Post-normal medicine

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The evolution of post-normal thinking—from normal to post-normal science

Since the time of the Renaissance, the predominant metaphor for science has been the machine. Normal science is based on logical positivism—the belief that there is a single universal condition that can be validated and which accumulates with time building on what has gone before.1 With the application of science to medicine—‘the paradigm of certainty’—the modern world had arrived. With it came a view that the methods of science would transcend the psychological, social and cultural forces that previously had shaped world views. But is the clockwork universe finally running down?

More recently, post-modernism has challenged the directives of science, emphasizing the process of knowing and the importance of how our minds form an integral part of that process. To the post-modern eye, the truth is not out there waiting to be revealed but something constructed by people, always provisional and contingent on context and power. A description of reality is an ever-changing approximation which, as we make it more real, slips from our grasp.2 In a recent essay in the Lancet, Muir-Gray argued the case for post-modern medicine,3 an approach characterized by a plurality of meanings and contingencies. However, entrapped by the dictates of the modern and the realities of the post-modern, he misses an essential point—things have already moved on.

Converging from a number of disciplines, post-normal science4 is beginning to recognize a world where many phenomena cannot be understood by breaking them down into their constituent elements and the application of analytical rule-based frameworks. Challenging both modernism and the restricted vision of post-modernism,5–7 its approach is holistic, reflecting diversity, rich interaction and complex dynamics: a meta-view of which the nihilism of post-modernity is seen merely as a limited gaze.

Post-normal medicine does not replace traditional medicine or contest its claims to reliable knowledge, but offers a complementary perspective on the delivery and evolution of health care which we feel resonates with the experience of medical practitioners and the contingencies of the real world.

Some fundamentals of complex systems

A complex system is a system of individual agents, who have the freedom to act in ways that are not always totally predictable, and whose actions are interconnected such that one agent’s actions change the context for other agents. Interactions invariably are non-linear—small changes can have large effects and large effects can lead to small changes. Systems cannot be understood by a reduction into their component parts, and are sensitive to their starting conditions.

Agents operate according to their own internal rules or mental models, i.e. rules for how they respond to the environment. Because agents can both change and share mental models, complex systems can learn and adapt over time. Complexity is the result of the rich non-linear interaction of agents in response to the information each of them is presented with. Examples of complex systems include the immune system, a patient–doctor consultation, a hospital, health authority or the health service itself.

Understanding complex systems

A fundamental insight from this approach is that it is rarely possible to define goals and engineer complex systems accordingly. However, despite the lack of predictability, it is possible to obtain valuable insights about the behaviour of complex systems and retain a degree of prediction and control.

Trajectories and attractors

A useful metaphor is to view complex systems as a multi-dimensional phase space. Each dimension will define one of the many variables that describe the system, of which the observer will be an inevitable part. Configurations of higher dimensions can be studied by their projections onto lower dimensions, but no perspective
will encompass the whole. Post-modernism becomes simply a limited perspective within the system.

Each agent will follow trajectories through this phase space and, in some areas, all trajectories will lead towards an area of phase space known as an attractor. Attractors limit the room for manoeuvre in phase space. In a GP practice, attractors could be maximization of income or equitable access to health care provision. Two current NHS attractors are a desire for equity and efficiency.

**Complex systems are dependent on their history**

The history of a system will be critical to the framework within which meaning is generated. For example, it would be inadvisable to consider the current developments in primary care in the NHS without an understanding of their historical context. Davies has warned of the dangers of comparing health systems where the historical context is often different.

**Information is distributed across the whole system**

Although agents act strongly with elements closest to them, information is distributed across the whole system. Due to non-linear characteristics, small changes in one area can have large effects across the whole system.

For example, the riding accident of the actor Christopher Reeves had a large but probably inappropriate impact on the redistribution of research funding into spinal injuries in the USA. Alternatively, large influences may only result in negligible outcomes. *The Health of the Nation* initiative was a major strategic NHS initiative designed to influence health, but a retrospective analysis confirmed it as a failure with little impact on the targets it sought to influence.

**Complex systems are unpredictable but have emergent properties**

Although unpredictable, complex system behaviour evolves from the interaction among system agents without external direction or the presence of internal control. This property is known as emergence and gives flexibility to adapt and self-organize in response to change. A balance of co-operation and competition drives this change in such a way as to maintain system stability. In a highly stable system there will be one or two strong attractors, the system will quickly come to rest and the capacity for adaptation will be impaired. If, however, there are too many weak attractors, the system may jump around haphazardly.

Towards post-normal medicine

The complexity approach has much in common with other systems approaches which have already been developed, such as grounded theory and total quality management. However, complexity theory offers a broader, potentially unifying framework in which health care can be understood.

There is a small but growing literature on the application of this new way of thinking in medicine. For example, Griffiths has suggested how complexity may be applied to a conceptual model of understanding general practice and how it can offer insights into the future development of general practice research linking qualitative and quantitative methods. Harris has used the complexity approach to facilitate inter-agency working and the resolution of practical problems at a community level within a large city. At a micro-organizational level, Miller has offered insights into the organization of individual primary care practices, how change occurs and can be implemented. Davies has drawn upon complexity theory to describe the evolution of learning organizations with the NHS, stressing the importance of rich interactions from which learning organizations emerge. Royston has drawn upon the analogy of an ecosystem to understand health care systems and capture the essentials of their complexities.

Post-normal medicine does not overturn modern medicine—certain properties can be described by rules if they prove to be useful, particularly when systems are highly structured. It seeks to complement it by offering valuable insights into system behaviour at every level. It cautions that in many areas, predictive and analytical power can only be obtained from standing back; that often the emphasis should be on the gaze rather than attempts to compress reality into a disciplinary framework: that sometimes it may be better to be vaguely right than to be precisely wrong. The legitimacy of common sense and experience is elevated to sit alongside specialist and empirical knowledge.

The post-normal approach is not without its detractors who see it as little more than intuition already contained in popular wisdom. Invariably, these commentators lack the insight of practitioners who are in contact with the contingencies of the real world and for whom modern medicine has been unable to provide a model to describe the physical, psychological and social elements of illness and the complex interactions between health care and health. Post-normal medicine may offer the framework that reflects the essential interaction between information, knowledge and wisdom that they seek.

The Complexity in Primary Care Group web site is at [medicine21.com/complexity](http://medicine21.com/complexity). The Group is holding a conference in Exeter, 20/21 September, 2001. Details are available from David Kernick at SU1838@eclipse.co.uk.

References

9 Greenberg D. NIH resists research funding linked to patient load. Lancet 1997; 349: 1229.