Complexity and Healthcare

An introduction

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CHAPTER FOUR

Complexity and the clinical encounter

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‘If things were simple, word would have gotten round.’
Derrida (1988)¹

Summary
Models of the clinical encounter have been developed in general practice over the last 50 years. More recently, there has been an emphasis on the use of probabilistic research evidence in clinical practice. The consultation may usefully use such evidence but the majority of consultations tackle health issues where it may be more useful to consider the patient as a complex system interacting with their environment, where outcome can not be reliably predicted. The patient’s narrative of their illness brings the time dimension and the patient’s context to the consultation. In addition, there can be flashes of understanding that emerge through the interaction of the doctor and patient. Complexity theory provides a framework for incorporating non-linear science, including narrative and intuition, into clinical practice along with probabilistic forms of evidence. Such a framework raises questions about how, and for what benefit, clinical data is recorded in this age of electronic health records.
Introduction

The essential skills of the clinician are the ability to gain rapport with the patient, to elicit significant findings and to integrate them into an appropriate diagnostic and therapeutic model based on the application of expert clinical methods.² Thus clinical medicine is not just a scientific discipline, but depends on expert clinical interpretation and integration of the various contextual narratives that make up the patient’s story.³

The interaction between patient and clinician has been especially well studied in the context of British general practice through analysis of the patient–doctor consultation. In this chapter I will review the major studies and models of the patient–doctor consultation that have been developed since general practice emerged as a specialty in its own right in the 1950s. I will then review the strengths and weaknesses of applying linear models in the consultation and, finally, consider the application of ideas developed from complexity theory to the clinical encounter. The patient and the clinician can both be seen as complex biological systems living within larger complex systems that make up the local community and society at large. Their interaction over time through various clinical and social encounters may be seen as a complex medicosocial system in its own right. How might complexity theory shed new light on the consultation in clinical medicine?

Modelling the clinical encounter (consultation)

The study of what happens in the consultation between clinician and patient has developed in the UK from the 1950s onwards. Balint’s work in the 1950s based on case study analysis had a profound influence on the teaching of a generation of British general practitioners (GPs).⁴ In the 1960s, Berne developed the transactional analysis model of interactions between individuals.⁵ While in the 1970s Byrne and Long published their well-researched and pioneering study of doctors’ verbal behaviour.⁶ These attempts to develop an understanding of the clinical encounter underpinned the emergence of general practice as a medical specialty in its own right and helped to foster an intellec-
tual, academic and educational framework for the learning and teaching of general practice in the UK. 7

Roger Neighbour states that the purpose of modelling the consultation is to simplify the complex – ‘when we speak about models of some complex experience, we are in the realm of metaphor, of analogy, of maps and representations … Models make sense of sensation’. 8 Neighbour describes many different models of illness, which include scientific, moral, magical, social and political themes. Some or all of these may come into play during the consultation, both from the patient and the clinician as they seek to make sense of the world. Understanding each other’s models of illness is a crucial step on the way to establishing rapport in the clinical encounter.

Early attempts at developing an understanding of the consultation used the ‘role model’ to study the doctor–patient relationship. An example of a behaviour derived from this model is the ‘sick role’. Patients and doctors have certain expectations of each other based on the roles they assume during the consultation. This type of approach tended to reinforce a medical model of illness which was doctor-centred and linked to the achievement of particular tasks during the consultation, while Helman’s ‘folk model’ of illness offered a series of patient-centred tasks during the consultation. Byrne and Long analysed the range of behaviours used by doctors talking to patients and used this model to develop profiles of doctors’ consulting styles. All contributed to the development of an understanding of the behaviours and approaches that clinicians could adopt to facilitate the patient–doctor relationship and enhance the quality of the consultation. Neighbour draws on all these influences in the development and presentation of his ideas of a ‘left brain organiser’ and ‘right brain responder’, representing the intellectual and intuitive skills respectively which the doctor needs in the consultation.

The rationale for the development of these models has been to progress our knowledge and understanding of the tasks and behaviours in the clinical encounter. Thus it should become easier to learn and teach consultation skills based on an understanding of the tasks and behaviours that facilitate successful outcomes from the consultation. The application of these skills is formally assessed in British general practice, both through the summative assessment of all GP registrars at the end of their training and by the
Royal College of General Practitioners in their examination for membership.

**Linear models in clinical practice**

The application of an evidence-based approach to medicine is at the heart of recent health policy in the UK. The approach suggests that:

- to make better decisions, clinicians will need to develop the necessary skills and tools to apply probabilistic methods to clinical reasoning
- the application of simple linear models can significantly improve diagnostic performance
- the gathering of good base-rate data in clinical practice and the application of Bayesian statistical techniques could facilitate the application of these methods to clinical care.

If most of our work in clinical practice was effectively modelled using simple linear methods then the adoption of an evidence-based probabilistic approach to clinical care and the consultation would surely be an ethical duty and priority for all practising clinicians. However, Tudor Hart has observed that many patients in primary care do not have the sort of hypertension (raised blood pressure) that lends itself to a standard evidence-based guideline.

The application of a (Popperian) scientific hypothetico-deductive clinical method would seem to be appropriate for the practice of probabilistic, evidence-based medicine. However, there is evidence that expert clinicians do not often use these hypothetico-deductive methods of reasoning. Experts may instead rely on a rich network of factual knowledge (syntax) and the abstract interrelationships between these items (semantics) to make decisions. This highly elaborate, structured and complex knowledge base is the true mark of the expert in the field. So, while it is important to apply linear models where they can enhance clinical performance, it is equally important to understand their limitations.

Patients also use simple linear models to help them understand health and illness. Perhaps the best known of these is the cause-effect model. Examples of this include smoking causing cancer,
drugs causing side effects and life events causing depression. Patients may understand the limitations of these models, particularly in their ability to be predictive for the individual, and the importance of social and environmental factors. The use of linear models by the medical profession may well reinforce patient attempts to develop a similar ‘scientific’ approach to health and illness which will tend to be linear and positivist. These models may provide a useful way for patients to understand health matters. In a time of crisis or serious illness, where there is fear and uncertainty, the apparent certainty of medical science can be reassuring. However, overreliance on linear medical models can cause distress when the apparent certainty does not come about.

So it seems that while linear models can improve our clinical performance they do not reflect the way that expert clinicians make decisions, nor do they necessarily fit easily with the illness profiles and expectations that patients present to their doctors.

Key concepts in complexity theory

Key concepts in complexity theory that I will be using in the remainder of the chapter are as follows.

1 A complex system cannot be understood by analysing its components (reductionism). A system that can be understood in this way is merely complicated (e.g. a jumbo jet). Complexity arises from the interaction between the components of a system and the interaction between the system and its environment. These relationships shift and change over time, often as a result of self-organisation. This can result in new features (emergent properties). The brain, language and the economy are all complex systems. Chaotic systems usually appear from the non-linear interaction of small numbers of components, while complex systems contain a large number of interacting components. Simple theories (or definitions) cannot adequately explain complex systems. Perhaps the best working definition of complexity is by Luhman. ‘A complex system contains more possibilities than can be actualised’.
It is possible to model complex systems, but these models must themselves be as complex as the systems they represent (e.g. neural networks). Complex systems depend not only on their constituent parts, but also on the interactions between those parts. Thus a reductionist approach to analysis will inevitably lose some of this richness. We can model, explore and explain complex systems – but we may not be able to understand them.

Complexity is not located at a specific site in a system because it arises from the interaction between the components of the system. Complexity shows itself at the level of the system and many of these systems are biological. Self-organisation is a characteristic of complex systems. These systems are not stable, but tend towards 'self-organised criticality', whereby the system organises itself to be maximally sensitive to its environment. Small changes can lead to large differences in outcomes (as in chaotic systems). This sensitivity may be manifested through positive feedback loops, amplifying the effects of change, while negative feedback loops tend to lead to homeostasis.

A complex system must also have two key capabilities:

- it must be able to store information about its environment for future use (representation). This representation may be distributed across the system, existing in the pattern of connections between elements of the system.
- it must be able to adapt its structure when necessary (self-organisation). A system can develop a complex structure from fairly unstructured beginnings.

The concept of phase space is taken from chaos theory. A phase space diagram represents the complete set of knowledge about a system over time. It is like a road map of all the possibilities for that system with its history charted as a trajectory through time. Attractors live within phase spaces and represent boundary conditions for the system. Small changes within the system may lead to large and unpredictable changes as the system flips between various stable states (bifurcation).

Complexity and the consultation

Where in the application of linear models is there a place for the unstructured problems that patients present to their doctors, which
do not fit easily within an evidence-based approach, or for the intuitive insights and Balint-like ‘flashes’ of understanding\(^7\) that doctors are suddenly aware of in the consultation? How can we develop an understanding of the everyday clinical practice of a primary care physician, and develop a model for the consultation that reflects the real nature of the clinical encounter? One way of modelling the content of primary care is to use a Stacey diagram.\(^17\)

In the Stacey diagram (Figure 4.1), the zone at the bottom left represents medical conditions for which there is a high degree of certainty and agreement about actions and their effects on outcomes. As our evidence base expands, more conditions should

![Figure 4.1 The Stacey diagram – the health zone of complexity in primary care. (The word chaos in this diagram is used with the common meaning not the specific meaning in mathematics describing ‘chaotic systems’.)](image-url)
move to the bottom left zone. A linear, evidence-based approach is likely to be appropriate for managing these types of conditions. This zone typically represents a population-based approach to service delivery. The zone in the top right of the diagram represents areas in which agreement and certainty about outcomes is low. There is unlikely to be any (good) evidence to apply to conditions that fall into this zone and a scientific, linear approach is unlikely to be successful. The middle zone represents 'the zone of complexity' where there are only modest levels of agreement and certainty. This applies to individual patients and populations within primary care. Tudor Hart’s observations about hypertension in primary care would serve as an example of a condition falling into this zone.

The doctor and patient engaged in a consultation are themselves complex adaptive systems. They have their own history which influences their current state and they interact with their environment. The time dimension, and interactions within the system and with the environment are crucial to understanding the development of complex adaptive systems. This idea has a close parallel with patient narratives. I suggest a new intellectual model is needed that weaves together these three strands:

- the appropriate application of a scientific (probabilistic/linear) method
- the various narratives that make up the patient’s health and illness story
- the unpredictable, intuitive, emergent phenomena that emerge in the consultation.

The consultation is the central activity of general practice. The patient’s problems, hopes, fears and expectations are explored and the clinician formulates a biomedical diagnosis during the consultation. An exploration of how complexity theory may be applied to this interaction and lead to the development of a new intellectual model of the consultation is described below.

Complexity and a consultation with Mrs Smith

Mrs Jean Smith is a 48-year-old housewife and mother of two late-teenage children. Jean is an alcoholic who works in a local super-
market. She recently faced disciplinary action for drunkenness at work and poor attendance. At home she is unhappy and has suffered alleged sexual abuse from her husband and physical abuse from both her children. She is a heavy smoker with frequent winter chest infections and is being treated for hypertension. She has just been discharged from hospital after a serious suicide attempt. She attended the surgery for a sick-note to return to work. Despite her recent admission to hospital she looked remarkably well, smiling and chatting. She told me how friendly and supportive her family, friends and employer had all been and insisted that she was now ready to turn over a new leaf. Over the past few years I seem to have had little or no impact on this lady’s health as I have struggled to get her to face up to her various problems and modify her behaviour to improve her health. Suddenly I had my ‘flash’ of understanding and I was able to see her as she saw herself – a helpless victim of her circumstances rather than a ‘heart-sink’ collection of medical diagnostic labels and Read codes.* My sudden insight changed my view of her so that I could see and understand her as she saw herself. I seemed, at last, to have a grasp of her story.

How could complexity theory help to model this consultation? My flash of understanding of her predicament and the subsequent change in diagnostic label from ‘alcoholic’ to ‘victim’ was sudden and unpredictable. This change in direction (bifurcation) led me to consider new influences on her health, both negative (risk factors) and positive (medico-social interventions). The patient’s recent response (overdosage) could be understood as a reaction to these influences (emergent behaviour). Her overall state of health could be seen as an attractor, which gives a qualitative representation of her life. The factors that influence her at any moment in time will not be quantifiable and her health at any given time will be unpredictable within the overall behaviour of her health system, although it can be observed over time.

Jean Smith can be seen as part of a complex social system.

*http://www.cams.co.uk/readcode.htm or http://www.coding.nhsia.nhs.uk/default.asp
Understanding her problems required a lot more effort than the application of a few diagnostic labels (e.g. alcoholic). My new understanding required the ability to see (model) her relationships and roles within her social network. The support and recognition her actions brought from the local community, family and friends were crucial factors in her rehabilitation and somewhat enhanced status after her overdose. She now has a new status and new relationships within the system and, paradoxically, has probably benefited from her actions. These actions have had non-linear effects on herself, her family and carers. Feedback loops have undoubtedly been triggered by recent events, so she has now reached a new state of ‘criticality’ within her complex environment.

Complexity theory provides both a framework for modelling my patient’s health story and a clue to intuitive reasoning. Perhaps my flash of understanding was the final piece in the jigsaw of developing an accurate mental model that (at last) represented something of the complexity of this woman’s overall health influences. This shift in understanding came as a revelation to me and can be seen as the result of complex processes within my own mind as I struggled to develop a mental model for my patient. Such a radical shift in my thinking cannot be explained by linear hypothetico-deductive methods or by the recognition of a ‘pattern’ of illness. I believe that my new understanding of the patient arose as a result of complex processes within my own ‘neural-net’ that helped me to understand her illness script and the complex nature of her responses to her situation.

This links back to Neighbour’s ‘right brain responder’ and seems to be the antithesis of a logical, linear, hypothetico-deductive or reductionist approach to clinical problem solving, and to demonstrate the need for an integrated, complex and essentially non-linear reasoning model to supplement the traditional scientific clinical method. I suggest that we need to include an opportunity to consider intuitive/non-linear interactions within the consultation, particularly where the issues are difficult and the illness multifactorial. Complexity theory provides such a framework. This links back to the earlier work of Balint, Berne and Neighbour as they all sought to understand and promote clinician behaviours that could enhance the consultation.
Complexity and clinical knowledge

Complexity theory presents us with a challenge to the way that we perceive scientific knowledge. It also affects the way we think about research, particularly about the application of scientific ‘method’, where the choice of method influences the types of results. Scientific results need to be interpreted in the light of the methods used rather than generalised in ways that may be inappropriate – either to the situation or to the individual patient. The effects of interventions will also be unpredictable for my individual patient. This closely reflects the experience of many clinicians and has profound implications for the interpretation and application of population-based studies to the individual. Using biomedical evidence in clinical practice is difficult, because evidence from group studies cannot predict outcomes for individuals and is further complicated by the context of the consultation.

Perhaps we need to think in new ways based more on the relationships between individuals rather than on deterministic statistical methods. This has traditionally been the realm of qualitative research, but new statistical methods are now being developed that should increase our understanding of complex systems. This has implications for the way we undertake, interpret and enact research results. Population-based research can never predict how an individual will respond to a medical intervention (the doctor or the drug). An individual lives and interacts within a complex social environment. This too will affect that individual’s response to treatment. This is particularly important as we enter the brave new world of clinical governance and the pressures that we will be under to apply an evidence-based approach to individual patients and their problems.

The application of complexity theory provides a framework for incorporating non-linear science into clinical practice. This means we can consider narrative and intuition within a scientific clinical methodology. The world is complex, but organised. Descriptions of the world cannot always be reduced to simple deterministic statements. Complexity provides a framework within which we can study the complex, non-linear stories of our patients and our consultations.

Practising medicine requires interpretive skills – recognising the
patterns of symptoms and signs that are the essence of an expert clinical method. These methods of knowing have more in common with the social sciences, economics and law than the physical sciences. I believe that we should acknowledge the richness and complexity of the social interaction that sits at the heart of the doctor–patient relationship and move away from measurement and reductionist methods.

How is this relevant to the patient and doctor in everyday clinical practice? I believe that we should extend our clinical method to include non-linear science. Complexity theory provides an intellectual framework for the integration of non-linear science into our clinical method. By adopting this approach, clinicians give themselves an opportunity to understand the full richness and complexity of their patients’ lives and illness and to open new options for diagnosis, treatment and understanding. We are now in the position to establish a new model for clinical method that incorporates both the science and art of medicine. This demands that the linear and non-linear parts of the consultation must be given equal value and has major implications for learning and teaching clinical method at all levels in future.

What might such a clinical methods model look like? A simple scheme to represent these ideas is shown below (Box 4.1).

<table>
<thead>
<tr>
<th>Linear</th>
<th>Non-linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional scientific method</td>
<td>The ‘art’ of medicine</td>
</tr>
<tr>
<td>Left brain</td>
<td>Right brain</td>
</tr>
<tr>
<td>Logical cognitive model</td>
<td>Intuitive cognitive model</td>
</tr>
<tr>
<td>Hypothetico-deductive</td>
<td>Interpretive, contextual</td>
</tr>
<tr>
<td>Probabilistic</td>
<td>Unpredictable (within boundaries)</td>
</tr>
<tr>
<td>Reductionist</td>
<td>Holistic</td>
</tr>
<tr>
<td>Quantitative</td>
<td>Qualitative</td>
</tr>
<tr>
<td>Evidence-based</td>
<td>Narrative-based</td>
</tr>
<tr>
<td>Good for complicated problems</td>
<td>Good for complex problems</td>
</tr>
</tbody>
</table>
Complimenting the traditional scientific clinical method with new models helps us recognise and deal with the intuitive, non-linear, qualitative aspects of the consultation:

- the appropriate application of a scientific method to medical problems (alcoholism, hypertension, smoker)
- the various narratives that make up the patient’s health story (family, sexual and work problems)
- the unpredictable, intuitive, Balint-like flash of understanding (patient as powerless victim, understanding of context).

**Looking to the future**

We can and should use probabilistic reasoning and an evidence-based approach *when it is appropriate to do so*. To fully appreciate our patients and their health needs, we need to understand and apply a clinical method that incorporates the best scientific evidence but also appreciates the illness narrative and the complexity, including the non-linearity, of the patient’s and health professional’s experience.

The application of complexity theory is not an argument against evidence-based practice. I believe it is possible to practice evidence-based medicine in a complex, narrative-based world. Applying the best available evidence to support an intervention can complement the crucial medical skills of eliciting and interpreting the patient’s story. However, in the real world, the evidence base may only apply to a small proportion of our patients. The application of complexity theory to an understanding of the clinical encounter can enhance our models, interpretation and understanding of the problems our patients present to us. Through this better understanding, we should be able to offer appropriate interventions based on a sound clinical method. McWhinney describes general practice as ‘the only profession to define itself in terms of relationships, especially the doctor–patient relationship’. He acknowledges the complexity of (general practice) medicine by promoting an organismic rather than mechanistic metaphor of biology. In other words, we are more than the sum of our parts.

These new ideas have major implications for the way that we
record the consultation. Clinical coding methods tend to be reductionist. Recording a consultation with an 8-year-old asthmatic child and his distraught mother in a 5-digit Read code misses all the detail from the narratives of the patient, his mother and the doctor. Coding systems are important for transferring details of drugs, illnesses and allergies but they cannot capture what actually happens in the consultation. ‘Lest we forget, for countless patients it is the telling of their stories that helps make them well.’

The NHS is committed to developing electronic health records for all clinical systems over the next few years. These lifelong electronic health records will need to be able to record and present the full range of complex information that patients present to their health professionals throughout their lives. Consultation records will need to have multidimensional links to related problems, people and interventions longitudinally through time. These electronic records will need to be able to model and display this information in a way that helps the clinician understand the complexity of each case. Simple coding structures and problem lists are by definition reductionist and lead to a loss of colour, context and detail. This is very relevant when considering my alcoholic patient. How could a computer present this lady’s health story to me in a better way? Could the computer have helped me to see the situation differently earlier?

In this chapter I suggest bringing the non-linear and narrative elements of our clinical practice into a new model for the clinical encounter. I propose that the traditional Newtonian/Cartesian account of the world is inadequate for explaining the complexity of the relationships between a doctor, his patient and the social system in which they both operate. I suggest that complexity theory may help to bridge the gap between the ‘science’ (linear) and ‘art’ (non-linear) of medicine. This offers a new paradigm for the extension of our clinical methods to incorporate the intuitive, non-linear and narrative elements of our patients’ lives into a new scientific model of the expert clinical method.

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References