Systems and complexity thinking in general practice

Part 2 – application in primary care research

Joachim P Sturmberg
MBBS, MFM, PhD, FRACGP, is Honorary Associate Professor, Department of General Practice, Monash University, Melbourne, and Conjoint Associate Professor, Department of General Practice, Newcastle University, New South Wales.
jp.sturmberg@gmail.com

Systems organise themselves upward toward larger wholes, and downward toward ever smaller parts. The upward view describes holism or emergence (complexity science view), the downward view reductionism or analysis (Newtonian science view). Both views provide valid and valuable information, one being contextual, the other specific. A systems and complexity view allows a simultaneous understanding of a phenomenon from different perspectives, providing the opportunity to identify potentially different outcomes from a single action. The findings from studies on prescribing antibiotics and continuity of care will demonstrate and draw attention to the potential of this approach for primary care research.

An earlier article[1] provided a brief introduction to systems and complexity thinking, and how this approach can be introduced in solving clinical problems. Primary care researchers, however, are also interested in understanding the broader complexities confronting our discipline. Like general practice, complexity science focuses on relationships, which offers an exciting new way of approaching research questions in general practice.[2]

This article contrasts the still prevailing Newtonian scientific view with that of the emerging complexity sciences. Two examples illustrate the application of complexity theory to primary care research.

Assumptions underpinning classic (Newtonian) and complexity sciences

All scientific endeavour starts with *a priori* assumptions. Classic (or Newtonian) science assumes that any system can be understood by making as precise as possible distinctions between its different components, properties and states (ie. describing a closed system). It further assumes that these distinctions are absolute and objective, and that all observers will be able to see things in exactly the same way. The whole system is understood by analysing its smallest components.

According to this view, the world is inherently simple, perfectly regular and predictable.[3] However, the theories of modern physics – quantum mechanics, relativity theory and nonlinear dynamics – have overthrown these simplistic assumptions and have led to the conclusion that our scientific knowledge of the world is fundamentally uncertain.[3]

General systems theory describes the world as intrinsically open and in a state of interaction with its environment. Systems are constrained by their boundaries, however exchanges occur across boundaries, so that a system can receive inputs from outside and send outputs to systems beyond its own boundaries.

Systems organise themselves upward toward larger wholes, and downward toward ever smaller parts. The upward view describes holism or emergence, the downward view reductionism or analysis. Both views provide valid and valuable information, one being contextual, the other specific.

The behaviour of the whole system is not only determined by the properties of its parts – the behaviour of the parts is to some degree constrained by the properties of the whole. Even though the interactions within a system aim to maintain a given status quo, these interactions alter components of a system and thereby alter the system itself – the two mutually adapt through coevolution, a process that cannot be predicted in a cause and effect relationship; rather systems behave in nonlinear fashions and at times may produce surprising and unpredicted outcomes.

And so to general practice. The following two examples illustrate the application of systems and complexity thinking to primary care and the potential impact on health outcomes. These examples reframe the problems, arrange the 'known' in a systems way and demonstrate that this approach gains further – contextual – understanding of the issues.

Antibiotics in the treatment of 'sore throat'

The general message that people with sore throat presentations in general practice seldom require antibiotics is well known. However, audits still show that doctors prescribe antibiotics to a large proportion of their sore throat patients.

Little et al[4–7] reported a number of explanations for this phenomenon. *Figure 1* translates their findings into an influence diagram, and demonstrates the interconnectedness of the key elements at play.

Immediate prescribing of antibiotics improves patient satisfaction, enhances patients' belief in the benefits of antibiotics, and provides social justification for their visit to the doctor. There are additional consequences, however: an increase in the doctor's workload, increased cost to the health care system, and an increase in future prescribing and associated risk of potentially harmful side effects (*Figure 1*). The influence diagram provides additional explanations:

- communication failure
  - patients perceive their communication with the doctor to be better when antibiotics are prescribed than when antibiotics are not prescribed. Therefore, altering the way doctors communicate rather than reminding them about the judicious use of antibiotics may be the most important strategy in reducing overprescribing of antibiotics for sore throats
- doctor perception
  - doctors' perception of having to immediately prescribe antibiotics for sore throat may significantly impact on their communication with patients, an important factor that has not been taken into consideration. Understanding doctors' perception of their role in dealing with these common infectious diseases may be critical to breaking the reinforcing feedback loop between patient expectation, prescribing, satisfaction and future presentation for the same complaint
- workload
  - in a high pressure situation, writing a prescription takes less time than promoting symptomatic treatment to reluctant patients
- patient perception
  - a gap in understanding emerges from these studies: we do not understand the patients' perspective of the illness beyond their basic concern.

This short exploration not only provides an expanded view on prescribing in the consultation, it also highlights the interconnected features that impact on the decision making process. Gaps in knowledge become apparent, and the analysis can usefully inform the design of further studies.

Continuity of care

Continuity of care with a doctor is a hallmark of effective and efficient medical care.[7] Achieving continuity of care involves attitudinal, structural and process components.[8,9] *Figure 2* highlights the dynamic nature of interactions within a continuity system. A variable must exist in a context and will impact and be impacted upon by multiple variables simultaneously – a change in one variable will impact on all other variables in the system. Focusing solely on any one variable describes only one particular perspective and may lead to conclusions being drawn out of their proper context. Overlooking these characteristics of systems is likely to lead to 'unforeseen, and usually undesirable, outcomes'.[10]

The influence diagram indicates that doctor-patient stability is a variable directly affected by a number of diverse inputs: the doctor's knowledge about the patient, the patient's knowledge about the doctor, communication and access to care. Doctor-patient stability itself affects the doctor's knowledge about the patient, consultation difficulty, consultation actions and consultation length, patient attitudes toward care and the patient's knowledge about the doctor. A feedback loop starting with the variable 'unemployment' shows how the input of a variable from outside the 'continuity

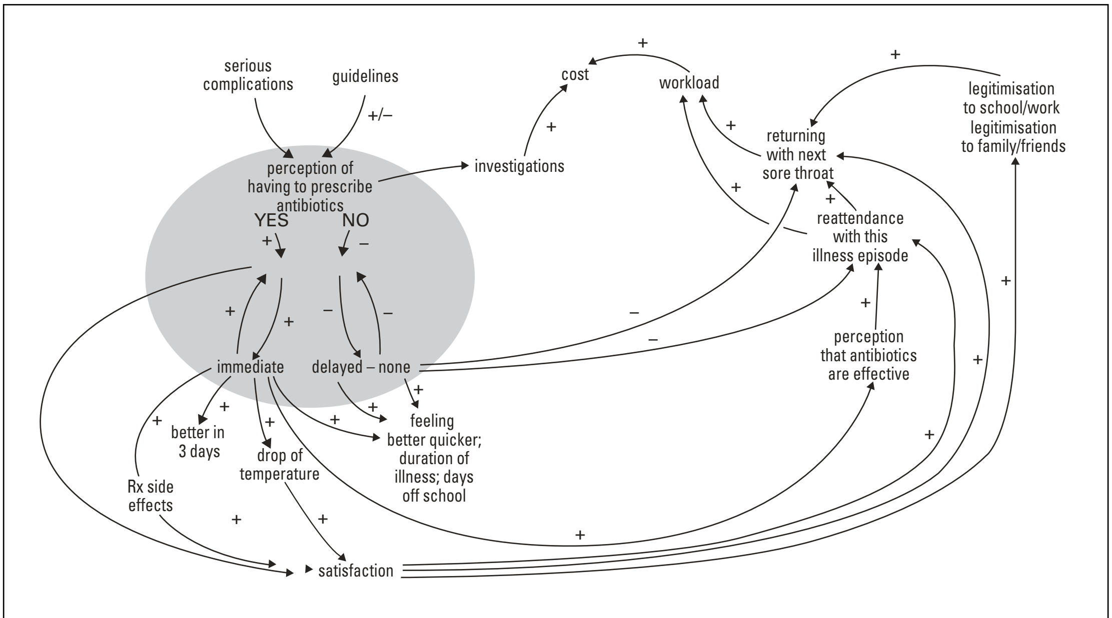

Figure 1. Influence diagram for 'prescribing for sore throats'
(Note: patients reported differences in communication with a doctor depending on prescribing decision. The reasons for these differences have not been examined)

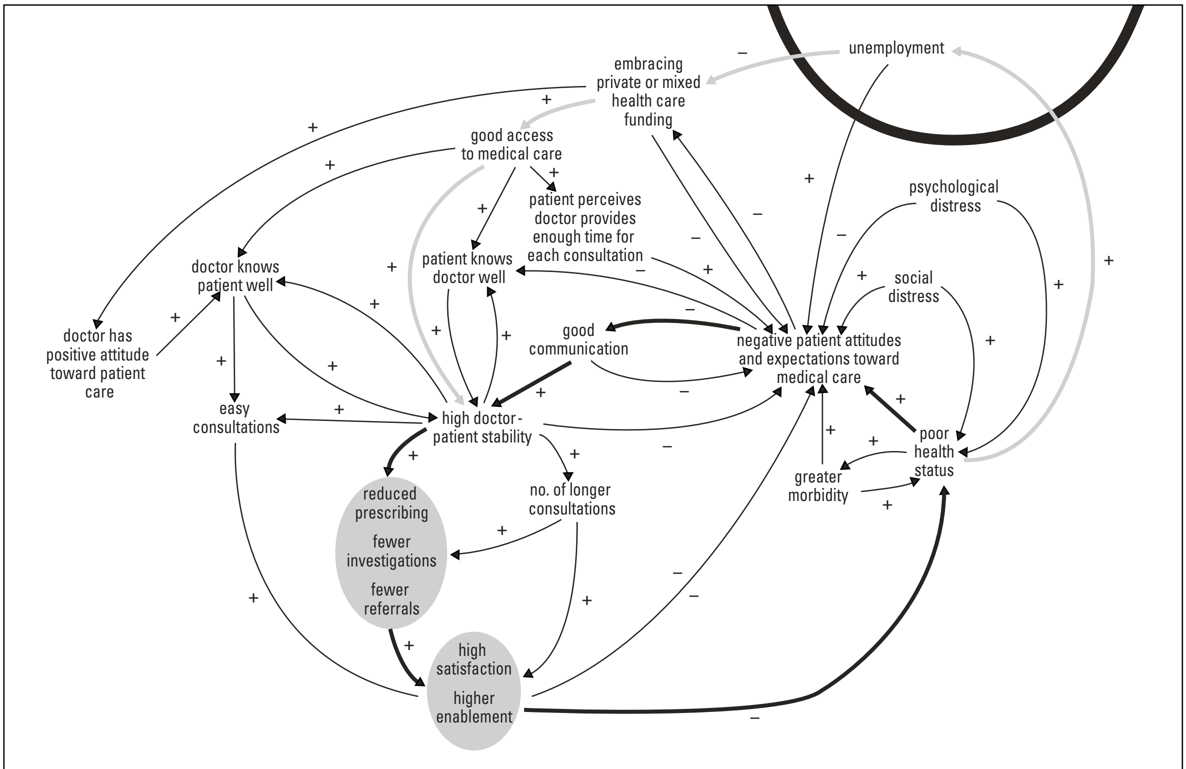

Figure 2. Continuity of care influence diagram (Note: age related differences in patients' attitudes toward ongoing doctor-patient relationships are not shown)

Increasing doctor-patient stability leads to an increase in the likelihood of providing longer consultations and an increase in better consultation activities, both of which lead to increased patient satisfaction and enablement. Increased satisfaction and enablement lead to a decrease in negative patient attitudes toward medical care, and a simultaneous decrease in poor health status, both of which decrease negative patient attitudes toward medical care. The decrease in negative attitudes toward medical care increases good communication and an increase in good communication leads to an increase in doctor-patient stability, closing the feedback loop (heavy arrows)

system' can substantially contribute to poorer consultation processes and decreased health outcomes, which in turn will reinforce unemployment levels (heavy grey arrows).

The continuity of care study demonstrated another system property; the context of a variable may exhibit different thresholds for influencing other variables. Better access to care can increase doctor-patient stability, however, healthy middle aged patients[11] did not see this as an important feature to their care and did not gain the inherent health and economic benefits associated with a stable doctor-patient relationship.[7]

Conclusion

These two examples show how systems and complexity thinking helps to better understand complex situations and to better avoid making potentially 'foreseeable' mistakes.[10] Systems and complexity thinking provides a formal way of describing and exploring patterns and causal relationships between the multiple variables of complex problems. These explain how particular actions may lead to divergent but mutually agreeable outcomes.

Conflict of interest: none.

Acknowledgments

Thanks to Professor George Freeman (UK) in the development of this paper, Professor Janet Smylie (Canada) and Dr Kaye Atkinson for their valuable comments on earlier drafts of this paper.

References

1. Sturmberg JP. Systems and complexity thinking in general practice – part one: clinical application. Aust Fam Physician 2007;36:170–3.
2. McWhinney IR. William Pickles Lecture 1996. The importance of being different. Br J Gen Pract 1996;46:433–6.
3. Heylighen F, Cilliers P, Gershenson C. Complexity and philosophy, 2006. Available at http://uk.arxiv.org/abs/cs.CC/0604072.
4. Little P, Williamson I. Sore throat management in general practice. Fam Pract 1996;13:317–21.
5. Little P, Williamson I, Warner G, Gould C, Gantley M, Kinmonth A. Open randomised trial of prescribing strategies in managing sore throat. BMJ 1997;314:722–7.
6. Little P, Gould C, Williamson I, Warner G, Gantley M, Kinmonth AL. Reattendance and complications in a randomised trial of prescribing strategies for sore throat: the medicalising effect of prescribing antibiotics. BMJ 1997;315:350–2.
7. Saultz JW, Lochner J. Interpersonal continuity of care and care outcomes: a critical review. Ann Fam Med 2005;3:159–66.
8. Sturmberg J. Continuity of care: towards a definition based on experiences of practising GPs. Fam Pract 2000;17:16–20.
9. Saultz JW. Defining and measuring interpersonal continuity of care. Ann Fam Med 2003;1:134–43.
10. Dörner D. The logic of failure: recognising and avoiding error in complex situations. New York: Metropolitan Books, 1996.
11. Sturmberg J. The foundations of primary care. Daring to be different. Oxford: Radcliffe Medical Press, 2007.

afp CORRESPONDENCE email: afp@racgp.org.au