What Level of "Proof" Do We Need for Evidence-Based Practices in Public Health Preservation and Improvement?

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ABSTRACT

The concept of evidence-based public health (EBPH) practice is relatively new, but rapidly gaining in momentum and recognition. The purpose of this paper is to define and describe evidence-based public health, and explore the level of 'proof' necessary to preserve and improve evidence-based practices in public health, using specific examples from the four major areas: community health, environmental health, public health infrastructure and emergency preparedness.

Umwelt und Gesundheit Online, 2011; 4, 105-110.

Introduction

Evidence-based public health (EBPH) is defined as the development, implementation, and evaluation of effective programs and policies in public health through the application of principles of scientific reasoning, including systematic uses of data and information systems, and appropriate use of behavioral science theory and program planning models (Brownson, 2003).

Evidence based public health is a branch of evidence-based medicine. The goal of evidence-based medicine is to be aware of the proof on which one's practice is based, the soundness of the evidence, and the strength of inference the evidence permits. The strategy employed requires a clear delineation of the relevant question(s); a thorough search of the literature relating to the questions; a critical appraisal of the evidence, and its applicability to the clinical situation; and a balanced application of the conclusions to the clinical problem (Brownson, 2003).

It is also important to explore the definition of evidence-based public health practice, which is the careful, intentional and sensible use of current best scientific evidence in making decisions about the choice and application of public health interventions. It explores the processes of systematically finding, appraising and using scientific research as the basis for developing sound practices. Policymakers are, therefore, provided with a better understanding of the science, ensuring that policy decisions are based on the best information available.

Some key characteristics of EBPH include:

- Making decisions using 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 in assessment and decision making;
- Conducting sound evaluation; and
- Disseminating what is learned to key stakeholders and decision makers (Brownson, 2009).

The evidence-based approach is considered important in public health practice for a number a reasons. Primarily, it provides assurance that the decision will be made based on scientific evidence and effective practices. Second, one can ensure that the retrieval of information for that particular public health issue is as up-to-date as possible. Third, it ensures that the best available information is being accessed, reducing any time inefficiencies (Brownson, 2009).

The most important term to define with regards to evidence-based public health is "evidence." Evidence in this context, can be defined as some form of quantitative data, including epidemiologic data, results of programs or policy evaluations, and qualitative data for uses in making judgments or decisions. Public health evidence is usually the result of a complex cycle of observation, theory, and experiment. Objective evidence exists in the form of scientific literature in systemic reviews and journal articles, public health surveillance data, program evaluations, qualitative data from community members and other stakeholders. Word-of-mouth and personal experience are considered subjective evidence.

Brownson et al. (2003) define th*ree* types of evidence as Type I, Type II and Type III. Type I

defines the causes of the disease and its magnitude, severity and preventability of risk factors and diseases. It defines the need for some kind of action regarding the disease. Type II describes the specific impacts of interventions conducted for this disease – whether they were successful or not; i.e. what needs to be done. Type III shows under what conditions these interventions were carried out and what the results were, thereby outlining the method through which it needs to be done (Brownson, et al. 2003).

All of this background is necessary to consider before approaching the topic of 'level of proof required for evidence-based practices in public health preservation and improvement.' Public health practices need to be accessible to the majority of the target population if they are to be successful. To reach the most people, the evidence-based practice needs to pass several tests. The first test, and the most critical, is to be published in a peer-reviewed scientific journal; the second, to be accepted as 'effective' by experts in the scientific community; and the third, for the intervention to be funded for broad reaching effectiveness. Each 'test' requires a different level of 'proof' to pass.

To be published in a peer-reviewed journal the level of proof necessary would be considered statistically significant data. In a randomized controlled trial, for example, these statistics would show the biological plausibility of the practice. If the data are insufficient to be published, the researchers would need to revise their intervention.

In the next step, being accepted by the scientific community, the level of proof would be considered for consistency. Consistency of data is required among similar interventions published at different times and by different researchers. This type of proof could be thought of as 'generalizability' in practical settings. Principles of evidence-based medicine currently being taught to healthcare students suggest that current studies need to be evaluated together to determine the best practice collectively. As Fiona Bath-Hextall et al. (2011) state: "meta-analysis is a difficult statistical concept for healthcare students to understand yet it is an important technique used in systematic reviews to pool data from studies to look at combined effectiveness of treatments." If the findings of a particular EBPH intervention are inconsistent with the findings of the meta-analysis pooled data sources, it will not be regarded as effective and will need to be revised before moving on to the next test.

If the intervention is intended to help a specific target population at risk of some adverse health effect, it will need funding and marketing to reach a maximum amount of 'at-risk' people. The amount of funding and marketing needed to reach the maximum amount of people will need to come from the government. To pass the intervention as policy or be approved for funding, it needs to be seen as cost-effective, i.e., causing the greatest effect for the least amount of money. Policymakers and grant funders need to see that there is money to be saved by the intervention. For example, if the intervention could be seen to reduce lost profit in businesses by keeping employees healthy, it could be seen as cost-effective. If the intervention costs more than it saves, it will not be funded, and consequently, will not be able to reach the population for which it is intended.

Once all three "tests" are passed the evidence-based public health intervention can be implemented and begin to help the maximum amount of people. A potential fourth test, beyond the scope of this paper, would be evaluating how the information is perceived by the people in the target population and whether they trust the source of the information enough to participate in the intervention.

Sufficiency of experimental data depends on the quality of the research performed. The results are considered valid and acceptable if they pass a certain number of 'research quality' checkpoints, which will differ according to nation, and the specific scientific domain (i.e., medicine, public health, chemistry, physics and so on). The National Registry of Evidence Based Programs and Practices (NREPP), through the Substance Abuse and Mental Health Services Administration (SAMHSA) under the U.S. Department of Health and Human Services, is an important research quality tool for implementing public health interventions. This registry measures the strength of the evidence supporting the outcomes of the interventions. The quality of research is reviewed using the following six criteria: (1) reliability of measures; (2) validity of measures; (3) intervention fidelity; (4) missing data and attrition; (5) potential confounding variables; and (6) appropriateness of analysis (Brownson, 2009).

The level of proof in evidence-based practices in public health preservation is dependent upon the type of intervention being implemented. Some practices may not require as many levels of evidence to be accepted as valid interventions; such 'common-knowledge' interventions may not require excessive data to confirm as fact. For example, studies suggesting that older adults should cease driving motor vehicles when their eyesight has deteriorated find little objection from the scientific community (Desapriya, 2011). However other, less intuitive interventions would require more comprehensive data to support their theses. The level of proof is used as the criterion for evaluating evidence for determining best practices in public health preservation interventions.

The level of proof necessary depends on a number of factors. First, it depends on the setting in which the intervention is implemented. An

intervention successfully implemented in a specific setting may not work as effectively in a broader social context; for example, dietary and physical activity programs implemented in a school setting may yield different results than in out-of-school settings such as the child's home, requiring more steps/levels of proof before becoming an accepted intervention. Second, it depends on the complexity of the evaluation of outcomes. Some outcomes are more difficult to measure and evaluate than others, resulting in a variance in the levels of proof required to implement interventions; for example, tracking tobacco use or immunization administration and their results is easier than determining the change in a community's literacy rate (Kelly et al., 2010).

Examples from the four major areas of public health have been analyzed to provide a better understanding of the variability in levels of proof needed in evidence-based public health preservation and improvement. These examples are not indicative of an entire domain; in fact, the level of proof needed can vary from one intervention to another based on various factors.

Community Health

Preventing Tobacco Use among Disadvantaged Youth in Urban Indian Slums

Arora et al. (2010) provide an example of how an evidence-based public health practice uses a wide variety of data collection methods to be successful in obtaining the first level of 'proof'. Tobacco cessation interventions are common in community health. Many prevention campaigns and experimental interventions are conducted to improve public health in communities. One such two-phased intervention was conducted in the urban slums of India in a study conducted in 2005. Tobacco consumption among Indian adolescents of a low-income background is a frequent occurrence in the urban slums of India. The easy access and low cost of tobacco products, as well as peer pressure, contribute to the high rates of tobacco consumption.

The study began in 2005, with qualitative research being conducted in two economically disadvantaged slums in Delhi, India. This was Phase I, where interviews, focus groups and other forms of qualitative analysis yielded important data about the tobacco-related habits of the adolescents living in the two communities. Phase II, the intervention phase, was initiated based on the results of Phase I. The intervention phase employed activities based on the following information provided through Phase I: the dynamics of regular tobacco use among the youth, the triggers initiating tobacco use, and the motivation to quit. The intervention phase consisted of tobacco cessation campaigns, educational program, and other helpful activities which could benefit the youth.

The results of the study were significant. Phase I – Qualitative analyses found that more boys than girls used tobacco; they used it because it was accessible, affordable and/or because of peer pressure; most of them had started at a young age (approximately age 6 years); most of them were addicted to tobacco; most of them had no motivation to quit; almost all of them knew tobacco to be injurious to health.

Phase II – Qualitative and quantitative analyses found that the intervention community showed a significant decrease in new tobacco users during and after the intervention, compared to the control community; more males than females decreased in tobacco usage; and there was no significant increase in number of youth quitting tobacco usage because of the intervention.

It was concluded that tobacco cessation interventions consisting of education programs, interactive activities, peer-group sessions, and other activities are effective in reducing the number of adolescents willing to take up smoking or chewing tobacco in urban, economically disadvantaged populations in India. However, stronger and potentially more extensive programs are required to target populations already addicted to tobacco (Arora, et al. 2010).

The level of proof required to implement the interventions in Phase II was dependent on the qualitative observations collected during Phase I. Determining tobacco smoking/chewing habits, recreational activities, and other such patterns of the youth allowed the researchers to determine the intensity and type of interventions to be implemented in Phase II. As is evident from the conclusion above, they were able to reduce the number of adolescents who were willing to take up smoking/chewing tobacco after the intervention, but were unable to make a significant difference in the number that quit after going through Phase II. It can, therefore, be concluded that the level of proof required to implement interventions which significantly reduced tobacco consumption by first-time users was significantly lower than the level of proof required for interventions that reduced regular tobacco consumers.

Environmental Health

Preventing Diarrhea in Developing Countries by Improving Water Quality

Diarrheal diseases are a leading cause of mortality and morbidity, especially among young children in developing countries. Whereas many of the infectious agents associated with diarrheal disease are potentially waterborne, the evidence for reducing diarrhea in settings where it is endemic by improving the microbiological quality of drinking

water has been equivocal.

Rather than focusing on one particular intervention, this example is comprised of a comprehensive literature search conducted by two independent researchers who examined 30 trials covering over 53,000 participants from developing countries where diarrheal diseases are endemic.

The literature suggests that interventions to improve the microbiological quality of drinking water are effective in preventing diarrhea for persons of all ages, including children under five years old. It also was found that household interventions were more effective than interventions at the water source. Effectiveness was positively associated with compliance. Effectiveness was not conditioned on the presence of improved water supplies or sanitation in the study settings, and was not enhanced by combining the intervention to improve water quality with other common environmental interventions intended to prevent diarrhea (Classen, 2006).

In this example, the level of proof necessary for public health preservation could be the point at which the number of cases of diarrhea in a population is significantly reduced to remove the 'endemic' status of the disease, or the point at which the number of *deaths* from diarrhea is reduced by a significant amount, and so on. The level of proof required will differ depending on the level of results expected from these interventions. Due to the financial restrictions of developing countries, these interventions probably go as far as helping individual communities as long as there is outside funding available. It is highly unlikely that government-funded policies will result from these studies, which means that most of these interventions will go as far as helping individual communities as long as outside funding is available. Therefore, the level of proof needed to implement diarrhea-reducing interventions in these communities will probably need only to pass the tests of accuracy, consistency, and reproducibility of results. Any other tests required to 'implement interventions into government policy' and so on probably will not be considered.

Public Health Infrastructure

Building Infrastructure and Capacity in State and Territorial Oral Health

Another example of how the different levels of proof are necessary for the improvement of evidence-based public health can be seen by the public health infrastructure. The public health infrastructure is the underlying foundation that supports the planning, delivery, and evaluation of public health activities and practices. This infrastructure makes it possible to respond to public health emergencies as well as to perform essential ongoing public health services.

As the 21st century evolves, the American public faces significant oral health problems. The two most common oral diseases, tooth decay and periodontal (gum) disease, continue to affect individuals across the lifespan. More than one-half of 8-year-olds (52%) and over three-fourths of 17-year-olds (78%) in the U.S. are affected by tooth decay. Tooth decay continues to affect U.S. adults: 96% of adults and 99% of seniors 65 years of age and older have experienced tooth decay. In addition, more than 30,000 oral diseases place a major burden on the public in terms of pain and suffering, poor self-esteem, cost of treatment, and lost productivity from missed work or school days. Optimal oral health substantially improves the quality of life for U.S. children and adults.

In November 1999, a Delphi method was used to identify elements for building infrastructure and capacity for state oral health programs. The method involved surveying the Association of State and Territorial Dental Directors (ASTDD)'s general membership of state dental directors and state dental consultants using two consecutive questionnaires. However, the 43 states responding to the ASTDD Delphi survey reported gaps in their dental public health infrastructure and capacity. Among these states, only 19% reported having a state-based oral health surveillance system; 38% had a state oral health improvement plan; and 48% had an oral health advisory committee representing a broad-based constituency.

The results of the study showed that the top two needs identified by the states included an oral health surveillance system (67% of states) and leadership consisting of a state dental director and an adequate/competent staff (63%). In addition, states reported a need for resources to build community capacity (62%) and establish health systems interventions to facilitate quality dental care (60%). Further, 40 percent of the states reported a high need for staff expertise and skills related to epidemiology. For state oral health programs to expand infrastructure and capacity and to fill existing gaps, funding is needed.

The assessment of resources needed to maintain fully effective state oral health programs provided three main conclusions:

- Funding is needed to build infrastructure and capacity for state oral health;
- Funding varies among the states due to differences in existing infrastructure, priorities, staffing, and strategies; and
- Each state should conduct its own assessment of infrastructure and capacity to determine gaps and specific funding needs for its state oral health program.

This particular examination was less of an

intervention study and more of an assessment of the public's dental health needs. However, for purposes of this paper, it does provide an idea of future steps to be taken by the U.S. government about the public dental health infrastructure. It sheds light on the main problem, lack of funding, which is an important determinant of allowing public health interventions of any kind to pass as government policy. When dealing with an important issue such as dental hygiene, improving public dental health infrastructure is a key step to preserving the public's health; therefore, it is vital that an important requirement like funding is met in every possible way.

Emergency Preparedness and Management

Reverse Quality Management: Developing Evidence-Based Best Practices in Health Emergency Management

Public health practice provides knowledge and contributes to prevention of and recovery from such emergencies as natural disasters, communicable disease epidemics, and man-made disasters. Government preparedness and funding is necessary to implement quick and effective responses to these emergencies. Lynch and Cox (2006) found that there were various steps that were deemed 'the best practice' for emergency preparedness. Prevention, preparation, clearly defined roles of responders, and government assistance were identified as necessary components.

Prevention practices were seen to promote health and well-being in the community. Risk assessment and mitigation practices helped identify risks and assess any threat to the community. Costs were then identified and there was collaboration between municipalities and community-based organizations. Preparedness practices (only when one cannot prevent or mitigate) were supported by well-defined leadership positions and thorough planning was found to be a necessary part of emergency preparedness. To respond to emergencies effectively a response/constitution of an Emergency Operations Center practice needed to start its emergency response during the uncertain time in the beginning of the emergency by contacting key people to gather the necessary information to respond quickly and efficiently. The importance of Emergency Operations Center management practices, consisting of a defined hierarchy of the people responsible for responding to emergencies, was emphasized (Lynch & C0x, 2006). It was also emphasized that recovery practices need to be planned before any emergency even begins. An "all-clear" cannot come before there is certainty of the end of the emergency. And finally, corporate/governance practices are responsible for implementing evidence-based public health emergency preparedness practices (Lynch, et al. 2006).

Conclusion

The different levels of proof necessary to improve and implement evidence-based public health practices and interventions are statistically significant data, consistency in meta-analysis, and cost-effectiveness. These different levels of proof need to build upon each other and work together for a public health intervention to be accepted, and consequently, improve EBPH practices for target populations. To explore this concept further, the paper looked at examples and practical considerations of EBPH practices that showcased the use of the three different levels of proof in four major public health areas: community health, environmental health, public health infrastructure and emergency preparedness.

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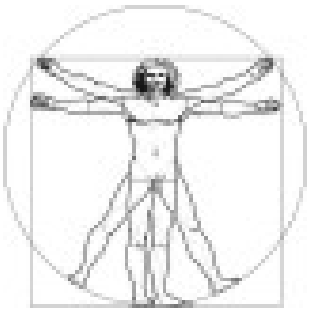

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