

Complexity and Public Health Policy

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Focus of Research

- public health concern of controlling emerging infectious disease
- current public health concern
- matches personal research interests in international health concerns, complex systems and ecological systems

The aims of GST

- To investigate the isomorphy of concepts, laws and models in various fields, and to help in useful transfers from one field to another
- To encourage the development of adequate theoretical models in areas which lack them
- To eliminate the duplication of theoretical effort in different fields, and
- To promote the unity of science through improving the communication between specialists

GST- Boulding

- "it aims to point out similarities in the theoretical constructions of different disciplines, where these exist, and to develop theoretical models having applicability to at least two different fields of study. At a higher level of ambition, but with perhaps a lower degree of confidence it hopes to develop something like a "spectrum" of theories—a system of systems which may perform the function of a "gestalt" in theoretical construction. Such "gestalts" in special fields have been of great value in directing research which they reveal" (Boulding, 1956, p197).

The Skeleton of Science

Level	Description	Characteristic	Example	Discipline
1	Structures and frameworks	Static, spatial pattern	Bridge, mountain, crystal, atom	Descriptive elements of all disciplines
2	Clockworks	Predetermined motion	Clocks, machines, solar system	Physics, astronomy, engineering
3	Control mechanisms	Closed-loop control	Thermostat, homeostasis	Cybernetics
4	Open systems	Structurally self-maintaining	Flames, cells	Theory of metabolism
5	Genetic-societal systems	Society of cells, functional parts	Plants	Botany
6	Animals	Nervous system, self-awareness	Birds and beasts	Zoology
7	Humans	Self-consciousness, knowledge, language	Human beings	Biology, psychology
8	Socio-cultural systems	Roles, communication, values	Families, boy scouts, clubs	History, sociology, anthropology
9	Transcendental systems	Inescapable unknowables	God?	Philosophy, religion

The process...

- Gather data about the risk factors in emerging infectious disease
- To determine the disciplines needed to address those risk factors
- To analyze the current health action policies for EID using Boulding's work
- To highlight any gaps in disciplines missing in use by health policy makers

Definitions of risk factors...

- H: “Biological, social, and behavioral characteristics ... that are relevant to health...”
- A: “A factor, such as a microorganism, chemical substance, or form of radiation, whose presence, excessive presence, or (in deficiency diseases) relative absence is essential for the occurrence of a disease.”
- T: “Any mechanism by which an infectious agent is spread from a source or reservoir to another person.” These mechanisms can be direct or indirect.
- E: “All that which is external to the individual human host. Can be divided into physical, biological, social, cultural, etc., any or all of which can influence health status of populations.”

Host, agent, transmission, environment factors...

Host factors...

- higher concentrations in population; 7 population biology; 8 sociology, economics
- movement of populations; 3 feedback, cybernetic systems; 8 sociology, politics
- susceptibility to infection; 4 molecular/biochemistry; 8 sociology, psychology
- speed of global transport of people; 2 clockworks; 8 sociology
- changes in human behaviour; 8 sociology, politics, psychology; 9 religion, philosophy
- herd immunity; 3 feedback mechanisms; 8 sociology, psychology
- recreational travel; 8 sociology, economics
- business travel; 8 sociology, economics

The policy addresses...

- > Surveillance and response:
Objective I-A. Strengthen infectious disease surveillance and response. Objective I-B. Improve methods for gathering and evaluating surveillance data. Objective I-C. Ensure the use of surveillance data to improve public health practice and medical treatment. Objective I-D. Strengthen global capacity to monitor and respond to emerging infectious
- This goal focuses on improving our country's early warning network and developing more effective international surveillance networks

Probable:

Information systems (4) feedback modelling (3) analysis of statistics/patterns (looking for the differences) (1, 2) operations research (1, 2) mathematical modelling (1, 2)

Possible:

behavioural sciences (7, 8) for investigating “the factors influencing their emergence”, although not detailed. Emphasis on clinical epidemiology.

CDC policy...

(1) frameworks/structures	analysis of statistics/patterns (1, 2)
(2) clockworks	chemistry (1, 2), mathematical modelling, operations research (1, 2)
(3) feedback/cybernetic systems	engineering (1, 2) Physical science (2)
(4) molecular/biochemistry, genetics, information systems	feedback modelling (3)
(5) botany	Information systems, biochemistry (4)
(6) zoology	communications (4) microbiology (4)
(7) ecology, population biology	collaboration/communications (4, 8)
(8) sociology, behavioural science, psychology, economics, anthropology, political science	biology (5,6); behavioural sciences (8)
(9) religion, philosophy	education (8)
	politics (8)
	Not covered!

Surveillance Recommendations

- a single network ... combining the “information for action” goal and the multi-disciplinary direction....to combine the talents of international and national surveillance agencies to operate for all contributing agencies and disseminate that information without political or ideological interference
- research direction .. that the qualitative and quantitative data gathering be incorporated into the same databases. This will require advances in models and methodologies which are capable of mixing and interpreting such data
- ecological approach to surveillance is necessary...with not just the biological and social (Krieger, 1994) but multiple disciplines who can also communicate with each other

Health Promotion/Education Recommendations

- addressing the balance between the individual and social concerns inherent in health promotion. Society does have certain needs regarding the control of individuals, especially in the economical and political settings but these are not always in favour of the health of the individual. Such conflicts can be explored by complexity and critical systems thinking and this expertise should be incorporated into the design and implementation of health promotion programmes.
- a second recommendation in this area is to refocus the educational content in the teaching of public health and epidemiology to emphasis learning across disciplines

Interagency Co-operation Recommendations

- education of international and national governmental bodies about the importance of multi-disciplinary research should be promoted. The success of such education would have two benefits: getting the political approval for an international network; and raising the financial support for such a network.
- this is also linked to research goals which must work to provide the justification for incorporating “soft” data into such networks so that approvals are possible.

Current Model

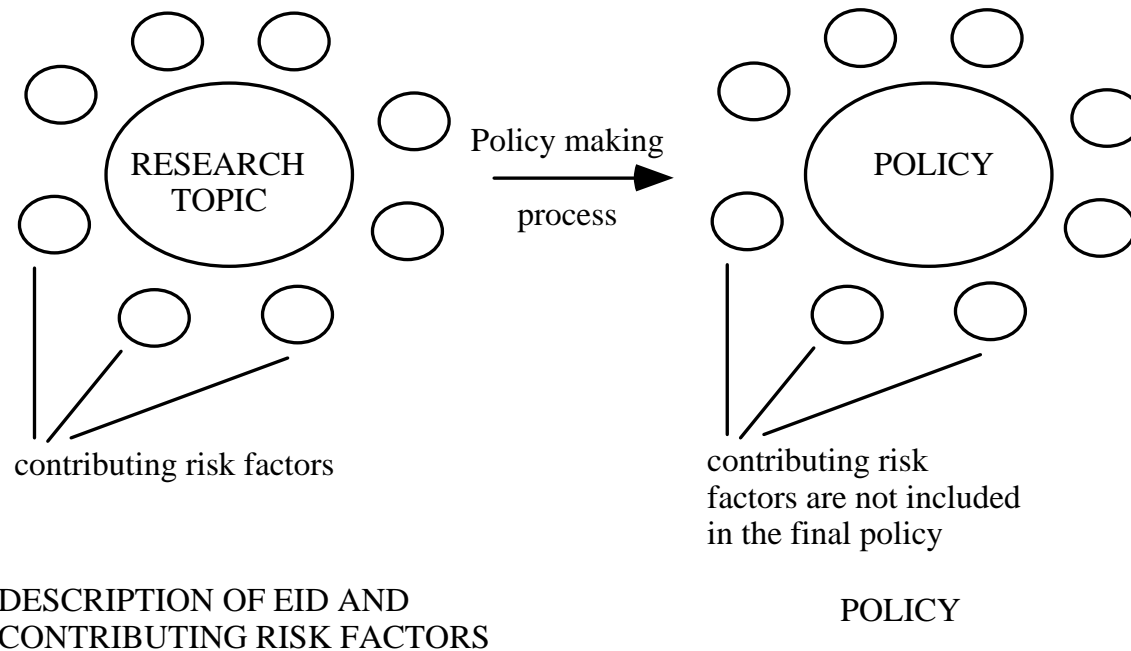


Figure 2: Policy Making with Modern Epidemiology

Proposed Model

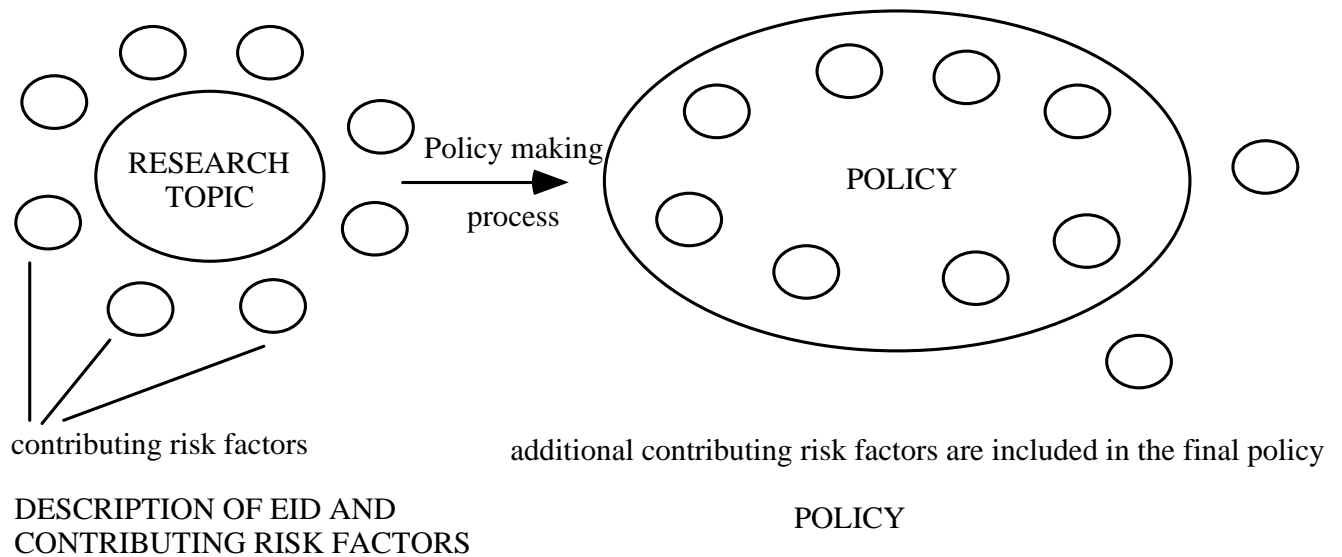


Figure 3: Policy Making with Multi-disciplinary Epidemiology

Applied Research Recommendations

- wise to expand the range of disciplines used in the investigation of emerging infectious diseases in order to possibly recognise emergent properties that come from intervening on levels that are beyond a singular discipline's capacity for understanding
- individual disciplines alone (and their discipline-focused research methods) cannot address the full complexity of such research issues
- Needed: an approach to incorporate all disciplines and increasing complexity and that is what complexity science can offer international public health policy making and its implementation.