Why system inertia makes health reform so difficult

Health systems around the world are struggling to find effective ways to make clinical practice safer, more effective, and evidence based. **Enrico Coiera** argues that the reason may be system inertia and looks to biology for solutions

It is a conundrum, and a source of deep frustration, that health systems seem so resistant to change. Safety and quality initiatives struggle to make care safer for patients.[1] Restructuring health services seems to achieve little.[2] Evidence based recommendations and standards pile up unheeded or poorly enacted.[3] Blame for system resistance shifts depending on the observer. We make culprits of clinical culture, policy, politics, or the vested interests of industry. However, this inertia to change may be a more fundamental property of the health system.

It is often said that systems are perfectly designed to produce the outcomes that they do. Somehow, healthcare has come to be constructed so that it is resistant to new policies and practices, even across apparently dissimilar national systems. The struggle that characterises health reform may thus not be a function of poorly designed or targeted initiatives.[4] We may instead be seeing what might be called system inertia, which is a tendency for a system to continue to do the same thing irrespective of changes in circumstance. Without seeking to understand the fundamental causes of system inertia we are unlikely to be able create the safer, more effective, and resilient health systems we all strive for.

Clinical inertia

Defined as a failure by healthcare providers to initiate or intensify therapy when indicated, clinical inertia has been documented for many conditions, including diabetes,[5] hypertension, and dyslipidaemia.[6] Although blame for clinical inertia was initially put on clinicians, its causes appear multiple.[7] One compelling explanation is that clinicians are in fact making the best decisions they can,[8] in the face of multiple competing demands.[9-11] Not everything that should be done can be done in a single encounter. Clinical encounters are constrained by time and uncertain or absent data,[12] and clinicians juggle multiple problems, prioritising some over others.[13] For example, the decision to increase hypertensive therapy for a patient with high blood pressure might be delayed if the clinician thinks other clinical priorities must be dealt with first. Competing demands have been found to influence management in diabetes, mammography, depression, and smoking cessation.[10 14-16]

Intentionally making a suboptimal decision to satisfy competing demands is called "satsificing."[17] When resources are limited, humans choose a "good enough" solution that partially meets multiple goals. This notion of satisficing does not fit easily with the linear and single problem model underpinning classical evidence based care.[18] It also does not sit well with quality strategies that target particular behaviours, failing to notice that resources are simply being withdrawn from elsewhere to meet new targets.[19]

As demands increase, it thus becomes harder for any single goal to get the full attention and resources it needs. For those who advocate clinical standards to improve the quality and safety of care, competing demands has one immediate, disturbing outcome. The inevitable consequence of an ever growing supply of clinical standards when human resources are scarce is that the fraction of standards that are actually complied with will eventually approach zero. A wealth of standards leads to a poverty of their implementation.

If we are to build a health system that can adapt to changing circumstances and new shocks, we need to understand the nature of the system we are asking to change

System inertia

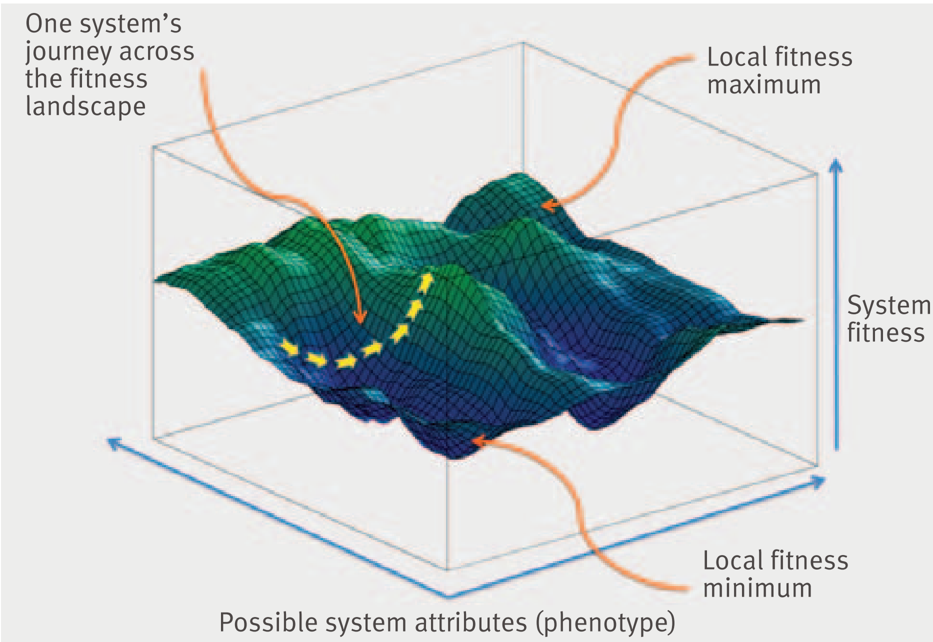
Clinical inertia alone cannot explain resistance to change across the health system. Inertia is not just seen in therapeutic decision making but in the slow progress with patient safety initiatives and the limited effectiveness of restructuring. Is clinical inertia thus just one manifestation of a more general phenomenon of system inertia? We could define system inertia as a failure by a human organisation to initiate, or to achieve, a sustained change in behaviour despite clear evidence that change is essential.

Organisational inertia has been studied in other fields for many decades. The blame for inertia was initially assigned to slow administrative and political decision making.[20] A structural inertia thesis—that organisational inflexibility was an outcome of poor adaptation to change—gradually replaced this thinking.[21] Humans apparently favoured structurally static organisations—perhaps, because they were believed to be more reliable or accountable. Unfortunately static organisations become increasingly out of step as the surrounding environment changes.

For a time the only solution to stasis was believed to be dramatic or catastrophic organisational shift: a "big bang" theory of organisational adjustment. Such ruptures temporarily opened the window for major institutional change, only to be followed by a period of further inertia, until the next crisis. Clearly however, system changes do occur, and crisis is not at the centre of them all. Rather, change is typically hard won, erratic, and hard to reproduce. There are levers to move the system; it is just that they do not move freely or predictably. This process of erratic change without major structural reform has been described as *bricolage* (French for tinkering) where we make do, shifting existing structures and resources around to new purposes, usually with variable success.[22]

Few studies have examined system inertia within health services. In one retrospective analysis, successful adaptation to change among US hospitals was found to be rare, and the problems of inertia increased with organisational age and population density.[23] Undirected change seems unsuccessful, and blunt interventions such as ownership change, corporate restructuring, downsizing, and a succession of chief executives all seem to be harbingers of hospital closure.[24] When hospitals do manage to overcome inertia and change services, their risk of closure seems to diminish. Adaptation to new circumstances seems easier for hospitals that provide a broad service. Specialised units struggle to adapt, perhaps because adding or removing a service is harder if it represents a major part of what an organisation does.[24]

Could competing demands also explain such health system inertia? It has been said that the larger the system, the less the variety in its product.[25] Have we accreted a health system with so many individual processes and structures that their competing demands interlock the system



A fitness landscape shows how organisational performance varies with design

into relative rigidity? If so, this could explain much about our failure to progress with health reform. The first question we thus need to ask is why human organisations appear to grow in complexity over time. We next need to ask how that complexity leads to inertia.

Causes of health system complexity

Health systems seem to become more complex over time (in the sense of having more interacting elements and interdependent behaviours) for various reasons. The first is simply the statistical tendency of all physical systems to accumulate random variation. Diversity and complexity can arise by simple accumulation of random events. In biology, the "first law" holds that evolutionary systems accumulate such diversity and complexity over time, independent of natural selection.[26]

There must also be a parallel first law of organisations, which holds that organisations accumulate diversity and complexity over time, independent of directed action. Random variation clearly shapes clinical processes. The same process implemented in two locations will over time accumulate variations, just because of random effects such as changes in staff, breakdowns, miscommunication, and workarounds. Eventually small differences become entrenched into "the way we do things around here." Even a simple process such as transferring a patient by trolley between wards is affected by random variation in the way that many small steps come together to generate a wide variety of outcomes.[27]

The second reason that health systems become more complex is directed action, much like natural selection. For example, a pro-innovation bias[28] may result from policy makers and managers being rewarded for introducing new or improved processes and not for dismantling old ones. Humans value gain over loss, and this may partly explain why relinquishing old processes seems more risky than adopting new ones.[29]

For many individuals and organisations, substantial costs are sunk into existing structures and processes, and change threatens that investment. In healthcare, we have a vast system that consumes enormous funds and which has a large number of stakeholders. Funders (such as government or insurers), the professional guilds, manufacturers of medicines and devices, and patients generate competing demands, and contribute to system complexity. Some demands arise from sunk costs, such as existing investments in operating services or professional skills and roles, and can generate conflict and power struggles when a compromise harms one group more than others.

How complexity and competing demands lead to system inertia

Theorists in physics and biology have developed a way of relating structural complexity to the way a system adapts to challenges. In these models, systems are composed of individual elements, with dependencies between the elements.[30] Each configuration has a certain "fitness" for purpose. The graph that shows all possible variations of the system, and the fitness value of each, is called a fitness landscape (figure). Each peak in a fitness landscape represents a system configuration that is fitter for purpose than its surroundings. Smaller peaks are called local optimums, and the highest peak of best performance is the global optimum. Fitness landscapes help visualise how changing an organisation's structure shapes its effectiveness and capability to change adaptively.

As organisations journey across their fitness landscape, changing structure and function over time, they can get stuck in territory where little improvement is to be found. In flattened landscapes, most directions for change yield little return. In rocky landscapes, you need to be in a space where the direction of change also takes you higher up the landscape. The journey from a small peak to another higher peak may even demand a journey that first decreases an organisation's fitness. Making such a journey requires all those with influence to understand that things will get worse before they get better. Asking an individual health service to change its locally optimum ways, for a period reducing its performance so that eventually the whole system will benefit, is a hard sell. Indeed, in hierarchical organisations, configurations known as sticking points can lock the organisation into behaviours that are not even locally optimal.[31]

Experimental computer modelling has shown that as the number of dependencies increases in a system, the height of the local optimums in a landscape lowers.[30] In other words, the more dependencies there are in a system, the more likely they will be in conflict (through competing demands), flattening the landscape and diminishing the potential for improving system fitness. Thus the more complex a health system becomes, the more difficult it becomes to find any system design that has a higher fitness.

System inertia and health reform

Recognising the existence of system inertia has implications for how we interpret the results of attempts to reform the health system.

Rather than seeing inertia as negative reaction to reform, we now see it as the natural emergent behaviour of the current system. System inertia may thus be a rational response to interventions that seek to reform when individuals and organisations have to manage other competing demands. If the benefits of a reform come at the cost of other important organisational goals, then organisations and the individuals in them will necessarily satisfice. In a system that is overconstrained with competing demands, the human attention and physical resources needed to make a new intervention succeed are just not available.

We must also be cautious in ascribing a failure to reform to the reform itself. When a system is overconstrained, any intervention, irrespective of intrinsic merit, will struggle to change system behaviour. The inability to show that a reform works may tell us more about the global state of the system than the intervention. Incentives are an instructive case in point. Pay for performance, the linking of reimbursement with adherence to safety and quality measures, can improve quality.[32] However, it can also distract efforts from non-targeted outcomes.[33]

When competing demands are modest, a small incentive is probably all that is needed to reweight priorities. But when competing demands are heavy, small incentives may not be able to change the decision equation. Only when incentives are substantial can they can bring change to an overconstrained system because they now also bring the resources needed for change. Setting the right price for an incentive may thus require more dynamic and flexible approaches, such as market based control.[19]

To fully understand the effect of competing demands on reform, we will need to compare similar change initiatives in different health systems.[34] The affordances to change in a system need to be measured as a comparator, along with outcomes—for example, which competing demands were present and how did they affect available resources for the intervention? Evidence might show that less complex systems in smaller nations or newer health services are more responsive to change.

System apoptosis

If this analysis is correct, then for innovation to succeed in the presence of system inertia there must first be reduction in system complexity. For example, we might need to retire old clinical standards to free clinicians up to adopt new ones, or clinicians must be supplied with genuinely new resources to meet the additional demand.

Understanding which elements of a system to remove for a specific change is non-trivial. Mathematical modelling shows that the complex networks most resistant to change are extremely vulnerable to selective removal of individual elements, greatly changing behaviour.[35] Biology, however, provides many examples of complex organisms undergoing extraordinary change, such as the journey from tadpole to frog or the development of a limb stub into a hand. All such changes depend on a biological process called apoptosis, or programmed cell death. Apoptosis has both local and global elements to it, where cells can respond to external (top down) signals as well as changes in their own local circumstances (bottom up).

System change thus requires a complex of coherent actions that both build and destroy. The idea of creating a "bundle" of clinical actions that together form a cohesive unit is gaining traction,[36] and has been shown to improve quality and safety in managing ventilation assisted pneumonia[37] and sepsis in intensive care.[38] One reason bundles might work is that they are programmatic, first ceasing enough existing processes to release new resources. Secondly, the bundle is a coherent set of actions, hopefully with a reinforcing internal logic. Once started, all steps must be completed, with limited opportunity to avoid individual steps because of competing demands. Bundles might help us understand the right size and complexity needed for system change.

Developing methods that allow complex human organisations to reliably and sustainably undergo the same degree of change we see in biology, by design, is a tantalising prospect. Apoptosis should be designed at the creation of new processes or structures, and triggered when indicators show that they are becoming obsolete. For example, large organisations today struggle with older "legacy" information systems that become increasingly out of date. Legacy systems constrain innovation by absorbing scarce resources and limit the choice of new systems to those that interoperate with the old. Information apoptosis would use clear retirement rules to manage growth in paper forms, software complexity, or information systems.

Conclusions

This thinking may change how we approach health system reform and the evaluation of health system interventions. Health systems research should not just focus on whether one intervention or another "works". If we are to build a health system that can adapt to changing circumstances and new shocks, we need to understand the nature of the system we are asking to change. Inspired by cellular apoptosis, we may also one day be able to design health systems that programmatically retire ageing or unneeded processes before new ones come on board.

A final word of caution, however. Apoptosis is death "by design," triggered by well-understood signals in the local environment. Apoptosis is not excision. Removing unwanted processes in a health system after the fact, and without programmatic rules, is likely to have many unanticipated and unpleasant consequences. That too is the nature of systems.

Enrico Coiera director, Centre for Health Informatics, Australian Institute of Health Innovation, University of New South Wales, Sydney, Australia

e.coiera@unsw.edu.au

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