POPULATION MEDICINE NEWS

Epidemiology, Preventive Medicine, Public Health
Production Medicine, Computer Applications in Vet Med

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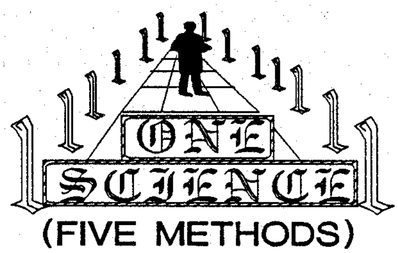
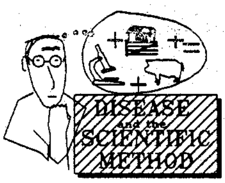


Much of the world cannot be seen from the straight and narrow path of experimental, laboratory science. This is especially evident to those on the front lines of health care.



"If a system of logic, no matter how elegant, fails to guide us in our selection of solutions, we have no choice but to look for answers elsewhere." Stephen K.C. Ng (1)

There is a duality in the human intellect as old as recorded history. Plato urged us not to be satisfied with sense experiences and the beliefs (inductive models) derived from them but to search within our minds for ultimate, rational Truth. More worldly intellectuals, Hippocrates among them, left Final Truth to the academes and sought instead to use recorded observations to build inductive models with the humble goal of solving problems.

We see the duality today in numerous contexts including research on health and disease. The "splitters," heirs to Plato, seek to divide scientific investigation into finer and finer questions, seeking to identify the true and ultimate causes of disease, perhaps (they speculate) at the molecular level. The "lumpers" seek to incorporate all the many causes of a disease into a single, broad, quantitative model. Disease mechanisms operating external to individuals (e.g., environmental and social factors) are included, usually centrally, as well as those occurring within living tissues.

From the standpoint of a splitter, the activities carried on by lumpers are not science or--at best--not good science. Good science involves the testing of a single hypothesis that is isolated from the noise of "extraneous" variables. Since extraneous variables can be highly controlled only in a laboratory setting, that is where good science is done. Science is properly carried on through the use of metal and plastic instruments you find in a lab supply catalogue, not with the "instruments" of questionnaires, latent variables, and multivariate statistics frequently used by the lumpers. From the viewpoint of a splitter, biomedicine is no different than the avowed "hard" or deterministic sciences such as physics and chemistry; indeed, it can be regarded as an extension of the deterministic sciences. So called "soft" or empirical sciences such as sociology, economics, and epidemiology are not really sciences at all. To quote one splitter spokesman:

"Scientists are generally reluctant to deal with the behavior of large groups of men and women. Thus, economists, for example, struggle to be considered scientists but usually in vain." (2)

If you follow the "news" and "letters" columns and "vision" articles of various scientific journals, you will find many other examples of splitters ranting about the lack of scientific discipline among the lumpers. Sometimes the conflicts spill over into the popular media as when a sociologist was almost kicked out of the NSF a few years back just for being a sociologist (thus a non-scientist to the dominant splitters in that organization).

The lumpers are usually too busy tinkering

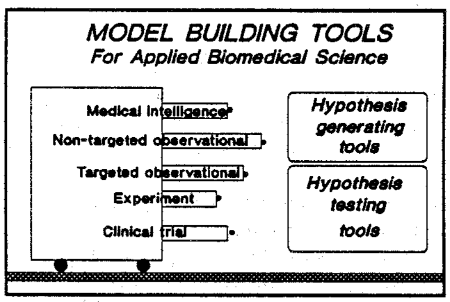


Figure 1. Despite the prestige of experimental, laboratory science, historical accounts indicate that the development of a scientific understanding of disease has been dependent on other methods.

with their models to take much notice of the scientific pharisees. But a nerve was evidently struck several years back which initiated an ongoing exchange of sallies in the Am J of Epidemiology, Am J Pub Health, and other publications. A central theme of many of these treatises is that the academic pursuit of Platonic truth doesn't go very far when there are problems to be solved. Solutions to health problems require inductive models and the key

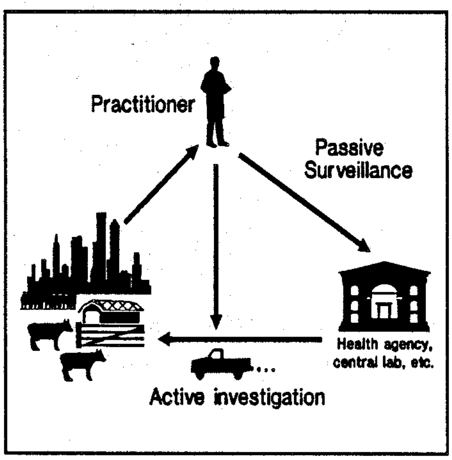


Figure 2. Medical intelligence is characterized by passive subject identification and active followup investigation. The later is very poorly developed in veterinary medicine.

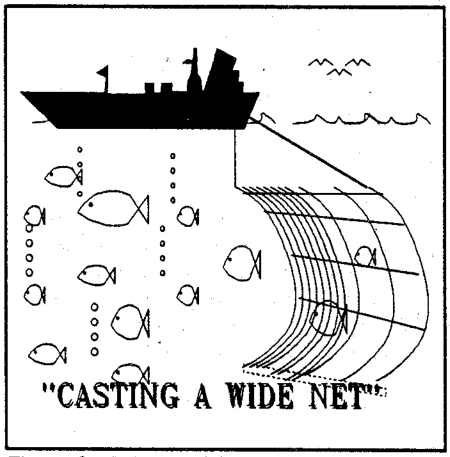


Figure 3. Disparaged by some as mere fishing expeditions, broad observational studies allow an efficient means of confining the causal model and thus allowing strategic hypothesis testing studies.

	1	2	3	4	5
	Medical	*Observational*		*Clinical*	
	Intelligence	*Not Targeted*	*Targeted*	*Trial*	*Experiment*
Subject selection	*passive*	*active*	*active*	*active*	*active*
Hypothesis	*generating*	*generating*	*testing*	*testing*	*testing*
Random assignment	*no*	*no*	*no*	*yes*	*yes*
Physical control of subjects	*no*	*no*	*no*	*no*	*yes*

elements of these models are derived from research outside laboratories, imperfections nothwithstanding. One cannot, according to this view, use "science" in a sentence with an action verb without reference to inductive models; actions are based on beliefs because there is nothing else on which to base actions.

It could be countered, of course, that models might better be assembled from the fruits of laboratory studies ("truths") without having to rely on the inductions of "soft" science. Yet, beyond the troubling fact that most of the papers from laboratory science have become unintelligible to most of the problem solvers, there are 3, more fundamental, points that a lumper would cite as reasons that laboratory-based science can never provide a firm basis for disease problem solving.

1. Diseases with communicable agents do not occur in individuals but in populations, and, thus, the homeostatic mechanisms of most interest ***to a problem solver*** are not those of individuals. For communicable diseases in which control efforts have been successful, social and environmental factors have played key roles.

2. Even for diseases that have non-communicable agents, causality is a complex interaction of multiple causes rather than a single Platonic cause. Though one can control--and thus ignore--the "extraneous" social and environmental factors in laboratory studies, it is not obvious how this can lead to discovery of solutions. Intervention aimed at solving disease problems necessarily involves some action beyond merely naming interesting features of the unfolding pathogenesis. For most diseases, the interventions of greatest utility lie within the broad categories of social and environmental causes.

3. The notion that all or most of our knowledge on disease control comes from laboratory science does grievous injustice to history.

Several specific examples have been presented on this latter point, an excellent example of which is Stephen Ng's recounting of the history of the scientific process with regard to AIDS.(1) The first awareness of AIDS came from medical intelligence.(3) Passive surveillance reports of unexplained clusters of previously recognized but normally rare diseases (eg., Pneumocystis pneumonia) led to active followup investigations (Fig 2). These, in turn, defined the syndrome and identified risk groups which allowed the first hypotheses about AIDS causality. Of particular note, the high risk groups for AIDS were similar to those for Hepatitis B infection (homosexuals with multiple sex partners, users of illicit IV drugs). Thus, medical intelligence--not laboratory science--led to several hypotheses about the infectious nature of AIDS. Several other possibilities were also noted from the original investigations (eg., AIDS caused by amyl nitrites) all of which were eliminated by broad observational studies (Fig 3). Thus, when the issue was taken up by laboratory scientists, there was overwhelming evidence that AIDS was an infectious process and that the agent was likely transmitted in blood and semen but not by other means such as aerosols or fomites (which set limits on the types of agents possible and where one should look for them). Laboratory science has greatly expanded our knowledge about the nature of human immunodeficiency virus and its pathogenic mechanisms. However, most of the information which has allowed containment of AIDS in industrialized countries has come not from lab experiments but from hundreds of targeted observational studies and clinical trials. Development of treatments of AIDS patients has also been heavily dependent on clinical trials. Laboratory science is not, therefore, the sun around which the earth revolves but merely one cog in the machine of science.

The scientific process that has increased our understanding of AIDS is not unique. Indeed, one is challenged to think of an exception in either human or veterinary medicine. Laboratory (experimental) science is critically important in clarifying pathogenic mechanisms but has limited utility in achieving applied solutions to disease problems as they occur in the world. Experiments in closely controlled environments are seldom able to achieve the statistical power necessary to discover key risk factors or to test proposed preventives and treatments, and the control over extraneous variables that is touted as the strength of "hard" science is gained to the detriment of external validity (relevance to the populations of interest).

The important message for future or present disease problem solvers (ie, practitioners) is that problem solving requires a broad knowledge of information gained by medical intelligence, observational studies, laboratory experiments, and clinical trials. Each of the scientific methods has limitations that can be overcome only by interpreting the data in the light of the results other sorts of studies. This process is difficult and subject to error, but the only alternative is the U.P.S.-vet model in which practitioners become mere collectors and shippers of specimens and receivers of vaccines and drugs, with all the intellectual work being left to a scientific elite. Historical evidence indicates that science cannot lead to solutions unless the problem solvers have their eyes, hands, and minds on the populations of interest.

References:
1. Ng SKC; Does epidemiology need a new philosophy? A case study of logical inquiry in the acquired immunodeficiency syndrome epidemic. Am J Epi 133:1073, 1991.
2. Van Doren C; A History of Knowledge: Past, Present, and Future. Birch Lane Press, NY, 1991, p 188.
3. MMWR 30:251, 1981.

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