Public Health Systems Analysis – Understanding and Handling Complexity – Part Two

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Abstract

Over recent decades public health practitioners have developed a better understanding of the complex relationship that links a wide range of social, economic, environmental and genetic factors to health outcomes. But, despite this better understanding, public health responses have remained distinctly mono-causal – focussing separately on individual lifestyle behaviours, social conditions or genetic combinations and their respective links to specific diseases. In this paper we will consider the potential of a new meta-discipline – *public health systems analysis*. Public health systems analysis draws upon emerging techniques of operational research/systems analysis to provide better representations of public health systems thereby enabling complexity to be retained and appropriate policy responses to be derived. The paper also considers the more sophisticated approaches to evaluation required to monitor the impact of complex public health interventions and to understand the political structures that are needed to underpin them.

The Analysis of Complex Systems

In the first part of this article (Thunhurst, 2014) we outlined the growing appreciation within the public health movement of the complex nature of public health systems. Following a formative period in which health determinants were variously identified and classified – as material, behavioural, societal, etc. – there has emerged an understanding of the need to consider the inter-relationships between individual determinants and the deeper influences acting upon them in a more comprehensive way. This has been called the *Whole Systems Approach*.

Adopting a *Whole Systems Approach* necessitates employing more sophisticated methods for the re-presentation of determinants and of the respective sub-systems surrounding them. It was argued that graphical representations can be employed as a means of capturing and displaying systemic complexities. Reference was made to a variety of techniques (policy analysis, cognitive mapping) which may be deployed to capture and to synthesise complex systemic interactions. Over recent decades a panoply of such techniques, generally grouped under the umbrella of *problem structuring techniques,* (Rosenhead and Mingers, 2001), reflecting the parallel appreciation within other sectors of the need to eschew simplistic mono-causal explanations in an increasingly inter-connected social, economic and political world. In the discussion below we will draw extensively upon this growing body of these techniques.

The Point However is to Change Them

The capturing and re-presentation of the complexities of public health systems is only the initial stage in achieving health improvement. As a once celebrated social philosopher might have said of

public health systems 'the point however is to change them'. Developing appropriate policies and identifying effective interventions requires a breadth of approach, supported by a new range of analytic techniques, to avoid a regression back to linear, simple cause to effect, public health planning.

In the first part of this article we considered briefly the complexities facing the transport planner wishing to place transport policy onto a health promoting footing. At the outset the planner will be aware that transport systems have significant health determining impacts – directly on traffic accidents, levels of obesity and social cohesion, indirectly on levels of heart disease, cancers and mental health. These influences do not necessarily (or simplistically) operate in the same direction – encouraging greater use of cycling (with its positive impact on obesity, heart disease, etc.) will prove counter-productive unless complimentary measures are adopted to ensure that cycling is a safe activity (mitigating the potential negative health impact through increased road traffic accidents). In a similar vein, the full health promoting potential of interventions may be conditional upon wider social and environmental planning considerations – the full potential and health promoting impact of greater cycling (for example) will only be realised if schools and shops are appropriately located. Conversely, the transport planner will need to develop an appreciation of the (negative and positive) health impact of seemingly unrelated policy interventions. It has been argued, for example, that the introduction of a cheap fares policy by a number of metropolitan local authorities in the 1970s and 1980s had positive benefits beyond the obvious economic ones in that it permitted enhanced opportunities for cycling and walking (through less congested and thereby safer streets), improved availability of cheap nutritious foods (where local markets were located in close proximity to bus terminals) and reduced social isolation.

In their ground-breaking attempt to put policies for tackling obesity onto a more holistic footing, the Foresight Committee (Foresight, 2007) commissioned a method of systems mapping (causal loop modelling) to "gain insight into a messy, complex situation", (Vandenbroeck, Goossens and Clemens, 2007a), leading to the production of an *obesity system atlas*, (Vandenbroeck, Goossens and Clemens, 2007b), within which the respective influence of a range of 'clusters' (social psychology, individual psychology, food production, food consumption, physiology, individual physical activity and the physical activity environment) were isolated. Critical linkages, both between and within clusters, were identified. From this, key influences were determined (called respectively the 'system engine' and 1st and 2nd tier variables) and leverage points (education, tendency to graze, purchasing power, stress, and appropriateness of maternal body composition) identified. Policy options were explored by embedding the systems maps into a scenario framework, whereby "the scenarios function as a set of boundary conditions that are imposed on the generic map".

The systems modelling undertaken for the Foresight Committee was conducted through a series of expert workshops. Working at a 'higher' policy level this is not inappropriate. But our transport planner, working at a more local level, will need to access information sources which lie outside of the terrain of the expert. The potential community response to putative interventions (increased provision of safe cycling opportunities, retention of shops within the city centre, greater segregation of different transport modes, etc) can only be determined 'from the horse's mouth', or from a mouth in close proximity to the horse. Health development planners, operating in less advantaged contexts, have deployed methods of rapid participatory appraisal for the assessment of community health needs, (Annett and Rifkin, 1995). This approach operates on the basis of the identification of

'key informants' within a community. "Key informants are people in the community who, because of their position or informal leadership, have access to information about community, rather than individual, views about community problems". On an even more localised scale, where more direct working with a community group is feasible, a Strategic Choice Approach (Friend, 2001) may be adopted or adapted. This guides participants through a number of stages (the shaping mode, the designing mode, the comparing mode, and the choosing mode). A critical output of this approach is a differentiation of decision areas, where action can be taken immediately or in the future, from uncertainty areas, where further exploration is needed.

Evaluating Complex Interventions

And so we come to what is generally represented as the final stage of the planning cycle – monitoring and implementation. In reality, if this treated as a final stage – that is, something to be undertaken after all other stages have been worked through – the intervention will almost inevitably be an unsuccessful one. As we will suggest further below, monitoring and implementation must be considered from the initial stage of design and appropriate processes built in from the start.

Conventionally the "gold standard" of monitoring is said to be the randomised control trial (RCT). However, very rarely will randomised control trials be suited to interventions within complex public health systems. This is for two reasons – one technical, the other practical. The technical difficulty associated with employing an RCT is to do with statistical power and sampling size. Standard calculations for the sample size required to achieve a pre-specified statistical power presume a very direct connection between the point of implementation and the point of impact (medical treatment leading to a change in patient condition). It has been shown that when the point of implementation is more distant from the point of impact (in the example, say, of a diagnostic test where a series of actions are required between intervention and impact) the required sample size increases geometrically. Interventions in complex public health systems will generally be far removed from impact. The geometric nature of the increase in required sample size would dictate the inclusion of millions of participants. The practical difficulty relates to the requirement for the conduct of an RCT that there should be a control group. Let us take again the example of the introduction of a cheap fares policy as a means of achieving numerous and diverse positive health outcomes of both mental and physical nature. Establishing a control area would require having two matched districts within the same local authority area and suggesting that one will have subsidised public transport whereas the other which would have a similar social and economic profile including the payment of local taxes will not would certainly ensure that the second matched area would immediately change in one important aspect – political control. A councillor that made such a proposal to a local population (albeit in the name of rigorous scientific practice) would very quickly be voted out of office. And, of course, there is the integrated nature of public transport systems. It would be the same buses (or trains) passing through the intervention and the control districts. Segregating passengers according to their point of departure is an equally ludicrous proposal.

For more profitable consideration of approaches to monitoring we can look to the experience of project and programme planners for interventions within developing health systems. These are necessarily complex interventions. Even the most straightforward intervention – the introduction of a new therapeutic treatment – would require attendant development of physical and human capacity and of logistic systems. The approach that has become standard for the monitoring (and indeed the design) of complex interventions in such settings centres on the use of a *logical*

framework. The logical framework is (in systems analysis terms) a model of the intervention. The model consists of a four by four matrix with the rows representing the various levels of what is known as the *hierarchy of objectives* – usually termed: goal, purpose, outputs and inputs. The columns represent characteristics of the intervention at each level – generally: a statement of the objective, observable (verifiable) indicators, means of verification and assumptions. Again precise terminology may vary. The hierarchy is so constructed that successful achievement of objectives at one level, together with satisfaction of stated assumptions will lead to successful achievement of objectives at the next level. Whether objectives have been achieved is assessed against the observable (verifiable) indicator – which may be of a quantitative or of a qualitative nature. The means of verification are included to ensure that, from the outset, data gathering systems are in place (or can be cost effectively introduced) to generate the data which are required to calibrate the observable (verifiable) indicators.

The logical framework offers a potentially valuable tool to the designer of interventions in complex public health systems. The hierarchy of objectives captures the complex pathway that generally exists between intervention and impact. Consideration of assumptions (which now becomes an integral part of the design process) provides a checking mechanism to ensure that the effectiveness of the primary intervention does not make unrealistic presumptions about parallel systems. If it does, the intervention should be refined accordingly. If, for example, the introduction of new forms of traffic control requires the cooperation of the local police force, the intervention may have to be modified to include some additional resources or some additional training to cover this. And specification of indicators and the means of their verification implies that monitoring and evaluation are built into intervention design from the outset – rather than a separate process to be conducted following completion of the intervention.

Implementing Complex Interventions

Because of the richness of the model captured by the logical framework project design will necessarily be a progressive and an inclusive process. This in turn can provide significant dividends when it comes to achieving successful implementation. Setting out the complexity of public health interventions implies identifying the range and the nature of the 'actors' involved in implementing the intervention. Securing that involvement may require high level political change. The Health Strategy for Ireland drawn up in 2001, (Department of Health and Children, 2001), a rare document for a developed health system given its acknowledgement of the need for inter-sectoral action for health improvement, proposed the establishment of a cabinet level sub-committee to implement the strategy. {Sadly, the minister who was responsible for developing the strategy was fairly quickly 'promoted' and replaced by a minister from another party from within the political coalition committed to a greatly reduced role for the public sector – with a consequent shelving of the strategy}.

The return of public health in England to its 'natural home' in local government has the potential to ensure the implementation of complex interventions across the respective sectors and departments represented at this level of local governance as well as providing more direct connection to local communities. (It may also coincidentally return a much-needed sense of purpose to local governance, the powers of which have been progressively eroded by central governments of all political hues over recent decades).

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