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Evidence Based Public Health

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<http://dx.doi.org/10.5772/52643>

1. Introduction

Evidence based medicine includes asking clinical questions that can be answered by research, finding the best available evidence based on available research, judging whether the evidence is accurate and applicable to the patients, and applying this evidence in clinical practice [1]. The aim of evidence based medicine in “Public health” is to apply the current best knowledge from research in the prevention, detection, and care of health disorders [1]. The importance of use of scientific knowledge for policy making has grown over the last two-three decades. Systematic review of all the available research data are undertaken to limit bias in the systematic assembly, critical appraisal and pooled result synthesis [2]. The use of evidence based approach helps in distinguishing effective interventions from less effective interventions. Evidence based medicine has been systematized by several groups, especially the U.S. Preventive Services Task Forces and Cochrane Collaboration [3, 4]. The Task Force on “Community Preventive Services” was formed with an aim of synthesizing the scientific information on effectiveness of disease prevention and health promotion interventions [5], and has reviewed hundreds of related topics. Half of the interventions reviewed by task forces have been considered as insufficient evidence to determine the effectiveness, because of inadequate quality and/or inconsistent evaluation outcomes.

Evidence of effectiveness is the central part of public health, with rapidly growing demand for the recent and best evidence. Public health improvement plans look for the evidence of program effectiveness before considering intervention options, to meet the health goals. Evidence based strategies have been highly recommended to achieve the state and national objective of improved population health [6, 7].

Ideally, evidence based approach should always be used by public health practitioners while implementing programs, developing health policies and evaluating the progress [8, 9]. Evidence based services such as electronic databases, systematic reviews, and journals make

accessing the current best evidence feasible, and easy in clinical settings. However, intervention decisions are often taken based on the short term applications in day-to-day clinical practice, lacking the evidence based systematic approach. Since scientific knowledge changes over time, it is necessary to make a decision based on the current scientific evidence. For that, public health providers and policy makers should be trained to synthesize conclusions based on the outcomes of interventions, including latest research in the concerned field. However, very few individuals in the public health practice have been trained to utilize the evidence based approach appropriately [10]. Many health care providers have difficulty finding, assessing, interpreting, and applying current best evidence[11]. Therefore, it would be of great interest to enumerate the importance of evidence based approaches in public health. Also, it is not always easy to implement evidence based approaches in public health due to various barriers like lack of relevant research, improper information systems, lack of leadership, incompetencies and political issues [11, 12]. Therefore, identification of barriers would help in making policies to overcome these obstacles, while applying evidence based medicine in public health sectors.

The objectives of this chapter are:

To define the evidence based medicine, evidence based public health, and enumerate the importance of evidence based medicine in public health.

To define the key analytical tools which could increase the adoption of evidence based medicine in clinical decision making in public health sector.

To enumerate the challenges and opportunities for implementing evidence based medicine in public health sector.

To describe the future issues of evidence based medicine in public health

1.1. Evidence based medicine & public health

Evidence includes the available body of facts or information which helps in defining whether a proposition is true or valid. Evidence for public health professional includes qualitative and quantitative data, programs results and policy evaluations, and the public health evidence is complex cycle of observation, theory and experiments [13, 14]. Three types of scientific evidence have been defined for public health practice, in literature [8, 15]. Type 1 evidence defines the severity and preventability of diseases and its risk factors, and suggests that something should be done about it. Type 2 evidence defines the impact of specific interventions on health improvement, and suggest that specifically this should be done [8]. Type 3 evidence informs, how something should be done as it define that under what conditions interventions were implemented, and how they were implemented and received [15].

There are many differences between evidence based approaches in medicine and public health. Pharmaceuticals and procedural medical studies rely on the results of randomized controlled trials, whereas public health interventions are based on cross-sectional and time series analysis, which sometime lack a comparison group unlike in clinical trials. Very few public health interventions have been performed over the last few decades compared to

randomized trials for medical treatments, as they are difficult to perform and are more costly [16, 17]. Population based studies require longer time to complete, and thus require more efforts and resources as compared to randomized clinical trials. In public health, intervention often involves combination of several interventions within the community, unlike randomized clinical trials where intervention is referred to one particular therapeutical, diagnostic or other measure.

In public health, there are limited academic credentials to certify the public health practitioners. Therefore, formal training is much more variable in public health sector as compared to other clinical disciplines, and only less than half of the workers of public health sectors have documented formal training in different disciplines like epidemiology, health educations etc. [18]. Public health is a heterogeneous sector where complex decisions making process involve multiple perspectives.

There are four groups of evidence based public health audience (Figure 1):

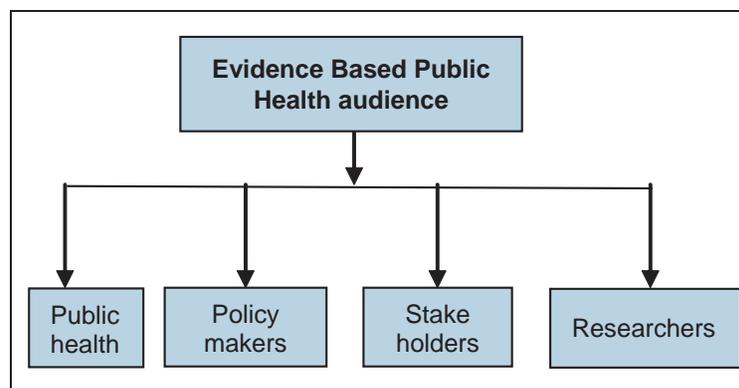


Figure 1. Audience of Evidence Based Public Health

1. **Public health practitioners:** This group has executive and managerial responsibilities. The public health practitioners want to know about the scope of alternative strategies and quality of evidence for such alternatives, however they have a narrow set of options. They should carefully review the evidence for alternative strategies to achieve the desired health goals in community.
2. **Policy makers:** The policy makers at local, regional, state, national and international levels have responsibility of allocating the public resources and making the policies on controversial public issues.
3. **Stake holders:** This includes the public and interest groups, who support or oppose the specific policies. This is the group which is affected by the interventions.
4. **Researchers:** The researchers evaluate the impact of any policy, program or intervention on population health.

Now it is a well known fact that practicing evidence based medicine improves patients' health, reduces complications, and help in saving more lives. In addition, increased focus of

evidence based medicine has many other direct and indirect benefits. Evidence based medicine provide access to high quality information regarding different programs, policies and treatments plans with higher likelihood of success, with greater productivity [8, 11, 19]. It also helps in better usage of public and private resources in medicine.

To improve the evidence based approach in public health practice, we need to understand several concepts. First, we need detailed information on the policies and programs that will most likely be effective in promoting public health [8, 19, 20]. Then, we need to translate the science into practice. We also need to better define the different processes that lead to evidence based decision making in public health, for which we need to gather maximum possible relevant information from peer-reviewed literature [8, 21]. Finally, different effective interventions must occur consistently at local, state and national levels [22].

Dfferent qualitative and quantitative factors should be taken into account while making the public health policy decisions [23]. These factors are described below (Figure 2):

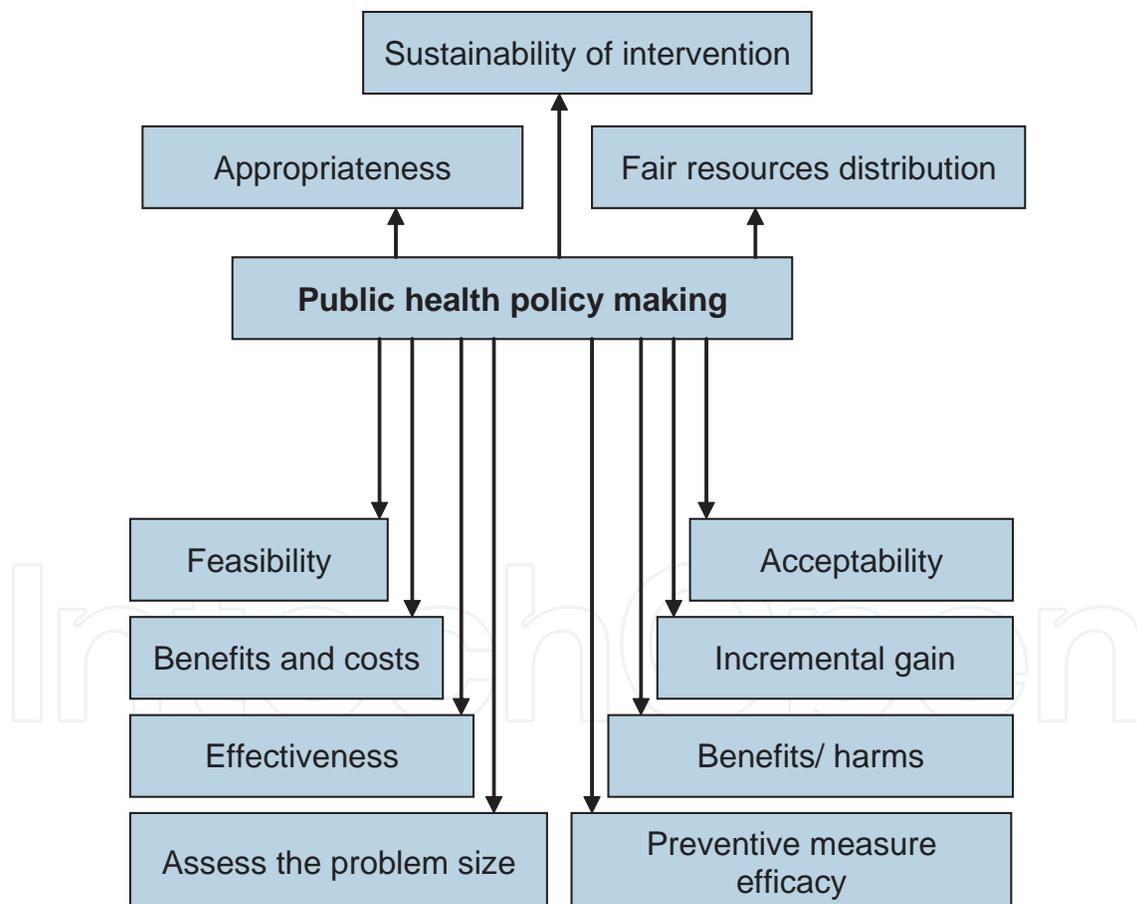


Figure 2. Factors necessary for making public health policy decisions

1. Size of problem: We should always evaluate the problem first, and make sure that it is an important issue with significant health burden.

2. Problem preventability: We should evaluate the efficacy and biological plausibility of the preventive measures before making any decisions.
3. Interventions effectiveness: We should evaluate the effectiveness and generalizability of intervention and make sure that it works in real world settings. We should also analyze the intervention in ideal settings and compare, how much less effective it would be? And, if there is better alternative intervention?
4. Benefits and harms: We should evaluate all the possible benefits and harms of intervention.
5. Comparison of benefits and costs: We should evaluate the total value of intervention and compare it with the possible alternative intervention.
6. Incremental gain: We should also evaluate if there is any additional cost and benefits associated with the intervention we are planning to implement.
7. Feasibility: Feasibility of intervention in prospect of money and time should also be assessed.
8. Acceptability: Acceptability of intervention by community culture and values, as well as by religious and political situations should be evaluated.
9. Appropriateness: Always analyze if the intervention is likely to work in particular settings and various populations?
10. Equitably: Intervention should distribute resources fairly.
11. Sustainability: Can intervention be maintained by available resources and incentives?

2. Analytical tools of evidence based public health

There are several analytical tools which can enhance the adoption of evidence based public health (Figure 3).

2.1. Public health surveillance

Public health surveillance is a very important tool for evidence based public health users. The public health surveillance involves timely and systematic collection, analysis and interpretation of data, and then dissemination of this data to the public health programs, who are responsible for preventing and controlling the disease [24]. To use this data effectively, public health surveillance system should regularly evaluate the effectiveness of disseminated data.

2.2. Systematic review and evidence-based guidelines

To get comprehensive information of any particular research topic, systematic-reviews are crucial, and can be efficient way to become familiar with any specific public health topic

[25-27]. Reviews done with systematic approach are a great source of reliable results, because of limited bias and chance effects. Such results can be used for making decisions in the public health. Guide to Community Preventive Services is one of the most useful sets of review regarding public health interventions, which provides overview of current scientific literature in well defined methods [28].

2.3. Economic evaluation

Another important tool of evidence based practice is economical evaluation, which provides the information about alternative expenditure on public health programs and interventions. Cost-effectiveness analysis compares health interventions with health impacts and outcomes, and can suggest the relative value of alternative interventions and policies [29]. In public health care sector, there is limited data available to support cost-effectiveness analysis for designing policies and programs [30].

2.4. Health impact assessment

Health impact assessment estimate the probable impact of non-health sector interventions on population health, and focus on involving stake holders in project development. Health impact assessment has now been accepted as a tool and is used to assess the potential effects of many health programs and policies on public health status and other outcomes [31, 32].

2.5. Participatory approach

Participatory approach engage communities in the evidence based public health, by involving communities' members in research and intervention projects [33, 34]. This approach relies on stake-holder's inputs where practitioners and community members define the issues, develop intervention strategies and evaluate the outcomes [35]. Stake holders should include people who would potentially benefit from those particular interventions/policies. Three groups of stake holders are important: those involved in program operations like sponsors, administrators, staff etc.; those affected by the program\interventions like family members, clients, elected officials etc.; and users of the evaluation, including those who decide about the programs.

3. Implementation of evidence based public health and challenges

Implementation of evidence based public health is a process which involves several steps.

3.1. Generating evidence from the research

Biomedical research is the first step in implementation of evidence based public health. Initial testing of innovations occurs mostly in laboratories, from where products/processes with merit undergo field trials to assess the efficacy and toxicity. Those with merits further undergo definite testing in large controlled trials with important clinical endpoints.

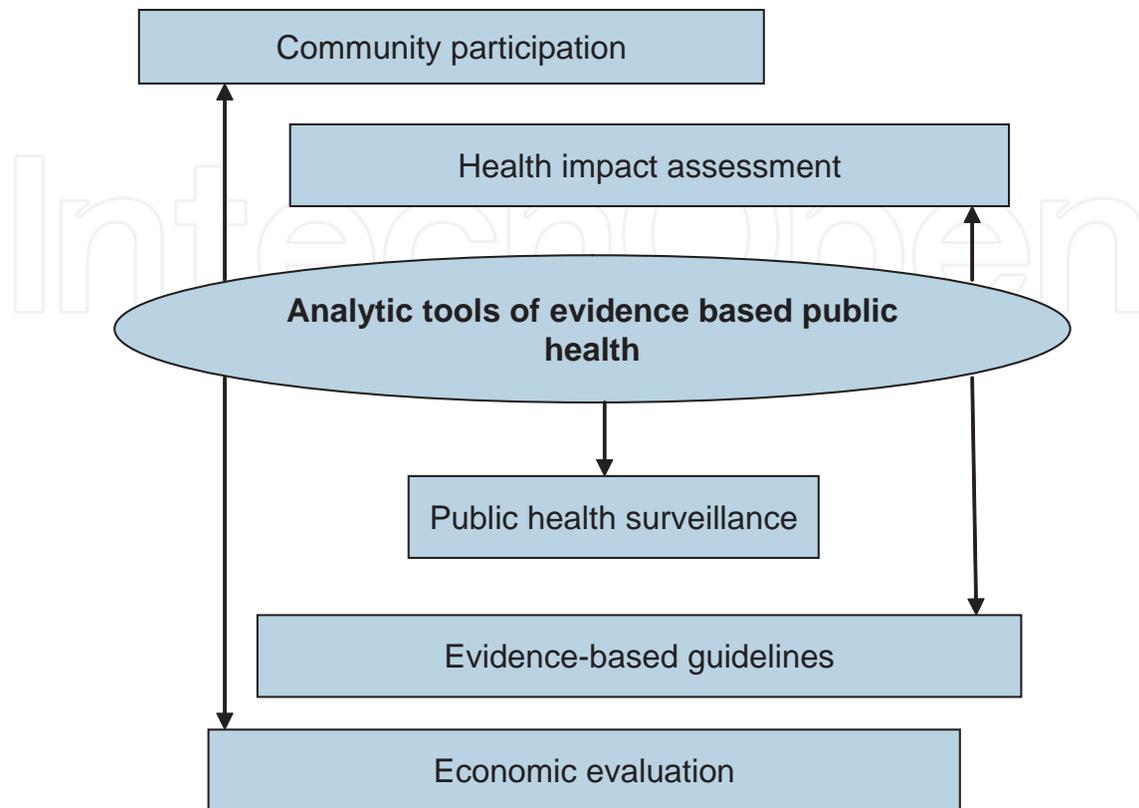


Figure 3. Analytic tools of evidence based public health

3.2. Synthesizing the evidence

Since most of the research results are published in large number of journals, readers are bound to be overwhelmed. Therefore, research results need to be synthesized in compact format which is ready to be applied in clinical settings. Many services like Cochrane collaboration have taken the initiative to summarize the randomized controlled trials of healthcare interventions, and Cochrane library is a robust source of synthesized evidence [36]. Besides this, advances in information technologies and computerized decision support systems are making practice of evidence-based health care systems more feasible.

3.3. Developing policies based on evidence

Clinical policies should be both evidence-based and clinically useful, therefore policies must balance between strengths and limitations of all the relevant research evidence with the practical reality of clinical settings. There are many non-evidence-based factors like culture, religion, ideology etc. which are often considered by policy makers while making national health care policies. Therefore, clinicians should balance research evidence with clinical circumstances, and should act as a part of team planning for change.

3.4. Applying evidence based polices in practice

Once policies are ready, they should be applied at the right time, right place and right away. However certain local and individual level barriers need to be addressed before application.

3.5. Making clinical decisions

Final step in the implementation of evidence based public health is clinical decisions. Research evidence must be integrated with the patient's clinical circumstances, preferences, values and wishes to derive a meaningful decision about management. Evaluating a patient's clinical circumstances requires clinical expertise, which is an important factor for the correct implementation of research evidence in clinical scenarios.

4. Challenges in implementation of evidence based public health

While implementing the evidence based public health, many challenges are faced as described below (Figure 4):



Figure 4. Barriers of evidence based public health

4.1. Organizational culture

Evidence based public health often relies on the evidence champions, who are willing to challenge the status quo and promote the new ways of decision making. For innovation, it is very important that organization support the changes [37]. Rigid personnel system is a barrier to the evidence based public health, which make implementation of new programs and approaches difficult. The continuation of old practices requires less effort than working through the new programs. Therefore, persons who propose the new approaches may get opposed and threatened by colleagues and supervisors, who want to continue with the old approaches.

4.2. Leadership

Leaders of the public health system are important factors in determining the organizational culture and use of resources for evidence based approach. Attention of leadership toward science, quality and performance are important predictors of strong public health system [38]. However in public health, leaders have to face challenges in choosing and implementing the evidence based new approaches.

4.3. Political challenges

Political challenges are big barriers in the implementation of evidence based public health. Policy making often occur quickly on the generalized knowledge and demands from the stake holders, rather than being based on the evidence collected though experimental studies by the researchers [39, 40]. Stake holders often create obstacles for public health agencies in implementing the new evidence based interventions. Occasionally, politics want to implement an intervention before there is sufficient evidence to support it e.g. Drug Abuse Resistance Education.

4.4. Funding challenges

Adhering to the requirements of funding agencies is another barrier in the implementation of evidence based public health. Most of the public health funding is categorical and limits the flexible use of funds to implement the new evidence based programs.

4.5. Workforce training

Poor workforce training is common in public health sectors. Less than 50% of the workers in public health sectors have formal training in public health disciplines [41], and even lesser number have formal graduate training from a public health program. Principles of evidence based medicine are not uniformly taught in the public health sectors. However, competencies for effective public health practice are becoming clearer and many new evidence based public programs have been developed to increase the specific training in public health [10]. However for the success of such training programs, life-long learning by leadership and staff are required [42].

4.6. Cultural and geographical differences

There are large differences across the different continents in evidence based public health. Whereas evidence based public health has been mostly developed in western world, use of evidence based approach to meet the public health problems are limited in developing countries [43, 44]. Even in developed world, results published in journal might not be true representative of all the populations of interest.

5. Future perspectives of evidence based medicine in public health

Out of nearly \$30 billion spent annually on health related research in United States, only a small proportion of it is spent on public health related research [45]. Translation from research to clinical practice requires long time [17, 46], which needs to be accelerated in future for the early adoption of evidence base interventions, to improve public health.

For early and effective adoption of research based evidence in public health will require intensive efforts in different fields, which include expansion of evidence based research and knowledge, engaging leadership, expanding skillful training in public health sectors, enhancing the accountability for public expenditures and overcoming the disparities in evidence based public health across the nations, different races, and communities.

In summary, implementation of evidence based public health is a difficult task which requires immediate attention. Public health is both an art and science, which should balance between research based evidence and beneficial policy decisions. Different barriers should be identified successfully, and early efforts are required to overcome these barriers. At the same time, analytic tools of evidence based public health should be utilized properly. By applying these concepts, public health practice can be improved in near future, across the all nations.

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