

EVIDENCE-BASED PUBLIC HEALTH

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THIRD EDITION



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We dedicate this book to our close colleague and friend, Terry Leet. He was one of the original contributors to our training program in Evidence-Based Public Health and an author on previous editions of this book. Terry was an outstanding scholar and teacher, and we miss him every day.

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FOREWORD

Evidence-based public health has become an often-used phrase by both practitioners and policymakers. However, its meaning and proper place in the development, conduct, and evaluation of public health programs and policies are often misunderstood. When we hear the word *evidence*, most of us conjure up the mental picture of a courtroom, with opposing lawyers presenting their evidence, or of law enforcement personnel sifting through a crime scene for evidence to be used in judicial proceedings.

Evidence, so central to our notion of justice, is equally central to public health. It should inform all of our judgments about what policies, programs, and system changes to implement, in what populations, and what will be the expected result. For example, “Is the goal to improve the health and well-being of the target population equally, or to also reduce health inequities, because the distribution of ill-health and injuries is so skewed in virtually all geopolitical units?”

In public health, there are four principal user groups for evidence. Public health practitioners with executive and managerial responsibilities and their many public and private partners want to know the evidence for alternative strategies, whether they are policies, programs, or other activities. Too infrequently do busy practitioners find the time to ask the fundamental question, “What are the most important things I can do to improve the public’s health?” In pursuit of answers, population-based data are the first prerequisite, covering health status, health risks, and health problems for the overall population and sociodemographic subsegments. Also important are the population’s attitudes and beliefs about various major health problems.

The second prerequisite is data on potential interventions. What is the range of alternatives? What do we know about each? What is their individual and conjoint effectiveness in improving health in the populations we are serving? And what is the relative health impact per dollar invested for single or combined interventions? This marriage of information can lead to a rational prioritization of opportunities, constrained only by resources and feasibility.

More often, public health practitioners and their partners have a narrower set of options. Funds from national, state, or local governments are earmarked

for a specific purpose, such as surveillance and treatment of sexually transmitted infections, inspection of retail food establishments, or treatment for substance abusers. Still, practitioners have the opportunity, even the obligation, to survey the evidence carefully for alternative ways to achieve the desired health goals be they population wide or more narrowly focused.

The next user group includes policymakers at local, regional, state, national, and international levels. As elected public stewards, they are faced with macro-level decisions on how to allocate the public resources. These responsibilities often include making policies on controversial public issues. Under what conditions should private gun ownership be allowed? How much tax should be levied on traditional cigarettes, and how should these tax revenues be used? Should e-cigarettes be taxed the same as combustibles? Should needle exchange programs be legal for intravenous drug addicts? Should treatment be the required alternative for perpetrators of nonviolent offenses who committed crimes while abusing alcohol or other drugs? What are the best strategies to reverse the obesity epidemic? Good politicians want to know the evidence for the effects of options they are being asked to consider or may want to propose.

Key nongovernmental stakeholders are a third user group for evidence. This group includes many organizations whose missions focus on or include improving health, directly or through enhancing the social and physical environments that are key population health determinants. Other stakeholders include the public, especially those who vote, as well as interest groups formed to support or oppose specific policies or programs. Issues abound, ranging from the legality and accessibility of abortion, to what foods should be served at public schools, or whether home visiting for the families of neonates should be a required health care benefit. Although passion on these issues can run high, evidence can temper views or suggest a feasible range for compromise. Sometimes voters are asked to weigh in on proposed policies through local or state initiative processes. Many of these, from clear indoor air ordinances to water and air regulatory changes or legalizing marijuana, can greatly affect the health of the public.

The final user group is composed of researchers on population health issues. They seek to evaluate the impact of specific policies or programs. Part of their critical role is to both develop and use evidence to explore research hypotheses. Some are primarily interested in the methods used to determine the quality and implications of research on population-based interventions. They frequently ask, "Was the study design appropriate?" and "What are the criteria for determining the adequacy of the study methods?" Others look at the factors that facilitate or retard progress in translating evidence into practice, or in what range of situations an evidence-based intervention can be applied with confidence as to its effectiveness. And an increasing

number of researchers are looking at how to model the effects and relative cost-effectiveness to a particular population, and how to determine the likely impacts over time.

This volume should be sweet music to all of these groups. Anyone needing to be convinced of the benefit of systematic development and synthesis of evidence for various public health purposes will quickly be won over. A step-by-step approach to compiling and assessing evidence of what works and what does not is well explicated. In a logical sequence, the reader is guided in how to use the results of his or her search for evidence in developing program or policy options, including the weighing of benefits versus barriers, and then in developing an action plan. To complete the cycle of science, the book describes how to evaluate whatever action is taken. Using this volume does not require extensive formal training in the key disciplines of epidemiology, biostatistics, or behavioral science, but those with strong disciplinary skills will also find much to learn from and put to practical use here.

If every public health practitioner absorbed and applied the key lessons in this volume, public health would enjoy a higher health and financial return on the taxpayer's investment. Armed with strong evidence of what works, public health practitioners could be more successful in competing for limited public dollars because they would have strong evidence of what works that is easy to support and difficult to refute. The same standard of difficult-to-refute evidence is much less common in competing requests for scarce public resources.

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PREFACE

As we finish this third edition of *Evidence-Based Public Health*, we reflect on the promise and challenges for public health. There are tangible examples where the gap between research and practice has been shortened. This may be best illustrated over the twentieth century in the United States, where life expectancy rose from 49 years in 1900 to 77 years in 2000. In large part, this increasing longevity was due to the application of public health advances on a population level (e.g., vaccinations, cleaner air and water, tobacco control policies). Yet for every victory, there is a parallel example of progress yet to be realized. For example, effective treatment for tuberculosis has been available since the 1950s, yet globally tuberculosis still accounts for 2 million annual deaths, with 2 billion people infected. In many ways, the chapters in this book draw on successes (e.g., what works in tobacco control) and remaining challenges (e.g., how to achieve health equity for populations lacking in basic needs of food, shelter, and safety).

Although there are many underlying reasons for these health challenges, our lack of progress on certain public health issues illustrates gaps in applying principles of evidence-based public health. There are at least four ways in which a public health program or policy may fall short in applying these principles:

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

To enhance evidence-based decision making, this book addresses all four possibilities and attempts to provide practical guidance on how to choose, adapt,

carry out, and evaluate evidence-based programs and policies in public health settings. It also begins to address a fifth, overarching need for a highly trained public health workforce.

Progress will require us to answer questions such as the following:

- Are we applying the evidence that is well established in scientific studies?
- Are there ways to take the lessons learned from successful interventions and apply them to other issues and settings?
- How do we foster greater leadership and stronger political will that supports evidence-based decision making?
- How do we develop and apply incentives so that practitioners will make better use of evidence?
- What lessons from one region of the globe can be applied in a different country?

The original need for this book was recognized during the authors' experiences in public health and health care organizations, legislatures, experiences in the classroom, and discussions with colleagues about the major issues and challenges in finding and using evidence in public health practice. This edition retains our "real-world" orientation, in which we recognize that evidence-based decision making is a complex, iterative, and nuanced *process*. It is not simply a need to use only science-tested, evidence-based interventions. In some cases, the intervention evidence base is developing in light of an epidemic (e.g., control of Zika virus)—hence the need to base decisions on the best *available* evidence, not the best *possible* evidence. It also requires practitioners to remember that public health decisions are shaped by the range of evidence (e.g., experience, political will, resources, values), not solely on science.

Our book deals not only with finding and using *existing* scientific evidence but also with implementation and evaluation of interventions that *generate* new evidence on effectiveness. Because all these topics are broad and require multidisciplinary skills and perspectives, each chapter covers the basic issues and provides multiple examples to illustrate important concepts. In addition, each chapter provides linkages to diverse literature and selected websites for readers wanting more detailed information. Readers should note that websites are volatile, and when a link changes, a search engine may be useful in locating the new web address.

Much of our book's material originated from several courses that we have taught over the past 15 years. One that we offer with the Missouri Department of Health and Senior Services, "Evidence-Based Decision-Making in Public Health," is designed for midlevel managers in state health agencies and leaders of city and county health agencies. We developed a national version of this course with the National Association of Chronic Disease Directors and

the Centers for Disease Control and Prevention (CDC). The same course has been adapted for use in many other US states. To conduct international trainings, primarily for practitioners in Central and Eastern Europe, we have collaborated with the CDC, the World Health Organization/Pan American Health Organization, and the CINDI (Countrywide Integrated Noncommunicable Diseases Intervention) Programme. This extensive engagement with practitioners has taught us many fundamental principles, gaps in the evidence-based decision-making process, reasons for these gaps, and solutions.

The format for this third edition is very similar to the approach taken in the course and the second edition. Chapter 1 provides the rationale for evidence-based approaches to decision making in public health. In a new chapter (chapter 2), we describe approaches for building capacity in evidence-based decision making. Chapter 3 presents concepts of causality that help in determining when scientific evidence is sufficient for public health action. Chapter 4 describes economic evaluation and some related analytic tools that help determine whether an effective intervention is worth doing based on its benefits and costs. The next seven chapters lay out a sequential framework for the following:

1. Conducting a community assessment
2. Developing an initial statement of the issue
3. Quantifying the issue
4. Searching the scientific literature and using systematic reviews
5. Developing and prioritizing intervention options
6. Developing an action plan and implementing interventions
7. Evaluating the program or policy

Although an evidence-based process is far from linear, these seven steps are described in some detail to illustrate their importance in making scientifically based decisions about public health programs and policies. We conclude with a chapter on future opportunities for enhancing evidence-based public health.

This book has been written for public health professionals without extensive formal training in the public health sciences (i.e., behavioral science, biostatistics, environmental and occupational health, epidemiology, and health management and policy) and for students in public health and preventive medicine. It can be used in graduate training or for the many emerging undergraduate public health programs. We hope the book will be useful for state and local health agencies, nonprofit organizations, academic institutions, health care organizations, and national public health agencies. Although the book is intended primarily for a North American audience, this third edition draws more heavily on examples from many parts of the world, and we believe that although contextual conditions will vary, the key principles and skills outlined are applicable in both developed and developing countries. Earlier

editions of *Evidence-Based Public Health* were translated into Chinese and Japanese and have been used in training programs for practitioners in Latin America, Europe, and the Middle East. Training-related materials are available at: <http://www.evidencebasedpublichealth.org/>.

The future of public health holds enormous potential, and public health professionals have more tools at their fingertips than ever before to meet a wide range of challenges. We hope this book will be a useful resource for bridging research with the policies and the practice of public health. With focused study, leadership, teamwork, persistence, and good timing, the promise of evidence-based decision making can be achieved.

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Perhaps most important, we thank the thousands of dedicated public health practitioners who have taken our courses and have added many critical ideas to the discourse on evidence-based decision making in public health.

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CHAPTER 1



The Need for Evidence-Based Public Health

Public health workers . . . deserve to get somewhere by design, not just by perseverance.
McKinlay and Marceau

Public health research and practice are credited with many notable achievements, including much of the 30-year gain in life expectancy in the United States over the twentieth century.¹ A large part of this increase can be attributed to provision of safe water and food, sewage treatment and disposal, tobacco use prevention and cessation, injury prevention, control of infectious diseases through immunization and other means, and other population-based interventions.

Despite these successes, many additional challenges and opportunities to improve the public's health remain. To achieve state and national objectives for improved public health, more widespread adoption of evidence-based strategies has been recommended.²⁻⁶ Increased focus on evidence-based public health (EBPH) has numerous direct and indirect benefits, including access to more and higher quality information on what works, a higher likelihood of successful programs and policies being implemented, greater workforce productivity, and more efficient use of public and private resources.^{4, 7}

Ideally, public health practitioners should always incorporate scientific evidence in selecting and implementing programs, developing policies, and evaluating progress. Society pays a high opportunity cost when interventions that yield the highest health return on an investment are not implemented (i.e., in light of limited resources, the benefit given up by implementing less effective interventions).⁸ In practice, decisions are often based on perceived short-term opportunities, lacking systematic planning and review of the best

evidence regarding effective approaches. Still apparent today,⁹ these concerns were noted nearly three decades ago when the Institute of Medicine determined that decision making in public health is too often driven by “. . . crises, hot issues, and concerns of organized interest groups” (p. 4).¹⁰ Barriers to implementing EBPH include the political environment (including lack of political will) and deficits in relevant and timely research, information systems, resources, leadership, organizational culture, and the ability to connect research with policy.^{11–15}

Nearly every public health problem is complex,¹⁶ requiring attention at multiple levels and among many different disciplines. Part of the complexity is that populations are affected disproportionately, creating inequities in health and access to resources. Partnerships that bring together diverse people and organizations have the potential for developing new and creative ways of addressing public health issues.¹⁷ Transdisciplinary research provides valuable opportunities to collaborate on interventions to improve the health and well-being of both individuals and communities.^{18,19} For example, tobacco research efforts have been successful in facilitating cooperation among disciplines such as advertising, policy, business, medical science, and behavioral science. Research activities within these tobacco networks try to fill the gaps between scientific discovery and research translation by engaging a wide range of stakeholders.^{20,21} A transdisciplinary approach has also shown some evidence of effectiveness in obesity prevention by engaging numerous sectors, including food production, urban planning, transportation, schools, and health.²²

As these disciplines converge, several concepts are fundamental to achieving a more evidence-based approach to public health practice. First, we need scientific information on the programs and policies that are most likely to be effective in promoting health (i.e., undertake evaluation research to generate sound evidence).⁴ An array of effective interventions is now available from numerous sources, including the *Guide to Community Preventive Services*,²³ the *Guide to Clinical Preventive Services*,²⁴ Cancer Control PLANET,²⁵ the Cochrane Reviews,²⁶ and the National Registry of Evidence-based Programs and Practices.²⁷ Second, to translate science to practice, we need to marry information on evidence-based interventions from the peer-reviewed literature with the realities of a specific real-world environment.^{28,29} To do so, we need to better define processes that lead to evidence-based decision making.³⁰ Third, wide-scale dissemination of interventions of proven effectiveness must occur more consistently at state and local levels.³¹ And finally, we need to more effectively build collaborations and networks that cross sectors and disciplines.

This chapter includes three major sections that describe (1) relevant background issues, including a brief history, definitions, an overview of evidence-based medicine, and other concepts underlying EBPH; (2) several key characteristics of an evidenced-based process that crosses numerous disciplines; and (3) analytic tools to enhance the uptake of EBPH and the

disciplines responsible. A major goal of this chapter is to move the process of decision making toward a proactive approach that incorporates effective use of scientific evidence and data, while engaging numerous sectors and partners for transdisciplinary problem solving.

BACKGROUND

Formal discourse on the nature and scope of EBPH originated about two decades ago. Several authors have attempted to define EBPH. In 1997, Jenicek defined EBPH as the "... conscientious, explicit, and judicious use of current best evidence in making decisions about the care of communities and populations in the domain of health protection, disease prevention, health maintenance and improvement (health promotion)."³² In 1999, scholars and practitioners in Australia⁵ and the United States³³ elaborated further on the concept of EBPH. Glasziou and colleagues posed a series of questions to enhance uptake of EBPH (e.g., "Does this intervention help alleviate this problem?") and identified 14 sources of high-quality evidence.⁵ Brownson and colleagues described a multistage process by which practitioners are able to take a more evidence-based approach to decision making.^{4,33} Kohatsu and colleagues broadened earlier definitions of EBPH to include the perspectives of community members, fostering a more population-centered approach.²⁸ Rychetnik and colleagues summarized many key concepts in a glossary for EBPH.³⁴ There appears to be a consensus that a combination of scientific evidence, as well as values, resources, and context should enter into decision making (Figure 1.1).^{2,4,34,35} A concise definition emerged from Kohatsu: "Evidence-based public



Figure 1.1: Domains that influence evidence-based decision making.

Source: From Satterfield et al.³⁵

health is the process of integrating science-based interventions with community preferences to improve the health of populations” (p. 419).²⁸ Particularly in Canada and Australia, the term “evidence-informed decision making” is commonly used.^{36,37} In part, the “evidence-informed” description seeks to emphasize that public health decisions are not based *only* on research.³⁸

In addition, Satterfield and colleagues examined evidence-based practice across five disciplines (public health, social work, medicine, nursing, and psychology) and found many common challenges, including (1) how evidence should be defined; (2) how and when the patient’s and/or other contextual factors should enter the decision-making process; (3) the definition and role of the experts or key stakeholders; and (4) what other variables should be considered when selecting an evidence-based practice (e.g., age, social class).³⁵

Defining Evidence

At the most basic level, evidence involves “the available body of facts or information indicating whether a belief or proposition is true or valid.”³⁹ The idea of evidence often derives from legal settings in Western societies. In law, evidence comes in the form of stories, witness accounts, police testimony, expert opinions, and forensic science.⁴⁰ Our notions of evidence are defined in large part by our professional training and experience. For a public health professional, evidence is some form of data—including epidemiologic (quantitative) data, results of program or policy evaluations, and qualitative data—that is used in making judgments or decisions (Figure 1.2).⁴¹ Public

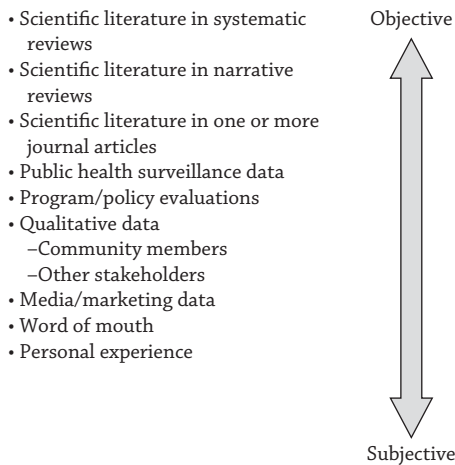


Figure 1.2: Different forms of evidence.

Source: Adapted from Chambers and Kerner.⁴¹

health evidence is usually the result of a complex cycle of observation, theory, and experiment.⁴² However, the value of evidence is in the eye of the beholder (e.g., usefulness of evidence may vary by discipline or sector).⁴³ Medical evidence includes not only research but also characteristics of the patient, a patient's readiness to undergo a therapy, and society's values.⁴⁴ Policy makers seek out distributional consequences (i.e., who has to pay, how much, and who benefits)⁴⁵; and in practice settings, anecdotes sometimes trump empirical data.⁴⁶ Evidence is usually imperfect and, as noted by Muir Gray: "The absence of excellent evidence does not make evidence-based decision making impossible; what is required is the best evidence available not the best evidence possible."²

Several authors have defined types of scientific evidence for public health practice (Table 1.1).^{4,33,34} Type 1 evidence defines the causes of diseases and the magnitude, severity, and preventability of risk factors and diseases. It suggests that "*something* should be done" about a particular disease or risk factor. Type 2 evidence describes the relative impact of specific interventions to affect health, adding "*specifically*, this should be done."⁴ There is likely to be even less published research on type 3 evidence—which shows how and under what contextual conditions interventions were implemented and how they were received, thus informing "*how* something should (or could) be done."³⁴ This contextual evidence is highly valued by practitioners.⁴⁷ A literature review from Milat and colleagues⁴⁸ showed the relative lack of dissemination research (Type 3) compared with descriptive/epidemiologic research (Type 1). In the most recent time period (2008–2009), between 3% and 7% of published studies were dissemination studies. Experience from Australia indicates that stakeholders can be engaged to assess the usefulness of evidence in public health practice along with the gaps in the EBPH process (Box 1.1).^{36, 49}

Studies to date have tended to overemphasize internal validity (e.g., well-controlled efficacy trials such as randomized trials), while giving sparse attention to external validity (e.g., the translation of science to the various circumstances of practice).^{50,51} The evidence framework proposed by Spencer and colleagues is useful because it provides four categories of evidence (best, leading, promising, emerging) and takes into account elements of external validity (reach, feasibility, sustainability, and transferability) (Figure 1.3).⁵² This broader framing of evidence is addressed in some tools for rating the quality of intervention effectiveness (e.g., *Using What Works for Health*⁵³).

Particularly for policy-related evidence, research hierarchies that favor the randomized trial have serious limitations.^{38,46,54} It has been noted that adherence to a strict hierarchy of study designs may reinforce an "inverse evidence law" by which interventions most likely to influence whole populations (e.g., policy change) are least valued in an evidence matrix emphasizing randomized designs.^{55, 56}

Table 1.1. COMPARISON OF THE TYPES OF SCIENTIFIC EVIDENCE

Characteristic	Type One	Type Two	Type Three
Goal/action	Identify a problem or priority (something should be done)	Identify what works (what should be done)	Identify how to implement (what works for whom, in what context, and why)
Typical data/relationship	Size and strength of preventable risk—disease relationship (measures of burden, descriptive data, etiologic research)	Relative effectiveness of public health intervention	Information on the adaptation and implementation of an effective intervention
Common setting	Clinic or controlled community setting	Socially intact groups or community-wide	Socially intact groups or community-wide
Example 1 questions	Does smoking cause lung cancer?	Will price increases with a targeted media campaign reduce smoking rates?	What are the political challenges of price increases in different geographic settings?
Example 2 questions	Is the density of fast-food outlets linked with obesity?	Do policies that restrict fast-food outlets change caloric intake?	How do community attitudes about fast-food policies influence policy change?
Quantity	Most	Moderate	Least

Understanding the Context for Evidence

Type 3 evidence derives from the context of an intervention.³⁴ Although numerous authors have written about the role of context in informing evidence-based practice,^{34,57–60} there is little consensus on its definition. When moving from clinical interventions to population-level and policy interventions, context becomes more uncertain, variable, and complex.⁶¹ For example, we know that social and economic factors can result in inequities in health and access to health care resources.⁶² One useful definition of context highlights information needed to adapt and implement an evidence-based intervention in a particular setting or population.³⁴ The context for type 3 evidence specifies five overlapping domains (see Table 1.2).⁶³ First, there are characteristics of the target population for an intervention such as education level and health history. Next, interpersonal variables provide important context. For example, a person with family support to seek screening because of a family history of cancer might be more likely to undergo cancer screening. Third, organizational variables should be considered when

*Box 1.1***DEVELOPING A PRACTICAL UNDERSTANDING OF AN EVIDENCE TYPOLOGY IN AUSTRALIA**

In Australia, as in other parts of the globe, there are numerous taxonomies, typologies, and frameworks (hereafter referred to as “typologies”) to guide evidence-informed decision making (EIDM) for public health. Relatively little is known about the practical utility and application of these various typologies. To be useful, they must acknowledge that the process of EIDM includes not only research evidence but also of several other types of information. The many other inputs include political and organizational factors, such as politics, habits and traditions, pragmatics, resources, and values and ethics. The *Public Health Insight* group, based in Australia,⁴⁹ tested the relevance of the typology described in this chapter: data (Type 1), intervention effectiveness (Type 2), and implementation evidence (Type 3). The team triangulated relevant findings from three applied research and evaluation projects. Practitioners were perceived to be highly competent at finding and using Type 1 data for priority setting (describing the problem). They were less effective at finding and using Type 2 (impact) and Type 3 (implementation) evidence. Organizational processes for using Types 2 and 3 evidence were almost nonexistent. The findings suggest that a typology for EIDM is useful for defining key concepts, identifying gaps, and determining the needs in organizational cultures and the broader public health system.

considering context for a specific intervention. For example, whether an agency is successful in carrying out an evidence-based program will be influenced by its capacity (e.g., a trained workforce, agency leadership).^{64,65} The important role of capacity building (e.g., more training toward prevention, increasing the skills of professionals) has been noted as a “grand challenge” for public health efforts.⁶⁶ Fourth, social norms and culture are known to shape many health behaviors. Finally, larger political and economic forces affect context. For example, a high rate for a certain disease may influence a state’s political will to address the issue in a meaningful and systematic way. Particularly for high-risk and understudied populations, there is a pressing need for evidence on contextual variables and ways of adapting programs and policies across settings and population subgroups. This is particularly important in a range of public health efforts to address health equity and health disparities, in which certain challenges are pronounced (e.g., collecting the wrong data, sample size issues, lack of resources allocated for health equity).^{67,68} Contextual issues are being addressed more fully in the new “realist review,” which is a systematic review process that seeks to examine not



Figure 1.3: Typology of scientific evidence.

Source: From Spencer et al.⁵²

only whether an intervention works but also *how* interventions work in real world settings.⁶⁹

Challenges Related to Public Health Evidence

Evidence for public health has been described as underpopulated, dispersed, and different.^{70,71} It is underpopulated because there are relatively few well-done evaluations of how well evidence-based interventions apply across different social groups (type 3 evidence). Information for public health decision making is also more dispersed than evidence for clinical interventions. For example, evidence on the health effects of the built environment might be found in transportation or planning journals. Finally, public health evidence is different, in part because much of the science base for interventions is derived from nonrandomized designs or so-called natural experiments (i.e., generally takes the form of an observational study in which the researcher cannot control or withhold the allocation of an intervention to particular areas or communities, but where natural or predetermined variation in allocation occurs.⁷²)

Table 1.2. CONTEXTUAL VARIABLES FOR INTERVENTION DESIGN, IMPLEMENTATION, AND ADAPTATION

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

^aBasic human needs include food, shelter, warmth, safety.⁶³

Triangulating Evidence

Triangulation involves the accumulation and analyses of evidence from a variety of sources to gain insight into a particular topic⁷³ and often combines quantitative and qualitative data.⁴ It generally involves the use of multiple methods of data collection and/or analysis (i.e., mixed methods that combines quantitative and qualitative approaches) to determine points of commonality or disagreement. Triangulation is often beneficial because of the complementary nature of information from different sources. Though quantitative data provide an excellent opportunity to determine *how* variables are related for large numbers of people, these data provide little in the way of understanding *why* these relationships exist. Qualitative data, on the other hand, can help provide information to explain quantitative findings, or what has been called “illuminating meaning.”⁷⁴ There are many examples of the use of triangulation of qualitative and quantitative data to evaluate health programs and policies, including HIV prevention programs,⁷⁵ family planning programs,⁷⁶ obesity prevention interventions,⁷⁷ smoking cessation

programs,⁷⁸ and physical activity promotion.⁷⁹ These examples also illustrate the roles of numerous disciplines in addressing pressing public health problems.

Cultural and Geographic Differences

The tenets of EBPH have largely been developed in a Western, European-American context.⁸⁰ The conceptual approach arises from the epistemological underpinnings of logical positivism,⁸¹ which finds meaning through rigorous observation and measurement. This is reflected in a professional preference among clinicians for research designs such as the randomized controlled trial. In addition, most studies in the EBPH literature are academic-based research, usually with external funding for well-established investigators. In contrast, in developing countries and in impoverished areas of developed countries, the evidence base for how best to address common public health problems is often limited, even though the scope of the problem may be enormous.⁶ Cavill compared evidence-based interventions across countries in Europe, showing that much of the evidence base in several areas is limited to empirical observations.⁸² In China, the application of EBPH concepts is at an early stage, suggesting considerable room for growth.⁸³ Even in more developed countries (including the United States), information published in peer-reviewed journals or data available through websites and official organizations may not adequately represent all populations of interest.

Key Role of EBPH in Accreditation Efforts

A national voluntary accreditation program for public health agencies was established through the Public Health Accreditation Board (PHAB) in 2007.⁸⁴ As an effort to improve both the quality and performance of public health agencies at all levels, the accreditation process is structured around 12 domains that roughly coincide with the 10 Essential Public Health Services, with additional domains on management and administration (domain 11) and governance (domain 12).⁸⁵ The accreditation process intersects with EBPH on at least three levels. First, the entire process is based on the predication that if a public health agency meets certain standards and measures, quality and performance will be enhanced. The evidence for such a predication, however, is incomplete at best, and often relies on the type of best evidence available that can only be described as sound judgment, based on experience in practice. Second, domain 10 of the PHAB process is “Contribute to and Apply the Evidence Base of Public Health.” Successfully accomplishing the standards and measures

under domain 10 involves using EBPH from such sources as the *Guide to Community Preventive Services*, having access to research expertise, and communicating the facts and implications of research to appropriate audiences. Third, the prerequisites for accreditation—a community health assessment, a community health improvement plan, and an agency strategic plan—are key elements of EBPH, as will be described later in this chapter.

A critical aspect of the early implementation of PHAB is the development of an evaluation and research agenda, based on a logic model for accreditation, which can serve as a guide for strengthening the evidence base for accreditation. In many ways the accreditation process is parallel to the development of EBPH: the actual use of standards and measures presents opportunities to strengthen the evidence base for accreditation, and, as EBPH evolves, new findings will help inform the refinement of standards and measures over time.

Audiences for Evidence-Based Public Health

There are four overlapping user groups for EBPH as defined by Fielding.⁸⁶ The first includes public health practitioners with executive and managerial responsibilities who want to know the scope and quality of evidence for alternative strategies (e.g., programs, policies). In practice, however, public health practitioners frequently have a relatively narrow set of options. Funds from federal, state, or local sources are most often earmarked for a specific purpose (e.g., surveillance and treatment of sexually transmitted diseases, inspection of retail food establishments). Still, the public health practitioner has the opportunity, even the obligation, to carefully review the evidence for alternative ways to achieve the desired health goals. The next user group is policy makers at local, regional, state, national, and international levels. They are faced with macro-level decisions on how to allocate the public resources for which they are stewards. This group has the additional responsibility of making policies on controversial public issues. The third group is composed of stakeholders who will be affected by any intervention. This includes the public, especially those who vote, as well as interest groups formed to support or oppose specific policies, such as the legality of abortion, whether the community water supply should be fluoridated, or whether adults must be issued handgun licenses if they pass background checks. The final user group is composed of researchers on population health issues, such as those who evaluate the impact of a specific policy or programs. They both develop and use evidence to answer research questions.

Similarities and Differences Between Evidence-Based Public Health and Evidence-Based Medicine

The concept of evidence-based practice is well established in numerous disciplines, including psychology,⁸⁷ social work,^{88,89} and nursing.⁹⁰ It is probably best established in medicine. The doctrine of evidence-based medicine (EBM) was formally introduced in 1992.⁹¹ Its origins can be traced back to the seminal work of Cochrane, who noted that many medical treatments lacked scientific effectiveness.⁹² A basic tenet of EBM is to de-emphasize unsystematic clinical experience and place greater emphasis on evidence from clinical research. This approach requires new skills, such as efficient literature searching and an understanding of types of evidence in evaluating the clinical literature.⁹³ There has been a rapid growth in the literature on EBM, contributing to its formal recognition. Using the search term “evidence-based medicine,” there were 255 citations in PubMed in 1990, rising to 2,898 in 2000, to 8,348 citations in 2010, and to 13,798 in 2015. Even though the formal terminology of EBM is relatively recent, its concepts are embedded in earlier efforts, such as the Canadian Task Force on the Periodic Health Examination⁹⁴ and the *Guide to Clinical Preventive Services*.²⁴

There are important distinctions between evidence-based approaches in medicine and public health. First, the type and volume of evidence differ. Medical studies of pharmaceuticals and procedures often rely on randomized controlled trials of individuals, the most scientifically rigorous of epidemiologic studies. In contrast, public health interventions usually rely on cross-sectional studies, quasi-experimental designs, and time-series analyses. These studies sometimes lack a comparison group and require more caveats in interpretation of results. Over the past 50 years, there have been more than one million randomized controlled trials of medical treatments. There are many fewer studies of the effectiveness of public health interventions⁴ because they are difficult to design and their results often derive from natural experiments (e.g., a state adopting a new policy compared with other states). EBPH has borrowed the term “intervention” from clinical disciplines, insinuating specificity and discreteness. However, in public health, we seldom have a single “intervention,” but rather a program that involves a blending of several interventions within a community. Large community-based trials can be more expensive to conduct than randomized experiments in a clinic. Population-based studies generally require a longer time period between intervention and outcome. For example, a study on the effects of smoking cessation on lung cancer mortality would require decades of data collection and analysis. Contrast that with treatment of a medical condition (e.g., an antibiotic for symptoms of pneumonia), which is likely to produce effects in days or weeks,

or even a surgical trial for cancer with endpoints of mortality within a few years.

The formal training of persons working in public health is much more variable than that in medicine or other clinical disciplines.⁹⁵ Unlike medicine, public health relies on a variety of disciplines, and there is not a single academic credential that “certifies” a public health practitioner, although efforts to establish credentials (via an exam) are now in place for those with formal public health training (e.g., the National Board of Public Health Examiners Certified in Public Health exam).⁹⁶ This higher level of heterogeneity means that multiple perspectives are involved in a more complicated decision-making process. It also suggests that effective public health practice places a premium on routine, on-the-job training.

KEY CHARACTERISTICS OF EVIDENCE-BASED DECISION MAKING

It is useful to consider several overarching, common characteristics of evidence-based approaches to public health practice. These notions are expanded on in other chapters. Described subsequently, these various attributes of EBPH and key characteristics include the following:

- Making decisions based on the best available peer-reviewed evidence (both quantitative and qualitative research)
- Using data and information systems systematically
- Applying program planning frameworks (that often have a foundation in behavioral science theory)
- Engaging the community of focus in assessment and decision making
- Conducting sound evaluation
- Disseminating what is learned to key stakeholders and decision makers

Accomplishing these activities in EBPH is likely to require a synthesis of scientific skills, enhanced communication, common sense, and political acumen.

Decisions Are Based on the Best Possible Evidence

As one evaluates evidence, it is useful to understand where to turn for the best available scientific evidence. A starting point is the scientific literature and guidelines developed by expert panels. In addition, preliminary findings from researchers and practitioners are often presented at regional, national, and international professional meetings.

Data and Information Systems Are Used

A tried and true public health adage is, “what gets measured, gets done.”⁹⁷ This has typically been applied to long-term endpoints (e.g., rates of mortality), and data for many public health endpoints and populations are not readily available at one’s fingertips. Data are being developed more for local-level issues (e.g., the Selected Metropolitan/Micropolitan Area Risk Trends of the Behavioral Risk Factor Surveillance System [SMART BRFSS]), and a few early efforts are underway to develop public health policy surveillance systems.

Systematic Planning Approaches Are Used

When a program or policy approach is decided on, a variety of planning frameworks and models can be applied (e.g., ecological^{98,99} and systems dynamic models¹⁰⁰). These models point to the importance of addressing problems at multiple levels and stress the interaction and integration of factors within and across all levels—individual, interpersonal, community, organizational, and governmental. The goal is to create healthy community environments that support the health and well-being of all people. That may involve a combination of programs and policies designed to enable people to live healthier lifestyles.¹⁰¹ Effective interventions are most often grounded in health-behavior theory.^{42, 102}

Community Engagement Occurs

Community-based approaches involve community members across multiple sectors in research and intervention projects and show progress in improving population health and addressing health disparities.^{103,104} As a critical step in transdisciplinary problem solving, practitioners, academicians, and community members collaboratively define issues of concern, develop strategies for intervention, and evaluate the outcomes. This approach relies on stakeholder input, builds on existing resources, facilitates collaboration among all parties, and integrates knowledge and action that seek to lead to a fair distribution of the benefits of an intervention for all partners.^{104–106}

Sound Evaluation Principles Are Followed

Too often in public health, programs and policies are implemented without much attention to systematic evaluation. In addition, even when programs are ineffective, they are sometimes continued because of historical or political

considerations. Evaluation plans must be laid early in program development and should include both formative and outcome evaluation (as further described in chapter 11).

Results Are Disseminated to Others Who Need to Know

When a program or policy has been implemented, or when final results are known, others in public health—as well as community members themselves—can rely on findings to enhance their own use of evidence in decision making. Dissemination may occur to health professionals via the scientific literature, to the general public via the media, to communities of focus via reports and meetings, to policy makers through personal meetings, and to public health professionals through training courses. It is important to identify appropriate channels for dissemination¹⁰⁷ because public health professionals differ in where they seek information (e.g., public health practitioners prefer peer leaders in practice, whereas academicians prefer peer-reviewed journals).¹⁰⁸

ANALYTIC TOOLS AND APPROACHES TO ENHANCE THE UPTAKE OF EVIDENCE-BASED PUBLIC HEALTH

Several analytic tools and planning approaches can help practitioners in answering questions such as the following:

- What is the size of the public health problem?
- Are there effective interventions for addressing the problem?
- What information about the local context and this particular intervention is helpful in deciding its potential use in the situation at hand?
- Is a particular program or policy worth doing (i.e., is it better than alternatives) and will it provide a satisfactory return on investment, measured in monetary terms, health impacts, or impacts on health disparities?
- How can we understand the effect of a program or policy on health equity?

In this section, we briefly introduce a series of important tools and analytic methods—many of these are covered in detail in later chapters.

Public Health Surveillance

Public health surveillance is a critical tool for those using EBPH (as will be described in much more detail in chapter 7). It involves the ongoing systematic

collection, analysis, and interpretation of specific health data, closely integrated with the timely dissemination of these data to those responsible for preventing and controlling disease or injury.¹⁰⁹ Public health surveillance systems should have the capacity to collect and analyze data, disseminate data to public health programs, and regularly evaluate the effectiveness of the use of the disseminated data.¹¹⁰

Systematic Reviews and Evidence-Based Guidelines

Systematic reviews are syntheses of comprehensive collections of information on a particular topic. Reading a good review can be one of the most efficient ways to become familiar with state-of-the-art research and practice on many specific topics in public health. The use of explicit, systematic methods (i.e., decision rules) in reviews limits bias and reduces chance effects, thus providing more reliable results on which to make decisions.¹¹¹ One of the most useful sets of reviews for public health interventions is the *Guide to Community Preventive Services* (the *Community Guide*),²³ which provides an overview of current scientific literature through a well-defined, rigorous method in which available studies themselves are the units of analysis. The *Community Guide* seeks to answer, (1) “What interventions have been evaluated and what have been their effects?” (2) “What aspects of interventions can help *Community Guide* users select from among the set of interventions of proven effectiveness?” and (3) “What might this intervention cost and how do these compare with the likely health impacts?” A good systematic review should allow the practitioner to understand the local contextual conditions necessary for successful implementation.¹¹²

Economic Evaluation

Economic evaluation is an important component of evidence-based practice.¹¹³ It can provide information to help assess the relative value of alternative expenditures on public health programs and policies. In cost-benefit analysis, all of the costs and consequences of the decision options are valued in monetary terms. More often, the economic investment associated with an intervention is compared with the health impacts, such as cases of disease prevented or years of life saved. This technique, cost-effectiveness analysis, can suggest the relative value of alternative interventions (i.e., health return on dollars invested).¹¹³ Cost-effectiveness analysis has become an increasingly important tool for researchers, practitioners, and policy makers. However, relevant data to support this type of analysis are not always available, especially for possible public policies designed to improve health.^{46,114} Additional information on economic evaluation is provided in chapter 4.

Health Impact Assessment

Health impact assessment (HIA) is a relatively new method that seeks to estimate the probable impact of a policy or intervention in nonhealth sectors (such as agriculture, transportation, and economic development) on the health of the population.¹¹⁵ Some HIAs have focused on ensuring the involvement of relevant stakeholders in the development of a specific project. This is essential for an environmental impact assessment required by law for many large place-based projects. Overall, HIA has been gaining acceptance as a tool because of mounting evidence that social and physical environments are important determinants of health and health disparities in populations. It is now being used to help assess the potential effects of many policies and programs on health status and outcomes.¹¹⁶⁻¹¹⁸ This approach dovetails with the conceptualization and application of “health in all policies.”¹¹⁹

Participatory Approaches

Participatory approaches that actively involve community members in research and intervention projects^{103,104,120} show promise in engaging communities in EBPH.²⁸ Practitioners, academicians, and community members collaboratively define issues of concern, develop strategies for intervention, and evaluate the outcomes. This approach relies on stakeholder input,¹²¹ builds on existing resources, facilitates collaboration among all parties, and integrates knowledge and action that hopefully will lead to a fair distribution of the benefits of an intervention or project for all partners.^{104,105} Stakeholders, or key players, are individuals or agencies that have a vested interest in the issue at hand. In the development of health policies, for example, policy makers are especially important stakeholders. Stakeholders should include those who would potentially receive, use, and benefit from the program or policy being considered. Three groups of stakeholders are relevant: people developing programs, those affected by interventions, and those who use results of program evaluations. Participatory approaches may also present challenges in adhering to EBPH principles, especially in reaching agreement on which approaches are most appropriate for addressing a particular health problem.¹²²

SUMMARY

The successful implementation of EBPH in public health practice is both a science and an art. The science is built on epidemiologic, behavioral, and policy research showing the size and scope of a public health problem and which

interventions are likely to be effective in addressing the problem. The art of decision making often involves knowing what information is important to a particular stakeholder at the right time. Unlike solving a math problem, significant decisions in public health must balance science and art because rational, evidence-based decision making often involves choosing one alternative from among a set of rational choices. By applying the concepts of EBPH outlined in this chapter, decision making and, ultimately, public health practice can be improved.

KEY CHAPTER POINTS

- To achieve state and national objectives for improved population health, more widespread adoption of evidence-based strategies is recommended.
- There are several important distinctions between EBPH and clinical disciplines, including the volume of evidence, study designs used to inform research and practice, the setting or context where the intervention is applied, and the training and certification of professionals.
- Key components of EBPH include making decisions based on the best available, peer-reviewed evidence; using data and information systems systematically; applying program-planning frameworks; engaging the community in decision making; conducting sound evaluation; and disseminating what is learned.
- Numerous analytic tools and approaches that can enhance the greater use of EBPH include public health surveillance, systematic reviews, economic evaluation, health impact assessment, and participatory approaches.

SUGGESTED READINGS AND SELECTED WEBSITES

Suggested Readings

- Brownson, RC, Fielding JE, Maylahn CM. Evidence-based public health: a fundamental concept for public health practice. *Annu Rev Public Health*. 2009;30:175–201.
- Frieden TR. Six components necessary for effective public health program implementation. *Am J Public Health*. Jan 2013;104(1):17–22.
- Glasziou P, Longbottom H. Evidence-based public health practice. *Aust N Z J Public Health*. 1999;23(4):436–440.
- Green LW, Ottoson JM, Garcia C, Hiatt RA. Diffusion theory and knowledge dissemination, utilization, and integration in public health. *Annu Rev Public Health*. 2009;30:151–174.
- Guyatt G, Rennie D, Meade M, Cook D, eds. *Users' Guides to the Medical Literature. A Manual for Evidence-Based Clinical Practice*. 3rd ed. Chicago, IL: American Medical Association Press; 2015.
- Muir Gray JA. *Evidence-Based Healthcare: How to Make Decisions about Health Services and Public Health*. 3rd ed. New York and Edinburgh: Churchill Livingstone Elsevier; 2009.