions), it enables for a comparison of multiple programs. Its outcomes (see **Figure 3**) illustrate the possible results of the economic evaluation [2]. In view of the four (4) squares of the graph. Programs toward improving health as well as saving money (Quadrant IV) are certainly valuable as well as ought to be implemented. Likewise, programs that undermine health as well as costs affordability (Quadrant II) are unwelcome as well as must not remain continued or initiated. The two quadrants remaining (I and III) are in critical condition as well as where monetary appraisal can be more informative. In history, systems of environmental/public health as well as nations develop, interventions as well as programs began in Quadrant IV, through these programs that remain cost saving as well as improve and maintain health. Several initial public/environmental health interventions, like systems of sanitation, drop in Quadrant IV. When interventions are used as well as implemented, attention turns to programs in Quadrant I that improve and maintain health at an affordable cost. After all, as pressures in budgetary activities rise, programs in quadrant III are bear in mind: programs that lessen costs, nevertheless add loss toward health status. Aiming at the four (4) quadrants, the key question is, what is investment return

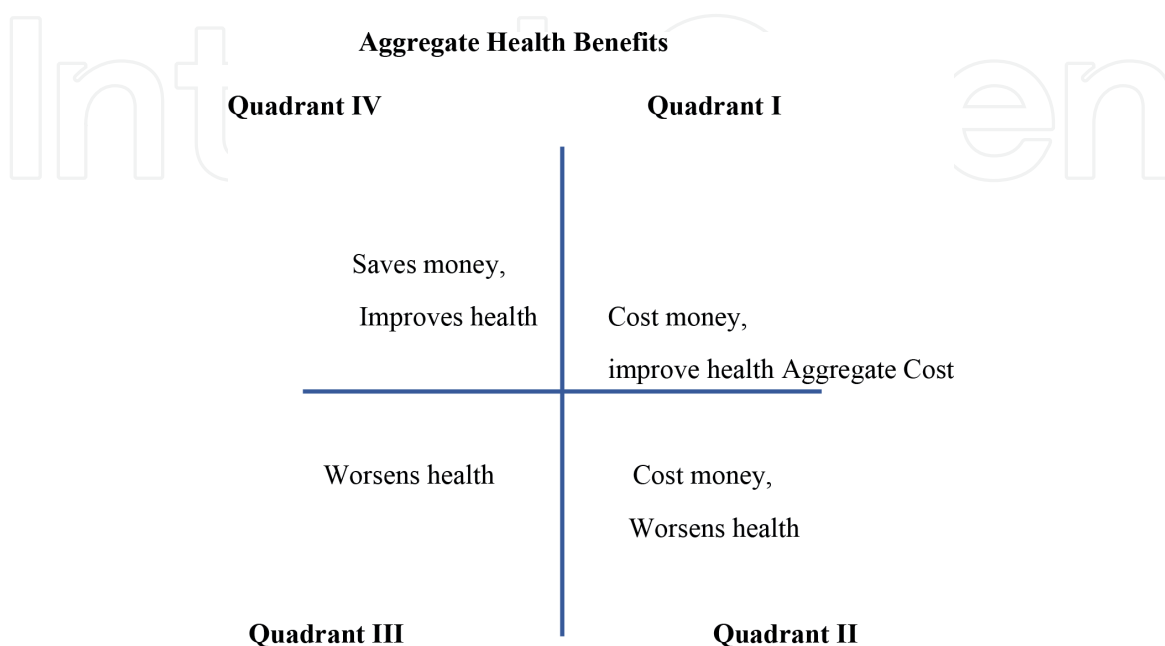


Figure 3.
Possible outcomes of an economic evaluation. Adapted from Raimi et al., [2].

(or disinvestment) toward public's funds? Economic evaluation offers a means toward answering this pertinent question, so programs can be selected for the highest investment return.

Using the above conceptual framework (**Figure 3**) for the case of COVID-19 pandemic, numerous important conceptual economic evaluation elements can remain recognized. Before bearing in mind the procedure of conducting economic evaluation, it can be helpful toward determining the overall elements as well as all economic evaluations approach. The primary step is toward choosing the economic evaluation opinion. Each intervention could be thought of in several ways, often categorized as going from narrow toward broad. Health agencies or organization opinion should directly take part in delivering projected intervention. The next step which may be the insurers opinion, or payers, particularly in the health care industry, where consumers as well as payers remain two (2) distinct groups. The widest opinion is that of the whole society. Recommendations has been based on this wide-ranging economic evaluation opinion for all, as well as it is obligatory in quite a few countries having an established national health system. The viewpoint of the society is importantly suitable in public/environmental health as it seeks interventions designed toward benefiting taxpayers as well as the public funding the costs.

11. Health impact assessment

Health impact assessment (HIA) is an evidence-based forward-looking instrument used toward informing stakeholders as well as policymakers around the possible health impacts of projects as well as policies being anticipated, while identifying opportunities aimed at maximizing possible health benefits as well as limiting potential damage. Similarly, Health Impact Assessment (HIA) is a blend of several methodologies in the assessment of the possible health impact on a population and its distribution, arising from policies, programmes, or projects is instrumental in linking with other sectors to deal with the root cause of health challenges and thereby fostering the successful actualization of the sustainable development goals, having sprung into prominence in the last few decades [16–18, 20–22, 63]. Health impact assessment (HIA) is a somewhat recent way of assessing the likely impact of policy or intervention in non-health sectors, for instance economic development, transportation, as well as agriculture, on population health [2, 6, 22, 29, 42–45, 63, 85–87]. Other HIAs is aimed to ensure the participation of the actors involved in a particular project development. This latter method, which forms the foundation of the environmental impact assessment that several massive place-based projects is obligatory through law, which is comparable toward the nonregulatory method that has remained accepted for other HIAs. In general, HIA, in all its procedures, has remained acceptable by way of a tool due to the growing evidence that the social as well as physical milieus remain a significant health determinant as well as health inequalities in populations (see **Figure 4**). Hence, social determinant of health (SDoH) could be influenced through policies as well as programs, and are related through improved health outcomes. Social Determinant of Health (SDoH) is strongly influenced through policies, systems, as well as the environments (PSE). Diagram in **Figure 4** shows County Based Health Rankings as well as Roadmaps recognize the interplay amongst health outcomes, the Social Determinant of Health (SDoH), are policies as well as programs. For instance, tobacco being a foremost health outcomes determinant (e.g., quality of life, mortality), as well as the reduction in the use of tobacco and is strongly influenced through cigarettes prices as well

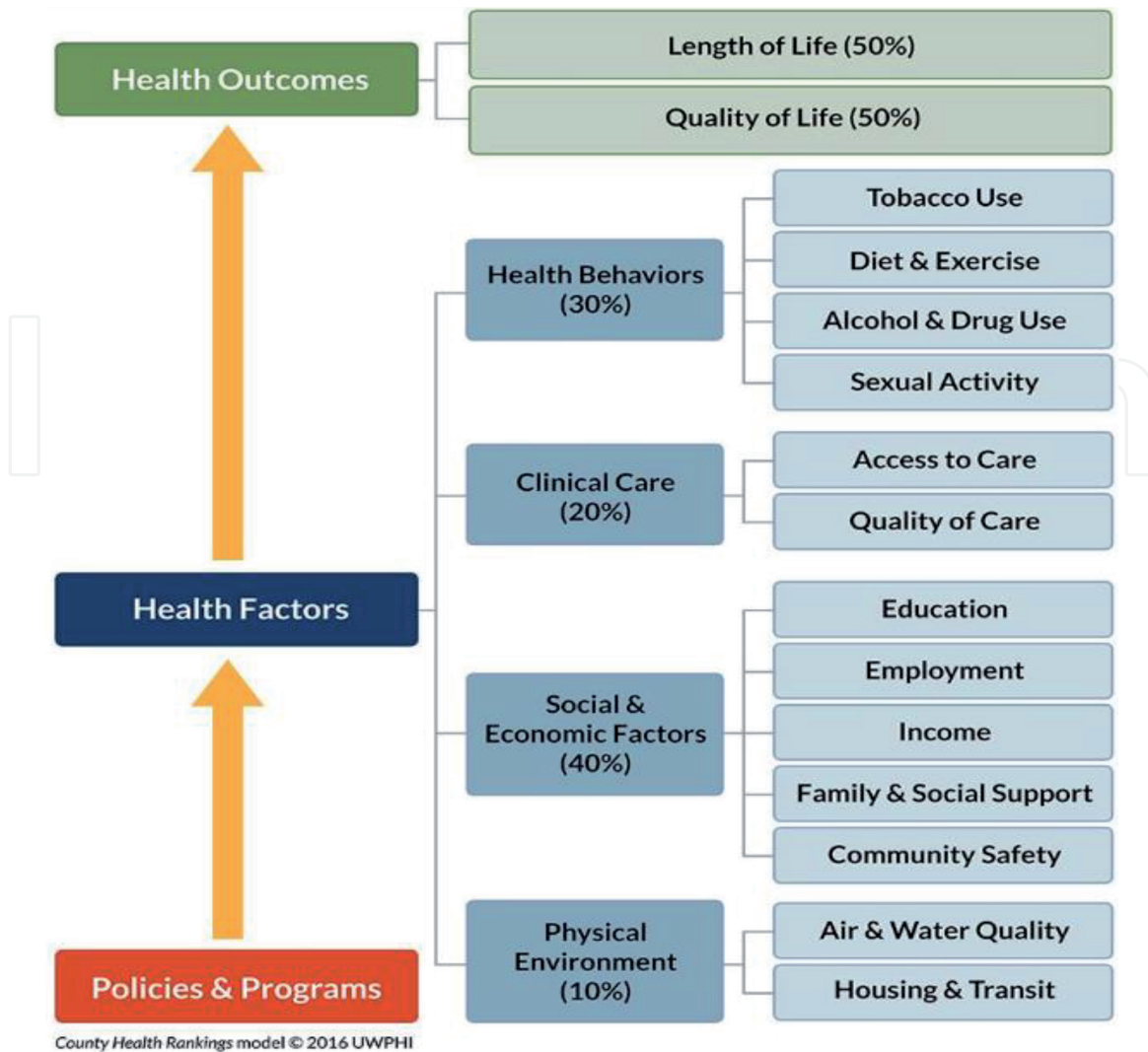


Figure 4.
 County Health Rankings & Roadmaps. Source: Reprinted with permission from County Health Rankings & Roadmaps, [88].

as environmental determinism in the community that are smoke-free using cessation clinics availability.

It is currently utilized toward helping in assessing the prospective health consequences and outcomes of several policies as well as health status programs [16–18, 20, 21]. HIA is a systematic procedure aimed at recognizing as well as communicating the possible health-associated impacts of anticipated projects along with policies and formulating recommendations toward reducing probable health benefits as well as lessening possible harm [16, 18]. It combines several multidisciplinary approaches in the assessment of health-related consequences that may arise from a project, policy, and programme that does not clearly define health as is major focus, based of evidences of health effects from a well-structured framework. HIAs application spans over its use in a wide range of situations, such as the appraisal of national policies, infrastructural development, transportation and national/regional agricultural projects. Public participation and interagency synergy are two key positive outcomes; however, the setback is that there are no globally accepted methods in the evidence-based health impacts. Despite being a promising emerging practice, it has proven to be a great tool in the understanding of possible human health consequences, thereby informing decision-making and public policies [16, 17, 21].

12. Participatory approaches

Involving communities in EBE/PH is promising in participating techniques that actively include community people in research and intervention programs [2, 27, 89]. Academicians, practitioners, as well as members of the community collaboratively identify concern issues, devise intervention strategies, as well as evaluate results. This method relies on the input of “stakeholder” [3, 74], builds on current resources, enhances collaborative synergy between all parties, as well as integrates knowledge along with activities which it is hoped, would lead toward a fair distribution for all partners to the benefits of project intervention [14, 90]. Stakeholders, or important development partners, are persons or agencies with an interest in the problem at hand [14, 91]. Policymakers for instance, remain particularly significant stakeholders in developing health policies [92]. Stakeholders must include people who might possibly receive, use, as well as profit from the policy or program being considered. The three (3) stakeholders’ groups remain pertinent viz.: people affected through interventions, people developing programs as well as those who used the program evaluations results. The three groups of people involved include: the creators of the program, those who participated in the program and those who used the results of the program. Participatory methods can also be an existing challenge in following EBEPH guidelines, particularly in attainment of appropriate agreement through which appropriate methods are used aimed at addressing a specific health problem i.e., Covid-19 pandemic [1–3, 9, 10, 19, 93].

13. An approach toward increasing evidence use in the practice of environmental/public health

Education as well as training backgrounds are needed to improve and strengthen EBEPH proficiencies workforce. The prominence on EBEPH principles is not taught in the same way in all the subjects epitomized by public/environmental health professionals. For instance, a public/environmental health professional may not be sufficiently trained to pinpoint the most recent evidence as well as interpret other possibility than what an epidemiologist can do. A newly health educator graduate having a master’s degree in public/environmental health is expected to have an expanded understanding of the significance of EBEPH better than a specialist in environmental health with a bachelor’s degree. Perhaps less than half of environmental/public health practitioners have little prescribed training or education in the discipline of environmental/public health like health education, environmental health ethics and epidemiology [4, 5, 94]. Most of these specialists receive formal regular graduate education or training in a college of health sciences or other programs in public health. Presently, it seems that limited public/environmental health departments need more ongoing education and training around mandatory EBEPH. Although the recognized EBEPH concept is relatively novel, but not fundamental skills. For instance, evaluating a program intervention through reviewing scientific literature aimed at evidence are skills frequently taught in postgraduate programs in environmental/public health or other areas of academic disciplines, as well as they are the basis for the practice of public/environmental health. While, the most frequently EBEPH applied outline is perhaps that identified by Brownson and his colleagues (**Figure 5**), which tends to use a seven-steps procedure [52, 64, 95]. The framework procedure used for applying is not linear as well as involves several iterations [2, 52, 96]. Competencies are becoming increasingly evident in terms of more effective public/ environmental health practice [1–3, 97, 98]. For instance,



Figure 5. Training approach for evidence-based environmental/public health. Adapted from Brownson et al., [64]; Hallfors et al., [93].

| S/N | Characteristic | Description |
|-----|--|--|
| 1. | Holistic and comprehensive | Collaborate to resolve problems deemed important; A good example is the Ottawa Charter for promoting health. |
| 2. | Flexible and responsive | Coalitions to answer emerging problems as well as adapt its strategies to meet the new needs of the community. |
| 3. | Build a sense of community | Members regularly express and report that they value as well as obtain professional and personal support for their participation in collaborative relationships. |
| 4. | Build as well as improve resident engagement in community life | Make available a structure for renewed civic engagement; Collaborate as a forum where multiple sectors can engage together. |
| 5. | Offer a vehicle for empowering community | When community coalitions address indigenous issues, it often develops social capital, permitting residents toward having an impact on multiple problems. |
| 6. | Permit diversity to be valued as well as celebrated | When communities become more diverse, integration offers a vehicle to bring together diverse group toward solving common challenges. |
| 7. | Incubators for innovative solutions toward large challenges | Solving problem happens not only at local levels, but also at regional as well as national levels; local leaders may become national/global leaders. |

Source: Adapted from Wolff, [109].

Table 3. Characteristics of effective community coalitions.

| S/N | Title | Domain ^b | Level ^c | Competency |
|-----|---|---------------------|--------------------|---|
| 1. | Community input | C | B | Understand the importance of soliciting public opinion before planning as well as implementing interventions that is evidence-based. |
| 2. | Etiologic knowledge | E | B | Understand the relationship amongst risk factors as well as diseases. |
| 3. | Community assessment | C | B | Understand how health issue is defined based on the needs as well as assets of the population/community of interest. |
| 4. | Partnerships at multiple levels | P/C | B | Understand the importance of recognizing as well as developing partnerships to meet the need for routine evidence-based strategies at various levels. |
| 5. | Developing a concise statement of the issue | EBP | B | Understand the important of developing a concise statement of the challenges in order to build support for it. |
| 6. | Grant writing need | T/T | B | Identify the importance of skills in grant writing which comprise the phases used in the application process. |
| 7. | Literature searching | EBP | B | Understand how scientific literature is searched as well as summarize the results of health issue. |
| 8. | Leadership and evidence | L | B | Identify the need for a strong leadership from environmental/public health professionals regarding the need and importance of evidence-based environmental/public health interventions. |
| 9. | Role of behavioral science theory | T/T | B | Comprehend the role of behavioral science theory in implementing, designing, as well as evaluating strategies. |
| 10. | Leadership at all levels | L | B | Comprehend the importance of commitment from all stages of environmental/public health leadership while improving the use of evidence-based strategies. |
| 11. | Evaluation in “plain English” | EV | I | Identify the importance of translating the programs impacts or policies in language that can be understood by practice sectors, communities as well as policy makers. |
| 12. | Leadership and change | L | I | Identify the importance of effective leadership from professionals environmental/public health when making decisions in the middle of ever-changing milieus. |
| 13. | Translating evidence-based interventions | EBP | I | Identify the importance of translating evidence-based strategies to unique “real-world” settings. |
| 14. | Quantifying the issue | T/T | I | Comprehend the importance of descriptive epidemiology (concepts of person, place, time) in quantifying the environmental/public health problems. |
| 15. | Developing an action plan for program or policy | EBP | I | Comprehend the importance of developing an action plan that will shows how goals and objectives are to be achieved, what resources are needed, and how to share responsibility for achieving assigned objectives. |

| S/N | Title | Domain ^b | Level ^c | Competency |
|-----|---|---------------------|--------------------|--|
| 16. | Prioritizing health issues | EBP | I | Comprehend the selection process and implement relevant criteria as well as processes for prioritizing program and policy options. |
| 17. | Qualitative evaluation | EV | I | Make sure that the value of qualitative evaluation approaches together with the steps involved in conducting qualitative evaluations. |
| 18. | Collaborative partnerships | P/C | I | Comprehend the importance of collaborative partnerships amongst researchers as well as practitioners when implementing, designing and evaluating evidence-based policies and programs. |
| 19. | Nontraditional partnerships | P/C | I | Comprehend the importance of traditional partnerships and those that have been considered nontraditional for instance those with planners, transportation department, and others. |
| 20. | Systematic reviews | T/T | I | Comprehend the rationale, uses, as well as systematic reviews usefulness that document effective strategies. |
| 21 | Quantitative evaluation | EV | I | Comprehend the importance of quantitative evaluation methods together with the concepts of measurement validity as well as reliability. |
| 22 | Grant writing skills | T/T | I | Demonstrate the ability toward creating a grant together with an outline of the steps involved in the application procedure. |
| 23 | Role of economic evaluation | T/T | A | Identifying the importance of using economic data as well as strategies toward evaluating costs and consequences when making public/environmental health decisions. |
| 24 | Creating policy briefs | P | A | Comprehend the importance of writing concise policy briefs toward considering the problem using evidence-based strategies. |
| 25 | Evaluation designs | EV | A | Understand the different designs that is useful in program evaluation with a specific focus on quasi-experimental (nonrandomized) designs. |
| 26 | Transmitting evidence-based research to policy makers | P | A | Comprehend the importance of coming up with creative as well as novel ways of transmitting what we know works (evidence-based interventions) toward policy makers in order to gain interest, political support, and funding. |

^aAdapted from Gebbie et al., [97]; Brownson et al., [99].
^bC, community-level planning; E, etiology; P/C, partnerships and collaboration; EBP, evidence-based process; T/T, theory and analytic tools; L, leadership; EV, evaluation; P, policy.
^cB, beginner; I, intermediate; A, advanced.

Table 4.
 Competencies in evidence-based environmental/public Health.^a

the EBEPH procedure, requires a certain set of competences to be capable of making evidence-based decisions [99] (see **Table 4**). EBEPH training programs in the developed countries aimed at public and environmental health professionals in their various state health agencies were created toward addressing these as well as other related competencies, [2, 3, 52, 100], community-based organizations as well as local health departments [2, 3, 101, 102], along with related programs have remained established in many countries [96, 99]. Some programs demonstrate evidence of efficacy [52, 102]. In the most frequent format, the faculty team with competence in EBEPH employs didactic lectures, computer workshops, as well as scenario-based exercises. The training programs scope could remain increased through stressing a train-the-trainer method [96, 99]. Other formats were employed, together with Internet-based self-study [101, 103], CD-ROMs, [99] distance as well as distributed networks learning, along with technical support that are targeted. Educational training programs can be very effective in delivering “change agents” who are seen as professionals, but also share general goals as well as characteristics through the trainees [104]. A leadership and staff commitment aimed at life-long learning are also key ingredient toward training successes [105]. Training implementation toward addressing EBEPH competencies must be in accordance with the principles of adult education and learning. These occurred problems remained recently articulated with Bryan along with his collaborators [106], who have stressed the need toward (1) recognize the reason why the audience is learning; (2) use a fundamental motivation toward learning the necessity of problems solving; (3) build as well as respect preceding experience; (4) developing learning methods that are aligned with the development background as well as recipient’s diversity; and (5) actively participating with the participants in the education/learning process. Below are a sequential framework seven-stage steps, toward promoting better evidence use in everyday policy making (see **Figure 5**). It is remarkable to remember that this procedure is rarely a stringently linear or prescriptive one, nonetheless it must include several feedback “loops” as well as common processes that exist in multiple models’ program-planning.

14. Community assessment

Community (or needs) assessment is “a systematic set of procedures undertaken for the purpose of setting priorities and making decisions about program or organizational improvement and allocation of resources. The priorities are based on identified needs” [107]. Diverse forms of data, together with epidemiologic (quantitative) data, qualitative information, health inequalities on data, as well as health resource utilization patterns, might include a variation of community assessment. The first part of community or need assessment is very important in identifying a problem or an issue. A community assessment typically could begin through looking at baseline sources or background information about health issues in a community. These may comprise data from primary as well as secondary sources. Primary data encompass novel information collection on specific programs or study through using techniques like a community examination, focus groups and interviews, etc. Although, the community might mean people who reside inside a specified geographic area or as people sharing a communal experience or share a specific cultural or social identity sense [100]. When doing the assessment, it is likewise necessary in order to appropriately portray the spectrum of community members, toward recognizing any subgroups around the community of interest (for instance, adolescence, adults on lower-income). Hence, community

assessments might thus involve an attempt to recognize mortality as well as morbidity, environmental and organizational circumstances, current policies, along with significant associations between stakeholders. Community assessments examine the community health concerns, the variables influencing the health in a community (for instance, health determinants), and the resources, assets, as well as difficulties influencing these factors [107]. Assessment, ideally is a community process by which stakeholders together with members of the community and a wide range of community-based as well as government organizations turn out to be partners in community assessment as well as a shift from assessment toward action planning. While, community assessments remain critical toward ensuring appropriate priorities are been carried out. This is for the reason that they can make available an understanding of the importance of the community setting so that priorities stay planned, designed as well as implementing ways to leverage as well as maximizing the community benefit. Additionally, the assessments can be recognized (as well as in some cases improve) support aimed at specific priorities' methods. This significant support is garnering resources as well as safeguarding an intervention that is successful. Assessments can likewise be an important baseline measure for a series of circumstances. Hence, assessing community characteristically arises before program development or policy as well as seeks toward comprehending the public/environmental health challenges as well as interventions in a specified community. It likewise begins toward recognizing recent resources previously in place toward addressing this apprehension. Data is occasionally obtained from national as well as local data sets in addition to surveillance systems. Another useful information at this level is a written contextual documentation, or setting, within which the problem of health is happening, together with social assessment, economic, as well as physical conditions. Data for assessing community may be collected with qualitative (e.g., individual or group interviews) or quantitative (e.g., questionnaires) methods. The decision concerning what to look for need to remain guided through the assessment goal. For example, a youth-focused assessment may include factors other than age assessment. For example, an adolescence focused assessment may comprise diverse elements other than focusing on adult's assessment who are older. Bearing in mind, there remain likewise some useful general guiding principle to consider when engaged in assessment planning. It is remarkable toward assessing factors in particular along the full ecologic series of factors influencing the health of population as well as well-being, in doing so, including the community assets, besides not just the challenges. Ecologic frameworks indicate the influence on the behavior modification as well as social health of the individual and contextual factors [101]. Numerous changes have been proposed to the ecologic framework [55]. Based on work conducted, it is useful to consider assessment of factors at five levels:

1. Individual factors: individual characteristics include knowledge, skills, attitudes, and developmental history of a persons.
2. Interpersonal factors: social networks of formal as well as informal, including social support systems such as friends and family.
3. Organizational factors: organizational features, social institutions, as well as operational rules or regulations. Organizational factors assessments might not only include the institutional existence nevertheless change readiness as well as organizational capacity (e.g., organizational support, communication within and amongst policy making structures, organizations, leadership as well as availability of resources [100]).

4. Community factors: associations amongst economic forces, organizations, the physical milieu, as well as cultural changes that could shape people behavior
5. Government and policy issues: national, state and local laws, rules, as well as regulations

The use of the ecologic framework makes it possible to assess indigenous community people (their health as well as wellness and people's behaviors), the agencies as well as the organizations serving the community, and the milieu within which members of the community reside [35, 69, 108]. In detail, the greatest effective priorities act at multiple levels because societies are people who communicate with each other on different social networks within a specific context; thus, need assessment should help to understand this extensive variety of factors in general. Hence, **Table 3** shows a number of probable ecologic framework indicators aimed at each of these stages.

15. Developing an initial statement of the issue

Professionals must start with developing a brief description of the problem or issue being considered. In order to receive support on any issue (by the organization, a funding agency or decision makers), the issue should remain evidently articulated. This part of the problem definition corresponds to the initial stages of the strategic program planning process, which typically includes a description of the internal strengths as well as weaknesses, mission, threats and external opportunities as well as future vision. This typically helps define the gaps amongst the program current status or organization as well as the goals desired. The main mechanisms in statement issue comprise the condition of health or perceived risk factor, number of affected population(s), the size and the problem scope, potential stakeholders as well as prevention opportunities.

16. Quantifying the issue

Once important information about a public health problem has been established, it is often helpful to identify the root sources of the prevailing data. Just as such data might depend on recent vital statistical data (records of death/birth), special surveys, surveillance systems or other national studies. In public/environmental health, qualitative studies could take many forms. The utmost popular descriptive type of study consists of scientifically effective sample survey of the people of interest (a representative cross section). This type of cross-sectional studies was not designed toward changing health status (like an intervention) but then to help determine the prevalence of quantifying behaviors, exposures, characteristics as well as diseases at a period (or point) of time, especially in a population that is defined. This information can help to understand the magnitude toward public/environmental health challenge at hand. Qualitative studies usually offer information about the designs of occurrence according to such individual attributes place (e.g., county of residence), (e.g., gender, age, ethnicity), as well as time (e.g., seasonal changes in the patterns of disease). In addition, cross-sectional data may in certain circumstances, offer used information in the design of analytic studies (e.g., baseline information/data toward evaluating the advantages of public/environmental health intervention).

17. Determining what is known from scientific literature

When problem to be addressed are clearly defined, professionals should be knowledgeable of prior or continuing efforts toward resolving the issue. This ought to comprise a systematic method for identifying, retrieving, as well as evaluating appropriate scientific reports based on research, panels, as well as conferences associated toward the issue of interest. The best way to start this investigation is through a formal study of the official literature review. Much databases information is available toward facilitating such a review; the best known of these public/environmental health purposes remain Scirus (Elsevier), MEDLINE Ovid, PubMed, ProQuest Dissertations and theses, CINHALL EBSCO Host, Web of Knowledge, Research Gate, Scopus/Elsevier, Mendeley, Geobase/Elsevier, Environment Complete/Ebsco, Campbell Collaboration databases, Google Scholar, Google Web, SSRN, Academia etc. These subscribed databases through an institution, can selectively remain accessible in the Internet, or occasionally the public can access it from institutions (like the National Library of Medicine [110], Hinari, Universities, Research4life as well as public libraries). There are also a number of organizations that sustain Internet sites that help identify appropriate information, together with several government health departments, the World Health Organization, Centers for Disease Control and Prevention, as well as the National Institutes of Health etc. It is remarkable to note that the published literature does not cover all (Type 2) intervention studies (see **Table 1**).

18. Developing and prioritizing program options

The first three phases examine a number of policy options or health program. The options list can remain expanded from various sources. Preliminary review from scientific literature may occasionally shed light on different priorities options. In most cases, a group of expert panels can provide advice on policy recommendations or program on various issues. A summary of the available evidence is usually provided in systematic reviews and practice guidelines. There are numerous assumptions or circumstances that underlie every development options. Five key focus areas are covered through these considerations: demographic, economic, political/regulatory, social values, as well as technological [2, 3, 111]. Specifically, it is remarkable toward assessing as well as monitoring the policy process once developing a crucial option in health policy. Doing so, stakeholder contribution can be suitable. The policy stakeholder may be health policy makers, while community intervention through coalition stakeholder may be a member of the community. With regard to health policies, supportive decision makers may often offer guidance on policy initiatives timing, problem-solving strategies, identifying sponsorship strategies, as well as techniques toward improving general public support. On the topic of community priorities, additional planning information can consist of significant informant interviews, coalition member surveys or focus groups [112].

19. Developing an action plan together with implementing priorities

This reform procedure has a profound impact on strategic planning snags. As soon as the option has remained carefully chosen, a set of goals as well as objectives must remain developed. The goal is a lasting desired variable in the intervention's status of related health need, as well as short-term objective, measurable, definite action leading in the direction of goal attainment. The action course describes how

to achieve the goals together with objectives, what required resources are needed, as well as how accountability aimed at achieving assigned objectives.

20. Evaluating the policy or program

Simply put, evaluation is a work experiment that has achieved policy goals as well as program objectives. After established research design, many public/environmental health policies as well as programs are frequently examined using a “quasiexperimental” designs (i.e., people lacking haphazard assignment toward intervention as well as comparison groups). Generally, the strongest appraisal designs recognize the roles of both parametric as well as non-parametric evaluation. In addition, evaluation designs tool must be flexible as well as sensitive enough toward measuring average variability, even individuals falling short of behavioral changes. Genuine variables take incremental place over time, in many ways frequently not known toward those individuals closest to the intervention.

21. Barriers to more extensive use of evidence in decision making

Several obstacles are present in the decision-making process to better employ data and analytical processes [51, 64, 113] (Table 5). Others have explored possible

| S/N | Barrier | Potential solution |
|-----|---|--|
| 1. | Inadequate resources | Commitment to increase funding for prevention and rectifying staff shortages |
| 2. | Leadership lacks and uncertainty in setting a clear and focused agenda for evidence-based approaches | Commitment from all levels of environmental/public health leaders to increase the understanding of the value of EBEPH approaches |
| 3. | Inadequate incentives for using evidence-based approaches | Identification of new ways of shaping organizational culture toward supporting EBEPH |
| 4. | Inadequate view of the long-term “horizon” for program implementation and evaluation | Adoption and adherence to causal frameworks and formative evaluation plans |
| 5. | External (including political) pressures drive the process away from an evidence-based approach | Systematic communication and dissemination strategies |
| 6. | Inadequate training in key public health disciplines | Wider dissemination of new and established training programs, including use of distance learning technologies |
| 7. | Inadequate time to gather information, analyze data, and review the literature for evidence | Enhanced skills for efficient analysis and review of the literature, computer searching abilities, use of systematic reviews |
| 8. | Inadequate evidence on the effectiveness of certain environmental/public health interventions for special populations | Increased funding for applied environmental/public health research; better dissemination of findings |
| 9. | Inadequate information on implementation of interventions | A greater emphasis on building the evidence base for external validity |

Source: Adapted from Brownson et al., [39].

Table 5. Potential barriers and solutions for use of evidence-based decision making in environmental/public health.

| 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 Anderson et al. [115]; Brownson et al., [39] and Raimi et al., [2].

Table 6.

Factors influencing decision making amongst environmental/public health administrators, decision makers, and the general public.

methods to overcome these obstacles [2, 3, 100]. The necessity for and relevance of evidence-based decision-making is the leadership that environmental and public health professionals need. Such leadership is apparent in training programs, for instance the regional environmental and public health leadership network [107] and continuous efforts to establish and distribute documented evidence-based recommendations for intervention [79].

However, numerous factors affect environmental/public health decision-making [114, 115] (see **Table 6**). Some of these variables are under the control of environmental/public health practitioners, while others are very difficult to change.

Also, there are quite at least four techniques in which environmental/public health policy or program cannot achieve a specific success goal:

- i. Choose an intervention forms whose effectiveness in scientific literature has not yet been confirmed.
- ii. Choosing a policy or program that may be effective but only attaining frail, partial implementation or “reach,” thus worsening to accomplish the objectives (few call this Type III error)

- iii. Assessing insufficient or improper evaluation that led to public ignorance of the impacts of a policy or program
- iv. Paying insufficient consideration toward acclimatizing an intervention between population as well as background 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 will not wear masks think the virus is not risky, since they do not think masks work, or just as their leaders including 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 point is a person. And with something like the coronavirus, where people are so deeply affected, there is need to think about the ethics of intervening in people's lives."

22. Addressing the issue

While, the 2020 COVID-19 pandemic unlocked our eyes toward the ever-changing situations as well as uncertainty that prevail in today world, particularly with regards to environmental and public health practices disruption. Due to the unprecedented novel nature and scale of coronavirus as well as the worldwide public/environmental health crisis nature, which upended several public/environmental research norms almost overnight. Though, the virus is expected with further waves as well as more pandemics increase is anticipated. COVID-19 had demonstrated a global catastrophe that touched everybody, including the scientific community. As we respond and recover rapidly from this pandemic, there is an opportunity to guarantee that the fabric of our society includes sustainability, fairness, and care. However, approaches to environmental health attempt to decrease the populations burden of COVID-19, toward saving patients from becoming ill along with preserving the allocation of clinical resources and public safety standards.

Even though the coronavirus continues to surge globally, the COVID-19 pandemic continues to put the health as well as economic security of millions of Nigerians and the world at large at risk, evidence is building and has accumulated over the course of the COVID-19 pandemic, scientific understanding about the virus has changed. Overall, to improve evidence-based or proven practices, every option must attempt to give practical recommendations on how programs and policies based on evidence in environmental and public health settings may be selected, implemented and evaluated. It also addresses the need for a highly trained environmental/public health workforce and expands available technologies, hence study into the origins of infectious diseases and the creation of vaccinations and medicines that have triggered formerly deadly diseases such as polio, smallpox and now COVID-19. Thus, the successful EBE/PH implementation in the practice of public/environmental health is both scientific as well as art. Science is based on behavioral, epidemiologic, as well as policy research that reflects the size with the magnitude of the public/environmental health issues and which interventions probable are to be of advantage to problem solving. The policy-making art experience usually comprises understanding of what information that is significant toward a specific stakeholder at the appropriate time. Remarkable environmental/public

health decisions should balance science as well as art, because rational, scientific-based policy making that frequently comprises selecting an option amongst set of choices that are rational in nature.

By using the outlined concepts in EBE/PH above, decision making are ultimately improving environmental/public health practice; this is particularly important in a times when environmental/public health practitioners should be incentivized, not disincentivized, toward providing remote and long-term care and if implemented as well as maintained successfully in the post COVID era, this could benefit from our efforts as well as welcome efficiency consequence and cost savings [3–5, 15, 16]. These efforts can assist toward adapting effective interventions strategies to improve the pandemic response to COVID-19. However, suppression of the COVID-19 pandemic, cannot depend solely on the hope that effective vaccines as well as medical treatment, especially having the new, fast spreading SARS-CoV-2 variants: thus, an effective behavioral, environmental, social and systems interventions (BESSI) known as “Plan B” is needed to cut transmission. Given the pandemic, Covid-19 is probable to remain around to at least first quarter of 2022 (hypothetically followed via seasonal outbreaks), even if an effective treatments or vaccine is established, it is essential to deal with Behavioral, Environmental, Social and Systems Interventions (BESSI) now and establish long-term research priorities and processes for improving evidence on BESSI Interventions toward preventing as well as managing outbreaks of futuristic infectious diseases through fostering research synthesis, systems thinking, incorporating interprofessionalism and team-based care, piloting, prioritization, as well as field trials in partnership with health organizations, communities, policy makers, as well as an array of relevant researchers to BESSI research strategy (see **Figure 6**).

Furthermore, there is need to fund evidence-based projects that will focus on recognizing condition of a health or disease, aimed at which there is need for community support intervention as well as engagement toward addressing the issues, articulate a cultural appropriateness process must be established and recognizing community strengths as well as resiliencies, advancing knowledge must be promoted to address the condition of health or disease by etiologic research, prevention research, building robust frameworks for governance, oversight, and accountability, treatment or research recovery, or dissemination as well as implementation research and accounting for sustainability in test communities

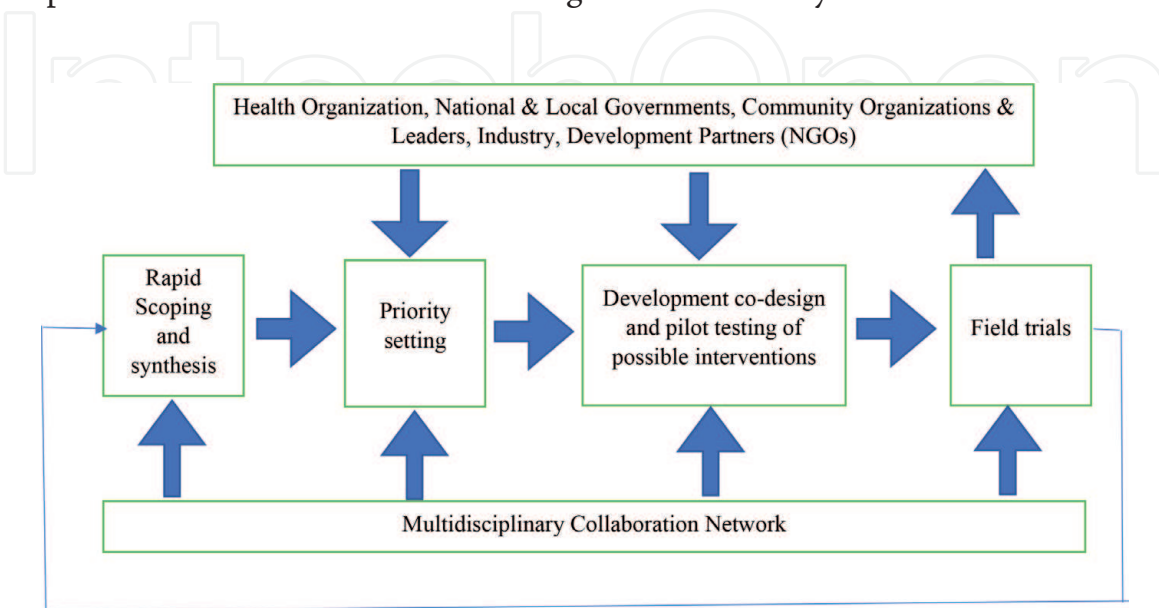


Figure 6. Behavioral environmental social and system intervention (BESSI) (for pandemic preparedness) research strategy. Adapted from [116].

and for dissemination and scale up to other communities as indicated. Hence, real-world evidence could significantly improve public health (community medicine, preventive medicine, social medicine, as well as community health) decisions throughout the health system, eventually improving environmental health. However, expanding its usage, will need multi-stakeholder engagement on numerous priorities, along with country-specific initiatives. Therefore, the broader public/environmental health community is best positioned toward making progress in addressing individual behaviors, social circumstances, or environmental factors associated with a disorder or disease. Making improvement on such goals will thereby help contribute to the creation of a culture where evidence-based innovation may thrive, while also ensuring that the required, complementary proficiencies occur toward supporting traditional research and development (R&D) operations activities. Likewise, governments at all levels must act expeditiously and aggressively in providing robust support for crucial national public/environmental health as well as health care programs, the development of medical countermeasures, global readiness and response mechanism programs as well as international collaborations. So as to reduce the virus effects. National as well as international response prompt action are now needed to respond and prevent worst case health as well as economic repercussions. Based on the identified realities of the present COVID-19 pandemic, it seems that government must urgently take additional steps now to prepare domestically and to invest globally and to help make the shift from containment of the virus to mitigation of its effects. This shift will be difficult, and the response will be exceptionally resource intensive. Response as well as readiness toward threats to health security like COVID-19 is as critical to the safety as well as well-being of humanity. Preparedness for emergency situations have been essential for increasing national resilience and capacities to combat health risk emergencies. There is need to build systems to strengthen evidence-based research and expertise must remain sustained as well as bolstered. With the intention of reducing death as well as diseases in the current dark times and time to come. The COVID-19 pandemic provides a unique opportunity to discuss critical issues related to defining living reviews and how often they should be conducted. It has significantly accelerated the production of living reviews as a useful tactic toward informing decision makers in a context where evidence is constantly evolving on a regular (sometimes even on a daily basis). Since 'living' reviews are most useful in a context where information is changing relatively frequently on a topic, so hopefully an update is expected to be happening at pace with evolving literature. From this perspective, part of the requirements of a living review should be that there is a positive plan to monitor for new relevant data or evidence, and a plan for managing this evidence when it emerges. Hence, there is needs to be a plan for incorporating new information as it emerges, with the aim that decisions that are made on the basis of the reviews can be relied on or trusted to be informed by the best current evidence. Thus, the framework above provides an important Living Evidence Network criterion from a positive sense (i.e., the question must be an important priority, there is uncertainty in the outcomes, and that new forthcoming evidence can likely improve this certainty). It is important to assess whether or not the review should no longer be updated on a living basis if at least one of these characteristics are no longer true. As we have seen with COVID-19, the frequency of updating may vary depending on the rate at which new research is coming through and its likely impact on the evidence base, but whatever frequency is adopted this needs to be communicated clearly together with the intent to keep the review under active surveillance. While, communicating with users and readers about the currency and comprehensiveness of the evidence.

23. Conclusion

Conclusively, as the Chinese proverb used to say “Problems give opportunity and changes, and the gods cannot help those who do not take advantage of this opportunity”. Out of a disaster provide opportunities toward building a safer, healthier, as well as a more just world. In all these domains, addressing health toughest triage will be crucial and will help strengthen and maintain the scientific integrity as well as political neutrality of action on human and environmental health in the times of concurrent international crises. Of course, this is not only a response toward COVID-19, but also for the full gamut of health challenges. Time has come toward revitalizing and rethinking governance, policies, as well as investments in scientific research for better health, which precede a more sustainable future for global as well as national health leadership in preparedness, response, and health recovery for emergencies, which will necessitate a range of research methods and analytic decisions. Increased focused attention toward these approaches and analytic decisions has the potential toward increasing the importance of policies and its uses toward health systems strengthening, hence potentially assisting policy makers toward improving mitigation efficiency while concurrently improving global and national health, with an attempt toward drawing remarkable lessons for strengthening pandemic preparedness as well as response. While the response to COVID-19 is constantly evolving and the situation is constantly changing, how a country respond to an outbreak depends on the resilient of its health systems, effective response is needed to fight the immediate outbreak and reduce its downstream impact on health. In general, environmental and public health research analyses as well as comprehensive health systems in all countries which may include integrated core capacities for environmental/public health at all governance levels, will be the best protection/defense against other major great pandemic outbreak. Therefore, sound national planning/preparedness necessitates visibly a comprehensive states situation of the capabilities toward predicting, managing as well as balancing public/environmental requirements at all pandemic stages. This requires leveraging data for rapid, accurate as well as reliably impacting on effective public/environmental policies on health, hence converting this intelligence into actionable solutions will thereby ensure shared accountability. The boundary amongst action as well as inaction is rarely separate. Scientific evidence along with values assessment, costs, preferences, as well as several benefits options must be carefully considered. Hence, this discovery as well as its plausible explanation therefore point to the necessity for far greater proof of evidence. There is therefore evidence requirement around the risks as well as discrete benefits of biologically tailored COVID-19 interventions as well as how these risks along with benefits differ across various population subgroups. Other recommendations include:

1. Investment in Behavioral Environmental Social and System Intervention (BESSI): Whilst the limited investment in BESSIs to date is a missed opportunity, we should learn from this pandemic to prepare for rapid, effective response to future pandemics. As BESSI collaboration should help develop rigorous “research in action”, with researchers and those tasked with implementing programmes working together. Thus, there is need to consider how to efficiently set research priorities and how to work more closely with WHO which potentially has the infrastructure to collate BESSI protocols that might be developed and then adapted for future pandemics. While a few examples of this have occurred, many public/environmental health and clinical services have felt too overwhelmed to engage with researchers, but clearly it is possible and we can learn from those that did engage.

2. **Collective Collaboration/Partnership:** Geographical hubs for BESSI collaborators will enable meaningful research interactions and activities between the global north and south. There is need to avoid designing research in the global north and then contextualizing it for the south. This interaction needs to be bidirectional and co-designed. As BESSI need to focused on funders, researchers, and major international organizations, while there is need to start to engage with some health professional organizations such as WFPHA, EHORCON, PAHO, etc.
3. **Emphasis on Practice-Based Research:** Research in environmental health is incremental, through a body of scientifically compiled evidence over a period of several years or decades. Hence, environmental health information for decision making should be founded on science, and science is based on the collection, analysis, and interpretation of data. Data in environmental/public health are generally derived from two overlapping sources: research studies and environmental/public health surveillance systems. Indeed, there is the need for a more practice-based research in which environmental/public health practitioners routinely collect as well as record data on the COVID-19 treatment and outcomes of their patients in order to better care for those in the future? Hence, there is pressing need for evidence development. More and better evidence including comparative as well as longitudinal data is required to determine the effectiveness and usefulness of novel medical interventions, drugs, treatments, devices, and genetic information.
4. **Clear Uncertainty:** The exposed uncertainty through the information environment. An irony of the information-rich environment is that information imperative for decision making is frequently not available, or is provided in ways that are not relevant to the broad spectrum of patients with differing levels of health, socioeconomic circumstances, and preferences, as well as the issues encountered in practice. This is due to too little research effectiveness, to poor evidence dissemination that is available, and to too few incentives as well as decision supports for evidence-based care. Hence, there is need for a rapid review on public/environmental health topics driving by: 1) emergence of new evidence (sometimes even on a daily basis 2–3 months into the pandemic; 2) research designs of available evidence, and likelihood that more rigorous designs may provide greater certainty in the findings; and 3) emergence of evidence that ‘add’s something new’. Also, it is found that the frequency of updating a living review has changed from earlier in the pandemic to now.
5. **Credible and Capable Leadership:** Broad leadership that stems from any part of the world will be needed to adapt to taking advantage from changes in the healthcare milieu. Involvement of the private sectors, public, policy makers, patients, providers, insurers, as well as other development partners working together in the steps toward transformation will require a planned focus on evidence development as well as required application. Else, there is need for a shift toward a culture of collective learning. Investment in infrastructure is essential to produce best proof of evidence for environmental/public health delivery which meets the requirements of individual patients (see **Table 2**), and aimed at collecting along with analyzing healthcare data as well as information, along with standards and protocols toward ensuring their reliability and accuracy. This evolving role will necessitate a culture which promotes the application of evidence along with its generation in patients and healthcare providers.

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Authors' contributions

All authors included in the manuscript provided substantial contribution to (i) conception and design, (ii) drafting the article or revising it critically for important intellectual content and (iii) final approval of the completed manuscript.

Declaration of 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 government, not-for-profit sectors or commercial institutions.

Abbreviations

| | |
|---------|---|
| HIA | Health Impact Assessment |
| WFPHA | World Federation of Public Health Associations |
| PAHO | Pan American Health Organization |
| SDoH | Social Determinant of Health |
| BESSI | Behavioral Environmental Social and System Intervention |
| EHORCON | Environmental Health Officers Registration Council of Nigeria |

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