14 *Toward a Systems Thinking Theory for Health Systems**

DAVID T. TAN

14.1 Lessons from the Case Study Approach

Thus far, we have utilised a problem-based approach in applying systems thinking to health systems. We have surveyed the historical development of the Malaysian health system for adaptive behaviours, unintended consequences, tipping points for change and other systems lessons and presented in-depth systems understandings of problems or interventions in 11 case studies co-developed with health experts (HEs). In addition to providing insights for health systems, described in Chapter 13, this exercise draws out lessons for the application of systems thinking to health system strengthening.

Challenges to developing and applying system insights in health system improvement and elsewhere have been discussed extensively (Trochim et al., 2006; Plsek & Greenhalgh, 2001; Basile & Caputo, 2017). In the process of researching and co-developing the materials for this volume, several obstacles stood out. First, in both interviews and surveys of written documents, we often encountered a plethora of facts with no organising hypothesis. That is, the development of the health system was often described simply as a series of events without critical reflection on how these events were connected and what the key enablers or alternative development possibilities were. While such event descriptions are an important source of data for mapping out the system of interest, this level of synthesis is insufficient for drawing out meaningful lessons.

Where an organising hypothesis was present, there was still a tendency toward simple narratives and universal solutions that frequently obscured complex interactions. For example, health system interventions were often presented as self-contained activities implemented by visionary leaders; much probing was necessary to uncover the contextual factors that allowed a change to occur, that shaped the form of the

https://doi.org/10.1017/9781108954846.017 Published online by Cambridge University Press

intervention and that mediated the intervention pathway. Finally, restricted views of the problem space, and of the health system itself, limited the ability to recognise causal pathways — a common reason for the health system shortcomings described in the case studies.

Overcoming these obstacles to understanding complexity is challenging and time-consuming; acting on these insights adds further challenges because co-operation from multiple actors is typically necessary. Thus without tools and incentives to support efforts to pursue systemic understandings, health system actors are likely to base their understanding and decision-making on simplistic mental models.

This is not to say, however, that health system actors are unaware of the complexity of health issues and health systems. Indeed, in the co-production of the case studies, the HEs readily recognised the system effects suggested to them, observed these effects themselves, or had already utilised system principles in making operational decisions. Nonetheless, systemic insights rarely emerged at the outset of the case study collaborations. Instead, the linear cause-and-effect analysis was typically prevalent in initial explorations of health system problems and interventions. While the HEs had, or could readily reach, systemic insights when asked about the broader context of the case studies, they often found it difficult to articulate these insights in understandable ways. Indeed, several proponents had experienced difficulty getting other health system actors to see the issues in the ways they did. This difficulty in communicating systems understandings hinders learning by making it difficult to blend the mental models of the broad range of stakeholders.

Narratives are powerful communication tools, with stories and case studies often being more persuasive than more 'robust' forms of evidence in persuading policymakers (Sallis et al., 2016). However, narratives are used for more than communication; the construction of narratives is a sense-making process in which we build understanding. Indeed, we need narratives to make sense of evidence even as we use evidence to construct more accurate narratives (Schlaufer, 2018; Rickinson et al., 2019). And, because narratives can be rich and multi-layered and hold competing ideas in tension, they are a useful tool for addressing complexity. However, because they are easier to develop and propagate, many narratives are relatively simple. This is good to the extent that the understandings they communicate are useful. However, for many complex problems in health systems, simple

narratives are unable to capture important features of the problem, leading to poor understanding and decision-making. The case studies in this volume are experiments in creating experience-based systemic narratives that better capture the key features of health system complexity and make the related insights more accessible to a broad audience.

It is not possible to prove that a given systemic narrative is accurate; any such 'proof' rests on *a priori* assumptions about what is and is not useful for understanding and decision-making. Nonetheless, we observe that the process of co-producing the systems diagrams developed in the case studies was useful for organising a wide array of data into narratives that captured important interlinkages and placed key feedback at the centre of the story. The diagrams captured intervention-context systems more holistically, typically extending beyond the initial scope proposed by the HEs. When these narratives were presented to stakeholders for feedback, the diagrams provided frameworks that kept the focus on the core hypotheses. Critically, they worked to hold the multi-faceted stories together. In several contentious case studies, the cause-effect pathways portrayed in the systems diagrams helped the team identify points of disagreement and facilitated discussion of the nature of interlinkages and causal mechanisms. These observations are evidence of the utility of the systemic narratives for generating and communicating understanding.

Co-production was critical to the process of narrative-building in the case studies. It required HEs with knowledge about the historical details of the subject, time and commitment to work with systems thinkers (STs) on the systems thinking approach and develop an understanding of the dynamic interactions, and it also required access to the necessary evidence to support the study. Also important was a willingness on the part of the HEs to follow key causal pathways in working out the proper scope of the system, which in some cases resulted in substantial shifts in focus or topic. A few promising case studies were excluded due to the absence of one or more of these key criteria. As with all methodologies that rely on participatory and co-production approaches, effective utilisation of systems thinking for health systems strengthening will require the capacity for engagement and adequate incentives for the necessary actors to participate.

One goal the case study approach did not achieve on its own was creating a clear picture of health systems structures. The case studies

presented selected problems or issues in each of the World Health Organization (WHO) health system building blocks. Each case study illustrated multiple relationships between these building blocks, with linkages central to the narratives shown in Table 14.1 to illustrate the nature of the linkages. However, a systems model for representing a generic health system and the key relationships between its component building blocks was not readily apparent from the compilation of examples. In retrospect, this is unsurprising. Just as each case study required an organising hypothesis to make sense of events and data, so a model of a health system would require an organising hypothesis to synthesise the insights from the case studies. This pointed to a need for an *a priori* theoretical framework and narrative that would help us organise the practical insights from the case studies. Based on this, we began developing a macro-level health system model to serve as a working hypothesis as the basis for further evaluation, critique and development.

14.2 Building a Macro-Level Model

In constructing a macro-level model of a health system, we re-visited what it should accomplish. We thought that a useful macro-level systems model of a health system should: (1) improve on existing ways of thinking about the health system and its component building blocks by (2) focusing on the influence pathways that form high-level feedback loops to (3) identify the proper boundaries of the health system. We assumed that the health system building blocks were a reasonable approximation of the scope of the health system and asked what key feedback loops shape each building block. To identify high-level feedback loops, we considered whether the various health system building blocks were subject to different influences and could be categorised accordingly. In this process, we noted that health systems are often described as open systems subject to exogenous forces (Gray, 2017) and that many of the feedback pathways 'travel' outside the health system. A larger view that includes populations and societies opens up new avenues for advancing health (Frenk, 2010). Thus we drew on the Cultural Adaptation Template (CAT) developed by Dyball and Newell (2015) as the framework for developing a health systems in society model that would encompass these feedbacks and 'exogenous forces'.

Table 14.1 *Key linkages between building blocks in the case studies*

Linkage	Case study	Description
Service delivery → financing[1]	Dialysis services	The model for the provision of dialysis services provides short-term benefit through mobilising private sector resources. In the longer term, however, the strategy threatens to create a major financing challenge in the face of rising rates of diabetes.
Service delivery → health information	Telehealth	Local implementation of telehealth systems was driven by perceived needs and constrained by infrastructure and capacity of the service delivery staff.
Human resources → service delivery	REAP-WISE	The team approach for service delivery was constrained by the career development paths of individual team members.
	Rural drinking water	Large community-engaged workforce enabled the Ministry of Health (MoH) to engage in small-scale drinking water and sanitation solutions that the Public Works Department was not positioned to carry out.
Human resources → leadership and governance	Managed care	General practitioners are insufficiently organised and motivated to successfully advocate for governance action to ensure holistic regulation of managed care organisations (MCOs).
Financing → service delivery[2]	Dialysis services	Capital financing as a constraint to the expansion of dialysis services in the public sector.
	Clinical waste management	Capital financing as a constraint to upgrading clinical waste management services to meet environmental standards.
	Managed care	Strict caps on reimbursement by certain MCOs leads to general practitioners adopting sub-optimal service delivery practices.
Financing → health information	Clinical waste management	Private sector clinical waste management contractors are paid by the weight of clinical waste, generating cost information to incentivise good practices by hospital administrators.

Table 14.1 (*cont.*)

Linkage	Case study	Description
	Adoption of case-mix	Adoption of case-mix approach would allow the generation of valuable information on medical cases and hospital performance through financing data.
Health information → leadership and governance	Harm reduction approach	Importance of monitoring and reporting stipulated in international agreements for drawing attention to marginalised groups and precipitating change.
Health information → human resources	House officer crisis	Lack of monitoring of local and foreign medical student intakes slowed responsiveness of the health system to the influx of medical graduates seeking house officer positions.
Health information → financing	Adoption of case-mix	Adoption of case-mix approach would allow better finance planning by hospital administrators and health ministry staff.
Medical products → financing	Hepatitis C drug	The system of intellectual property rights to incentivise the development of medical products also shapes the cost of treatment and the burden on public financing systems.
Medical products → leadership and governance	Hepatitis C drug	International trade agreements and intellectual property rights on medical products provide governments with the tools and constraints to negotiate prices and seek alternatives.
Leadership and governance → service delivery	REAP-WISE	Leadership is necessary to make changes to and invest in the healthcare ecosystem to adopt an integrated care approach in primary clinics.
	Harm reduction approach	Role of health system actors in engaging different government ministries and non-government stakeholders to generate support and co-ordination for harm reduction approach.
	Rural drinking water and sanitation	The MoH took on the responsibility of addressing rural drinking water and sanitation, areas traditionally outside its purview. Leadership was necessary to

		overcome internal and external resistance to the shift in the scope of service delivery responsibilities.
Leadership and governance → financing	Managed care	Gaps in the jurisdiction have left MCOs largely unregulated by the government.
Leadership and governance → health information	House officer crisis	Despite the experience of the house officer crisis, there remains no mechanism for tracking local and foreign medical student intakes. The cross-ministry nature of this problem may complicate solutions.
	Clinical waste management	Government actors recognised the importance of a hospital waste information system to ensure accountability of private sector service providers and hospital management.
	Telehealth	High-level health system leadership was necessary for the extensive implementation of telehealth. The lack of technical expertise at that level created conditions that gave rise to interoperability problems.
Leadership and governance → medical products	Regulation of traditional medicines	The development of a regulatory framework for traditional medicines has shaped their manufacture and sale.

[1] In many case studies, shortcomings in service delivery were the impetus for leadership actions and financing solutions.

[2] Linkage from financing to service delivery typically involved the human resource and/or medical product building blocks as an intermediate step for supporting service delivery.

Table 14.2 *Examples of health-related components of sub-systems in the cultural adaptation template*

Sub-system	Examples
Societal institutions	The health system, political lobbyists, legislation on workplace practices, international trade, patent systems, civil society groups
Cultural paradigms	Belief in universal healthcare, preference for private over public service providers, openness to immigration, level of trust in government
Human health and wellbeing	Prevalence of obesity, suicide rates, incidence of malaria, sense of security, job satisfaction, level of anxiety
Environment	Intensity of the urban heat island, air quality, access to healthy diets, amount of green space, level of societal acceptance or hostility

The CAT contains four major sub-systems (Table 14.2): societal institutions, cultural paradigms, human health and wellbeing, and the environment. In our macro-level model, the health system is the key societal institution of interest. Cultural paradigms are the worldviews, paradigms and beliefs held by society. Cultural paradigms, which reflect our understandings of the way the world is and how it ought to be, inform the ways we organise and operate our societal institutions. Human health and wellbeing encompass physiological and psychological health and the holistic meeting of needs critical to human flourishing. The health system contributes to this through the provision of healthcare, while shortcomings in the state of human health and wellbeing place demands on the health system. We have expanded the 'ecosystem' contained in the original cultural adaptation template to 'environment'. The former was limited to the natural and built biophysical environments; here, we include social environments to more fully represent how the state of the environment shapes the state of human health and wellbeing via the social determinants of health. In doing so, we distinguish between societal institutions and the social environments they create, while recognising that the two are not always neatly parsed.

Model construction began with identifying the relationships between the six health system building blocks and the feedback process that shapes them. An influence diagram format was chosen for its ability to represent broad, high-level concepts. We observed a natural division of the health system based on key drivers. The patient-facing portion of the health system, which we term the 'provider sub-system', is directly subject to and shaped by public health needs and demands. The second portion of the health system, which we call the 'enabler sub-system', plays a supporting and administrative role and is typically less visible to the public.

In considering the operation of the health system, the six building blocks are not co-equal. Service delivery is the means by which the health system achieves the goal of improving the state of human health and wellbeing; meanwhile, leadership and governance determines how the remaining health system building blocks operate to achieve good service delivery. We thus equate service delivery with the provider sub-system and leadership and governance with the enabler sub-system. The human resources and medical products and technology building blocks belong to the patient-facing portion of the provider sub-system whereas the financing and health information building blocks are less visible and thus placed in the enabler sub-system. 'Programmes and strategies' and 'infrastructure' have been added to the provider sub-system as key components of service delivery not covered by human resources or medical products and technology based on building block indicators proposed by the WHO and observations from the corresponding chapters in this publication; similarly, 'policies' and 'capacity for decision-making' have been added to the enabler sub-system (World Health Organization, 2010).

In mapping out important feedback loops shaping the health system building blocks, we propose five types of feedback loops that shape the health system and health outcomes (Figure 14.1). Each of these feedback loop types can be adaptive (i.e. leading to better practices and outcomes) or maladaptive (often due to incorrect understandings of causal relationships or actions that make sense locally but have negative consequences at a higher system level). Adaptive feedback is more likely when actors are aware of the full scope of the system, have good data, work across boundaries and seek global rather than local optimisation.

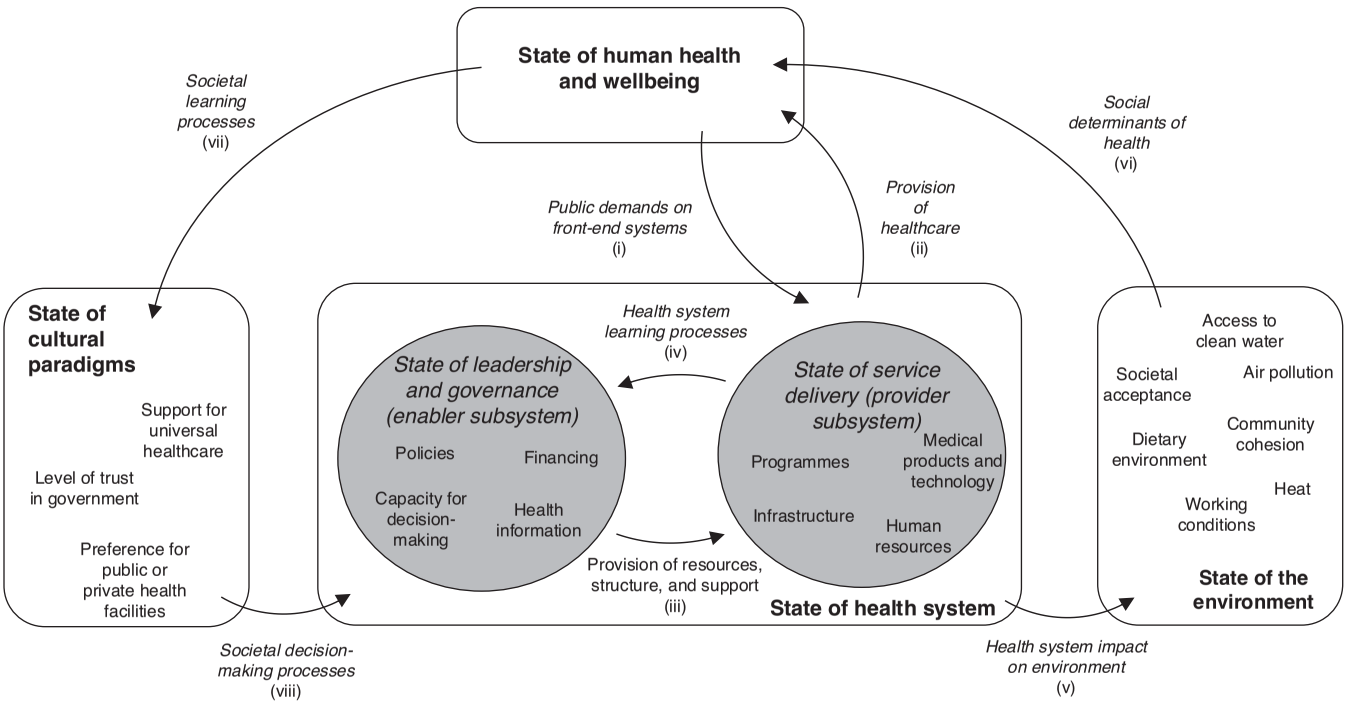

Figure 14.1 The health systems in society model contains eight linkages that form the macro-level feedback loops that shape the health system and its component building blocks.

Type I feedback loops occur due to 'natural' interlinkages within a health system building block or between multiple health system building blocks. For example, the purchase of expensive diagnostic medical equipment (medical products and technology) tends to lead to high use of the equipment to justify its purchase (service delivery); apparent demand for that diagnostic service encourages further investment in similar equipment. Some Type I feedback loops are well recognised while others are hidden in the fabric of the health system.

Type II feedback loops stem from direct public demands on health systems resulting from human health and wellbeing (i) and the response of health systems to meet these demands (ii). Public demands are typically directed at the visible provider sub-system. Due to political (for the public health system) and profit (for the private health system) pressures, shortcomings in the provider sub-system are often quickly identified and readily addressed where feasible, making Type II feedback loops relatively responsive.

Type III feedback loops are learning loops within the health system and are often linked to demands generated by Type II feedback loops. Improvements to service delivery frequently require support from the enabler sub-system (iii), while long-term demands and experiences from the provider sub-system shape leadership and governance of the health system (iv). The efficacy of Type III feedback loops often depends on the quality and flow of health information (Scott et al., 2018) and whether rules, structures and incentives align to support or obstruct adaptive learning (Committee on Quality of Health Care in America and Institute of Medicine, 2001; Carroll & Edmondson, 2002; Edmondson, 2004).

Type IV feedback loops are intertwined with social determinants of health. Health systems have been primarily organised as healthcare systems delivering services to individuals. Therefore, with a few notable exceptions, the structures, capacity and resource allocation in health systems are not designed to address social and physical environments (v), which in turn play a large part in human health and wellbeing (vi) (Friedman & Banegas, 2018; Solomon & Kanter, 2018). Despite the rapid rise of non-communicable diseases (NCDs), effective, large-scale solutions for health promotion and preventative care remain elusive (Baugh Littlejohns et al., 2018). To engage in Type IV feedback loops effectively, health systems will need to recruit and develop new types of expertise and learn to engage issues and stakeholders that have historically been outside its purview.

Type V feedback loops include cultural paradigms, being related to societal learning (vii) and decision-making (viii) processes. These often involve drivers that have been regarded as exogenous to health systems, such as education levels and national budgets. Societal learning shapes crucial beliefs, such as who should pay for healthcare, whether it should be delivered by public or private practice, the level of education required of the health workforce, etc. This learning comes not only from societal perceptions of the state of human health and wellbeing and experiences of the health system; rather, lessons are interpreted and filtered through value systems and *a priori* beliefs and are in dialogue with other societal narratives. Health systems will never have full control over Type V feedback loops (indeed, health system actors often have less control even over feedback loops within the health system than we would like to think). Nonetheless, health system actors have not only the right but the responsibility to engage with Type V feedback loops — a task that is severely underexplored in the literature and in practice.

This macro-level model highlights the importance of thinking about the larger societal context in which health systems exist. Much of the focus in health systems strengthening has been in improving processes within the health system (i.e. Types I, II and III feedback loops), with a lack of priority placed on intersectoral co-operation (Munir & Worm, 2016). Expanding the view of health systems strengthening, however, raises the question of *what else* health systems should be doing, *who else* they need to engage and how they need to be structured and strengthened to do so.

There are limitations in the health systems in society model. The first is related to categorisation and depiction of the variables and their relationships. For example, the health information building block is critical to health system learning processes, and we have postulated that the leadership and governance building block should influence societal learning processes; however, these relationships are not easily represented within an influence diagram. Also, certain variable boundaries are blurry, as noted previously regarding the division between societal institutions and social environments. However, we believe that these limitations do not substantially detract from the insights that can be derived from the analysis of the feedback loops.

Another set of limitations relates to the ways in which this macro-level model can be used. As a conceptual model, it is useful for

visualising relationships to formulate broad hypotheses about leverage points for strengthening the health system. It can also be a reference point when constructing more detailed systems diagrams around a particular problem, as a check on whether all the appropriate variables have been considered. It does not, however, provide predictive power. More detailed relationships that can support causal loop diagrams and stock-and-flow models are needed to develop trends and scenarios that have utility for prospective analysis.

Finally, the model remains a hypothesis in need of testing and improvement. We begin such testing in the following section; the health system community needs to do more work to determine if and to what extent the health systems in society model improves the way we think about the health system and how the model can be further developed to better inform various aspects of health system interactions.

14.3 The Case Studies and the Macro-Level Model

Construction of the model began with developing a high-level narrative to interpret the evidence from the case studies. The insights from interpretation were used in turn to evaluate the utility and limitations of the model. There is, of course, a danger that the macro-level model limits the dataset used to evaluate itself, potentially screening out data inconsistent with the assumptions used to build it. This problem is inherent in any theoretical approach, however. We also recognise that the case studies are not representative of the entirety of the Malaysian health system, and that the selection and analysis of the case studies was influenced by the availability of the participating authors and the understandings that they brought. With these caveats, we will draw some observations here.

To investigate whether the findings in the case studies support the health systems in society systems model, we classified each feedback loop from the case studies according to the five feedback loop types present in the model (Table 14.3). All of the feedback loops were readily categorised into at least one of the five types, although some crossed multiple categories. One such example was the efforts to adjust the health system to compensate for the unexpected influx of house officers, which was driven by both experiences within the health system (Type III) and political and societal pressures (Type V) and which created knock-on effects that affected the training process (Type I).

https://doi.org/10.1017/9781108954846.017 Published online by Cambridge University Press

Table 14.3 *Feedback loop types in the case studies*

Case study	Feedback loop number	Feedback loop type	Description
REAP-WISE approach	R1 and R2	I and III	Re-alignment of health clinic structures, practices and career incentives to achieve an integrated care approach.
Managed care	B1, B1b and B3	V	Employer–employee interactions that shape employee health benefits and how MCOs change this dynamic.
	B2 and R1	I and III	Adaptive practices by general practitioners in response to financial pressures by MCOs, which threaten quality of care.
	B4 and B5	V	Inadequacy of societal learning mechanisms to effect regulation of MCOs.
Dialysis services	B1 and B2	II	Health system attempts to keep up with demand for dialysis services.
	R1a and R1b	V	Health needs for dialysis are unable to align with market forces to meet dialysis demand without government intervention in the market.
	B3 and B4	I	Linkage between proliferation of dialysis services and health workforce.
Harm reduction approach	B1	II	Health system efforts to curb spread of HIV among drug users through education and rehabilitative efforts.
	R1	III	Success of harm reduction programme creating acceptance and ownership within the health system.
	B2	V	Willingness to take risks in search for effective solutions to HIV spread among drug users due to persistence of problem and the risk of missing Millennium Development Goals (MDG) targets.
Rural drinking water and sanitation	B1	IV and V	Lack of response by the Public Works Department to rural health issues due to water and sanitation infrastructure strategy; MoH expansion of functions to address issue.

	B2	II	Health system effort to provide educational services in response to prevalence of rural waterborne disease.
Clinical waste management	B1	III	Focus on direct patient services to the exclusion of waste management hinders learning processes that would improve clinical waste management.
	B2 and B3	V	Interaction between environmental regulations, perceptions of these regulations and hospital practice of clinical waste management.
House officer crisis	B1 and B2	V	Increasing access to medical education as a response to societal demand for career path for deserving students.
	R1 and B3	I, III and V	Efforts to adjust the health system to compensate for unexpected influx of house officers and resulting political pressure and the knock-on effects experienced.
	R2a and R2b	I	Training of medical doctors by specialists creates a potential bottleneck to creating new specialists.
	B4a, and B4b	V	Reactive responses to the education system to reduce intake of new medical students; continued lack of proactive data collection to enable response to future trends.
Adoption of case-mix	B1 and B2	I and III	Efforts to strengthen learning capacity of health system to improve hospital performance.
	R1 and R2	V	Government accounting norms as a barrier to the adoption of case-mix accounting methodology.
Regulation of traditional medicines	B1	II	Regulation of traditional medicines in response to negative health outcomes from improper manufacture and use.
	B2 and R1	V	Race between regulators and businesses to close or exploit regulatory loopholes.
Hepatitis C drug	B1, B2, B3 and R1	V	Competing paradigms around drug development and affordability and their impact on price control tools available to governments to regulate the price of treatment.

After categorising these feedback loops, we examined the frequency of each type (Table 14.4) to determine if particular portions of the systems model were over- or under-represented and what the implications might be for the model and for how we think about health systems.

A key hypothesis in developing the health systems in society systems model was that societal learning processes are important to understanding a health system. This hypothesis is supported by the case studies, in which 9 of the 11 case studies have a systems diagram containing at least one Type V feedback loop, a higher representation than any of the other types (Table 14.4). In each case, a Type V feedback loop was initially an obstacle to achieving a desired change or the precipitator of a disruption to the health system. The two exceptions (REAP-WISE and telehealth) focused on the role of Type I feedback loops in the implementation of a systemic change. The prominence of the Type V feedback loop in key developments in the Malaysian health system point toward this feedback pathway as a critical component with which health systems need to engage. However, health systems often lack leadership and governance capable of initiating and maintaining effective intersectoral collaboration to disrupt maladaptive Type V feedback loops (Baugh Littlejohns et al., 2018).

Among the case studies in this volume, only one, that is, rural drinking water and sanitation, contains a Type IV feedback loop (Table 14.4). This is despite the widely recognised importance of the social determinants of health, especially in the face of rising NCDs. Several linkages between the health system and the environment are apparent in reviewing the historical development of the Malaysian

Table 14.4 ***Feedback loop type frequencies in the case studies***

Feedback loop type	Number of case studies containing at least one example
I	5
II	4
III	6
IV	1
V	9

https://doi.org/10.1017/9781108954846.017 Published online by Cambridge University Press

health. There are a few positive examples, with (1) the Malaysian health system being an international leader in addressing rural water and sanitation issues, (2) current engagement in cross-sector efforts in formulating and implementing a National Environmental Health Action Plan, and (3) innovating in community intervention through KOSPEN (*Komuniti Sihat Pembina Negara*, or Healthy Community Builds the Nation), though rigorous evaluation of its efficacy and impact is still pending. Other examples that we were unable to cover in the book include tobacco control and promotion of good infant feeding practices. Nonetheless, the development of the Malaysian health system — mirroring health systems worldwide — has been almost entirely geared toward the delivery of clinical services. While the clinical services paradigm of health systems has delivered important advances for health in Malaysia and globally, this alone seems unable to support a health system structure that can deliver effective promotive and preventative care today.

In summary: (1) a survey of the case studies shows examples of all five types of feedback loops hypothesised in the model; (2) examples of the health system addressing the environment and social determinants of health were under-represented in our sample, which seems consistent with the composition of the health workforce and expenditure in the health system; (3) societal learning processes were over-represented and played pivotal roles in our sample. These observations, which need to be confirmed by other health system researchers, suggest that effective use of systems tools for health systems strengthening will need to account for wider societal issues and learning processes in feedback analysis.

14.4 Toward the Use of Systems Thinking in Health Systems

We see a variety of opportunities for the use of systems thinking in health systems strengthening, ranging from hypothesis generation and scenario-building to systems action. The creation of systems diagrams for mapping a system of interest is hypothesis generation. This is exemplified in the macro-level model of the health system proposed in this book, which raises questions around what drives health systems and whether the current concept of the role of a health system is adequate. Systems maps also posit causal chains that may be checked against experience and historical data, as with the case studies in this

https://doi.org/10.1017/9781108954846.017 Published online by Cambridge University Press

publication. This can be done prospectively as well, through qualitative analysis of feedback loops to identify potential trends or through the construction of quantitative models. From here, scenarios of possible futures can be generated for long-term planning. All these functions can be done top down, beginning with high-level questions and theory about the health system, or bottom up, beginning with very concrete problems.

Problem definition is a crucial part of systems analysis of a health system. Without some means of creating a problem boundary, the vast number of interconnections and causal chains quickly makes any attempt to make sense of a system untenable. A clear problem statement allows a system of interest to emerge; major and minor relationships can be distinguished. A problem-based approach does not limit the scale of issues that can be addressed through systems thinking. Problems exist on multiple scales, although larger problems tend to be more difficult to define well. Indeed, the macro-level model of the health system emerged when we were able to frame a problem statement, which was identifying the types of feedback loops that shape each health system building block.

A corollary to adopting a problem-based approach for systems analysis is the importance of the process of problem-framing. Improper frames overly limit the scope of analysis and cause relevant feedback loops that shape system behaviour to be missed out. For this reason, problem scopes should not be predetermined and problem identification should not be rushed. Instead, problem definition should be iterative and open to re-examination as the system of interest is mapped.

It is also important that problem definition and systems mapping be a co-produced process involving stakeholders from a range of disciplines and perspectives. It may be tempting to outsource systems analysis to an expert ST. However, the process of co-production creates a shared language, understanding and narratives necessary for collective action as knowledge is produced. Furthermore, bypassing the co-production process reduces the benefits to model-users, as they miss out on the learning that takes place in model construction and are usually unaware of the strengths and limitations of the model.

The use of systems thinking in health systems does not require everyone in a health system to be an ST thinker, nor does it require all health system experts to be expert system dynamic modelers. However, health systems experts will have to be capable of

understanding the interlinkages across organisational silos. Managing these interlinkages effectively will require at least the basic concepts of feedback dynamics in health systems. Tools and methodologies for systems thinking in health systems are well-developed and widely available. Investment in such expertise is critical to overcoming fragmentation and working toward coherence in a health system.

Apart from systems expertise, skills and resources to convene and engage the relevant actors across and beyond the health system are necessary to utilise systems thinking in health systems. The fact that systems problems invariably cut across organisational boundaries can make systems analysis and action a very political process. This is itself a systems problem! Ownership of the process at high leadership levels and facilitation by external parties may help address some of these barriers. In the long term, building horizontal linkages within the health system and increasing the capacity of the health system for external engagement will be necessary to sustain the use of systems tools.

Finally, there remains a need for useful models of a generic health system and examples of how such models can be contextualised and applied in a particular setting. We have proposed and begun testing of such a model, but much more input is needed from the systems thinking community. Areas for such work include a more detailed mapping of common feedback dynamics among health system building blocks, evaluation of whether the WHO health system building blocks are sufficient for describing a health system — especially in light of the changing needs in health — and consideration of how health system actors can manage feedback dynamics that extend beyond the traditional boundaries of a health system. We look forward to seeing how such work will contribute to the development and practice of health systems.

References

Basile, G. and Caputo, F. (2017). Theories and challenges for systems thinking in practice. *Journal of Organisational Transformation & Social Change*, 14 (1), 1–3. DOI: https://doi.org/10.1080/14779633.2017.1291148

Baugh Littlejohns, L., Baum, F., Lawless, A. and Freeman, T. (2018). The value of a causal loop diagram in exploring the complex interplay of factors that influence health promotion in a multisectoral health system

in Australia. *Health Research Policy and Systems*, 16(1), 126. DOI: https://doi.org/10.1186/s12961-018-0394-x

Carroll, J. S. and Edmondson, A. C. (2002). Leading organisational learning in health care. *BMJ Quality & Safety*, 11(1), 51–6. DOI: https://doi.org/10.1136/qhc.11.1.51

Committee on Quality of Health Care in America and Institute of Medicine. (2001). Formulating new rules to redesign and improve Care. In *Crossing the Quality Chasm: A New Health System for the 21st Century*. Online publication. www.ncbi.nlm.nih.gov/books/NBK222277

Dyball, R. and Newell, B., eds. (2015). *Understanding Human Ecology: A Systems Approach to Sustainability*. New York: Routledge.

Edmondson, A. C. (2004). Learning from failure in health care: frequent opportunities, pervasive barriers. *BMJ Quality & Safety*, 13(Supplement 2), ii3–9. DOI: https://doi.org/10.1136/qshc.2003.009597

Frenk, J. (2010). The global health system: strengthening national health systems as the next step for global progress. *PLOS Medicine*, 7(1), e1000089. DOI: https://doi.org/10.1371/journal.pmed.1000089

Friedman, N. L. and Banegas, M. P. (2018). Toward addressing social determinants of health: a health care system strategy. *The Permanente Journal*, 22. DOI: https://doi.org/10.7812/TPP/18-095

Gray, M. (2017). Population healthcare: designing population-based systems. *Journal of the Royal Society of Medicine*, 110(5), 183–7. DOI: https://doi.org/10.1177/0141076817703028

Munir, K. and Worm, I. (2016). Health systems strengthening in German development cooperation: making the case for a comprehensive strategy. *Globalization and Health*, 12(1), 81. DOI: https://doi.org/10.1186/s12992-016-0215-3

Newell, B. (2015). Towards a shared theoretical framework. In R. Dyball and B. Newell, eds., *Understanding Human Ecology: A Systems Approach to Sustainability*. New York: Routledge, pp. 214–39.

Plsek, P. E. and Greenhalgh, T. (2001). The challenge of complexity in health care. *British Medical Journal*, 323(7313), 625–8.

Rickinson, M., Walsh, L., de Bruin, K. and Hall, M. (2019, May). Understanding evidence use within education policy: a policy narrative perspective. *Evidence & Policy*, 15(2), 235–52. DOI: https://doi.org/info:doi/10.1332/174426418X15172393826277

Sallis, J. F., Bull, F., Burdett, R., Frank, L. D., Griffiths, P., Giles-Corti, B. et al. (2016). Use of science to guide city planning policy and practice: how to achieve healthy and sustainable future cities. *The Lancet*, 388(10062), 2936–47. DOI: https://doi.org/10.1016/S0140-6736(16)30068-X

Schlaufer, C. (2018). The narrative uses of evidence. *Policy Studies Journal*, 46(1), 90–118. DOI: https://doi.org/10.1111/psj.12174

Scott, P. J., Dunscombe, R., Evans, D., Mukherjee, M. and Wyatt, J. C. (2018). Learning health systems need to bridge the 'two cultures' of clinical informatics and data science. *BMJ Health & Care Informatics*, 25(2), 126–31. DOI: https://doi.org/10.14236/jhi.v25i2.1062

Solomon, L. S. and Kanter, M. H. (2018). Health care steps up to social determinants of health: current context. *The Permanente Journal*, 22. DOI: https://doi.org/10.7812/TPP/18-139

Trochim, W. M., Cabrera, D. A., Milstein, B., Gallagher, R. S. and Leischow, S. J. (2006). Practical challenges of systems thinking and modeling in public health. *American Journal of Public Health*, 96(3), 538–46. https://doi.org/10.2105/AJPH.2005.066001

World Health Organization. (2010). *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and their Measurement Strategies*. Online publication. www.who.int/healthinfo/systems/WHO_MBHSS_2010_full_web.pdf

Note

*We acknowledge and thank Barry Newell for his input to and feedback on this chapter.