

Use And Non-Use Of Epidemiologic Methods For Social/Societal Problems: Could Political Decisions Be Based On More Solid Evidence?

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Abstract: Many societal and social problems cause severe disease and suffering among the persons directly or even indirectly affected. Examples are diverse and include school massacres, fatal car accidents or long-term homelessness. What they have in common is that the political response to such events often varies extremely suggesting that more scientific grounding for policy decisions may lead to stronger support across different political interest groups. In comparison, other areas, such as medical therapies, benefit from sound scientific methodologies, e.g. the GRADE approach (“Grading of Recommendations Assessment, Development and Evaluation”) leading to well-accepted recommendations. This approach gives preference to studies with the highest methodological rigor. Experimental studies, such as placebo-controlled randomized trials, are ranked highest, however, when ethical or logistical reasons prohibit their use solid observational studies, for example case-control studies may provide valid results, too. For the path from evidence to policy the “public health paradigm” is a useful concept leading to the development of intervention or prevention strategies. Their implementation need to be evaluated to test their effect and form the basis for improved policies.

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1 Introduction

Many societal and social problems cause severe disease and suffering among the persons directly or even indirectly affected. Events, such as high school massacres or other mass shootings, regularly lead to almost ritualistic discussions in the public. At first, politicians express unanimously their consternation and sadness. In a second phase, culprits are quickly searched and found and solutions proposed. Astonishingly, they express often completely opposing views to a public left behind with questioning itself what in the world could be done to prevent such events in the future. For example, some politicians propose to restrict access to certain or any guns to private persons [12], while others suggest rather the contrary [15]. To put it carefully it is often unclear how politicians reach opinions or decisions. Frequently, party line might be as important as pressure by media, lobby work or the public polls of the week. One certainly has often the impression that – if such crucial issues lead to so divided standpoints, there may be little scientific grounding leading to these opposing views. In this article I would like to propose to use certain epidemiological study types more frequently AND suggest a simple way that politicians can go in order to find more certainty in their endeavor to protect the health and well-being of the population.

2 Using Science for Rational Decisions: The GRADE Method

First I would like to take a look at other areas where scientific developments and studies form the natural basis for rational decisions. One obvious example is medical therapies, and another is public health recommendations. Evidence-based science and meta-analyses of rigorous studies yield guidelines with therapeutic or public health recommendations that are cautiously graded according to the degree of existing evidence. Meta-analyses summarize the results of separate studies with similar study design with the attempt to raise the statistical power for significant results when single studies cannot reach this goal alone, e.g. because they are so expensive or logistically difficult. Methods exist that give meticulous technical assistance in finding these recommendations and their use usually leads to broad acceptance in the medical community. One of these is the "Grading of Recommendations Assessment, Development and Evaluation" (in short: GRADE) which "has developed a common, sensible and transparent approach to grading quality (or certainty) of evidence and strength of recommendations" in health care.[7, 8] The gold standard study type that GRADE asks for is a so called randomized, placebo-controlled trial where – for example – a new drug is given to one group of patients with a certain disease and a placebo is given to another group of patients with the same disease. Important study principles include that patients are randomly assigned to the group that receives the drug (or placebo, respectively), that patients take part in a study only when they have given informed consent and that patients and study personnel are blinded in respect to who receives the drug and who receives the

placebo (double-blinding).

2.1 Example: Public Health

Another, although related, area is the realm of rules and regulations with public health impact, for example in the food industry. Let us take the US egg safety rule. First studies of mostly outbreaks showed already in the late 1980's and early 1990's that consumption of chicken eggs was associated with human infection due to *Salmonella Enteritidis*. [3, 2, 11] Further epidemiological studies, including outbreak investigations, demonstrated the same association over and over again, in the 1990's and the decade after. It was only in 2009 when FDA announced the "final egg safety rule" with the goal to prevent *Salmonella Enteritidis* in shell eggs during production, storage, and transportation".[5] It states that "shell eggs are a primary source of human *Salmonella Enteritidis* infections" and FDA estimated that implementation of the rule would "reduce the number of *Salmonella Enteritidis* infections from eggs by nearly 60 percent".[5] Here, it was obviously not the gold standard of studies (randomized placebo-controlled trials) that created the evidence because that would have required to expose one group of persons with contaminated eggs and another not. It is another study type that has paved the way, so called observational studies. Epidemiologists call infectious disease outbreaks "experiments of nature", as they allow investigations in a situation where people are divided by an unfortunate, unintended incident into two groups, almost randomly. These two types of groups could be ill and not ill (so called case-control studies), or those who ate unvoluntarily a contaminated food and those who did not (so called cohort studies). The type of data gathered are analysed very similarly to the way experimental studies are analysed. It is the goal to find statistically robust associations between an exposure and an outcome.

Sometimes scientific evidence leads very quickly to consequences, for example when a food item or a batch of food that has caused a particular outbreak is recalled to prevent more disease from happening. [6, 1] The fact that science is not necessarily always followed immediately by sensible rules and regulations can be observed best when we look at the association of smoking and lung cancer. The famous studies by Doll and Hill already showed back in 1950 quite convincingly that tobacco smoking is associated with lung cancer[4] and since then an overwhelming amount of scientific studies have associated cigarette smoking not only with lung cancer, but also with coronary heart disease[14], stroke[10] and many other types of cancer[13]. However, despite this undisputed damaging role of cigarette smoking for the health of people the sale of cigarettes is still permitted to this day.

3 The Public Health Paradigm Applied To Political Decisions

In theory and the ideal world there is a clear and straightforward way to go from problem to solution and it is called the public health paradigm.[9] Step 1 is to define or formulate the problem, step 2 is to measure its magnitude, step 3 is to initiate research studies to get an understanding of the key determinants, or risk factors that contribute to the

Table 1: The public health paradigm [9]

Step	Action
1	Define the problem
2	Measure its magnitude
3	Understand the key determinants
4	Develop intervention/prevention strategies
5	Set policies/priorities
6	Implement and evaluate

problem. Step 4 is to develop interventions and evaluate them, and step 5 is to set policies. From then on it is an eternal cycle to implement, then evaluate, improve the intervention, implement, evaluate, improve, ...

Now, let us think of a few societal or social problems in this context, such as homicide, suicide, drunk driving, juvenile delinquency, etc. and let us go through the public health paradigm.

Step 1 Step 1 is already done when we have defined the problem, such as: deaths in a country or city x through homicide.

Step 2 To measure its magnitude might be difficult. One frequent way is to use some sort of database, for example police statistics that can be used to get a grip of the magnitude of – say - homicides.

Step 3 How can we get an idea of the key determinants? Of course, many types of studies can be used, also e.g. sociological or qualitative studies, however, in my eyes, case-control studies are a scientifically rigorous type of study that can give frequently extremely valuable results and is vastly underused in this context. One advantage of case-control studies is that many risk factors can be researched at the same time, for example ethnicity, gender, social class, educational level, parental upbringing, etc. In addition – when the control group is representative and selected wisely – the case control study will produce an unbiased set of risk factors that may be used to initiate further studies to get to the bottom of the problem.

I have made some simple searches in a database called Pubmed (pubmed.gov) which "comprises more than 28 million citations for biomedical literature from MEDLINE, life science journals, and online books". I selected some societal/social problems as well as – for comparison purposes - infectious and other health problems, and looked how many times the respective problem terms can be found in context with the term "case-control study". Apart from the terms suicide and homicide the terms could not be found more than 30 times, while all of the infectious disease and other health problems could be found more than 40 times (Table 2). While I am proposing here to use case-control studies more frequently for non-medical public health problems I acknowledge of course

Table 2: Pubmed hits for selected societal and infectious disease problems (as of 29 Dec 2017). Searched in: pubmed.gov. Societal and social problems were connected with "case-control study" using the Boolean term "AND".

Societal, social problems	"Case-control study"
suicide	524
homicide	66
Motorcycle crash	30
Bicycle helmet use	23
terrorism	11
Juvenile delinquency	10
Fatal car accident	9
School shooting	2
Long-term homelessness	1
School massacre	0
Trump voters	0
Infectious disease and other health problems	"Case-control study"
Lung cancer	2477
Liver cirrhosis	530
salmonella	387
Salmonella outbreak	206
measles	194
measles outbreak	43

that sociological, psychological, qualitative and other type of studies may contribute important additional information, too.

Step 4 Intervention or prevention studies. Using the knowledge about the risk factors for the problem as well as all of the other information one can gauge feasibility, the population where the intervention should take place, in which geographical area the study should be located, etc.. Perhaps after completion of a feasibility study an intervention study can be designed where for example one type of intervention can be implemented and assessed. A study population and a study goal should be formulated. For interventions it is often well possible to use some form of randomization to increase the evidence. For example one can randomize schools, households, cities, etc. where an intervention will be conducted or not. Double-blinding will only rarely be possible, of course. It is good practice to evaluate the intervention, and perhaps even perform cost-benefit calculations because politicians may ask "What does it cost to do xyz and what do I get for it?"

Step 5 With this information at hand politicians can make informed and scientifically founded decisions for the good of the population and these interventions are now called

policies, rules or laws. Nevertheless, these, too, need to be evaluated (step 6) and – if necessary – amended.

Step 6 Evaluation of the interventions.

4 Outlook

What could be done to consciously go the way of the public health paradigm? Governments need to fund not only studies and perhaps entire institutions, such as in the US the Centers for Disease Control and Prevention (www.cdc.gov), that can be tasked with getting truly independent answers on well-defined problems and questions. And they should also communicate that this is the path they want to go which quite certainly would add to their credibility. At the end it would be a win-win situation: something (a policy) will be done that is very likely to be of benefit for the people, and it would strengthen the confidence in politics and the good work of responsible politicians which – in these days – is direly needed.

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