

# Principles for embedding learning and adaptation into New Zealand health system functioning: the example of the Viable System Model

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## ABSTRACT

This article makes the case for taking a model-based management approach, specifically using the Viable System Model (VSM), to embed learning and adaptation into the New Zealand health system so it can function as a learning health system. We draw on a case study of a specialist clinical service where the VSM was used to guide semi-structured interviews and workshops with clinicians and managers and to guide analysis of the findings. The VSM analysis revealed a lack of clarity of organisational functioning, and of the systems, processes and integrated IT infrastructure necessary to support the fundamental requirements of a learning health system. We conclude that model-based management, specifically using the VSM, has significant potential for embedding the requirements for a learning health system into core functioning, including identifying technology infrastructure requirements. In addition, the VSM holds promise for improving clinical engagement and enhancing the health system's ability to achieve financial sustainability, high performance, distributed decision making and efficiency.

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The New Zealand health system is large, complex and subject to ongoing change.<sup>1</sup> To be viable over the long term, as for any system, our health system must take a consistent, continuous approach to learning.<sup>2</sup> Learning, defined here as how the system identifies, adopts and embeds organisational improvement and innovation, must sit alongside and enable other health system goals such as financial sustainability, high performance, distributed decision making, clinical engagement and efficiency.

In New Zealand, we are good at crafting health system strategies with ambitious goals, but we struggle with implementation and evaluation.<sup>1</sup> Further, we seldom recognise the interconnectedness between goals because we lack a deep understanding of the health system's functioning. Keeping up with the changes triggered by technological advancements, raising public expectations and the pressure to contain costs in such an interconnected system points to the need for organisations that can rapidly learn and adapt.<sup>2</sup>

Almost daily reports in the media remind us that our health system faces significant challenges. These include, but are not limited to, poor financial performance and an inability to clearly articulate the financial position;

staffing shortages and low staff morale; old or insufficient infrastructure—both physical and technological; long waitlists, especially for surgery and mental health services; and emergency departments struggling to manage volumes. These issues are exacerbated by Health New Zealand – Te Whatu Ora's lack of a clearly articulated operating model for over 2 years since its establishment in mid-2022. The current (2024) drive for “efficiency” is centred on removing support staff, but this does not address underlying issues. It will reduce costs in the short term and increase pressure on staff. An effective, high-performing health system must be designed to enable efficiency without “sweating the asset”—that is, the staff.

There is demand for an approach to organising health system functioning to achieve its goals and establish it as a learning health system, or at least to enable us to understand why we cannot make sustained progress. An approach that has significant potential and is grounded in systems thinking is model-based management, specifically utilising the Viable System Model (VSM). The VSM is theoretically robust and has elsewhere<sup>3</sup> demonstrated its usefulness in understanding the health system and service dysfunction.

## What is a learning health system and why is it necessary?

A learning health system ensures people are supported by technology, and enables learning cycles for improvement through an underlying information infrastructure<sup>4</sup> (see Table 1). Such a system is *“Informed by evidence and actionable data in ‘real-time’ and creates the foundations of a system capable of meeting systems-wide, clinically oriented, and patient-relevant delivery targets.”*<sup>4</sup> Most importantly, it is a dynamic system that assesses, reviews and improves its performance.

A learning health system requires strong feedback loops.<sup>5</sup> Feedback loops provide information about system behaviour and performance and can prompt action. For example, current information indicates that our waiting lists have built up and wait times have extended.<sup>6</sup> What action must we take to address this and restore acceptable wait times over the long term? To fully leverage the lessons learnt from experience, we can no longer rely upon quick fixes that are project-based and *ad hoc*, and do not reflect the underlying causes of problems.<sup>7</sup> A learning organisation must have the systems and processes (including training)

to enable lessons to be embedded in the system for the future, not simply to address the present,<sup>8</sup> and these must be supported by an underlying information infrastructure.<sup>4</sup> Therefore, the aim of being a learning organisation cannot be separated from operational management, including evidence-based, fit-for-purpose delivery models.<sup>4</sup> To embed our learning into the organisation’s functioning, we must first understand that functioning. Comprehensive systems models are essential if we are to achieve this.<sup>4</sup> Further, model-based management would support our system to become resilient (to recover quickly from shocks) and preferably ultra-stable. Resilient systems stay the same after recovering from a shock; ultra-stable systems improve.<sup>9</sup>

## The need for and benefits of a model

It is not possible for individual managers to maintain a full understanding of health system functioning, especially where each would likely have a different understanding based on their experiences, so a more formal, model-based approach is essential.<sup>4</sup> Model-based management is critical

**Table 1:** Key characteristics of a learning health system.

Clear standards of service delivery, both operational and clinical, to make sure we are managing patients/consumers through the process of healthcare service delivery effectively (where the patient/consumer is an active participant in their care and we are respectful of their time), as well as ensuring the clinical care provided is of the expected quality.
Timely assessment of non-adherence to standards (through feedback loops).
Communication processes that ensure prompt action can be taken in response to identified issues.
Clear operational management processes into which improvements can be embedded (resilience).
Training in new processes to support understanding and consistency of delivery.
Methods of monitoring known demand and changes in the environment that can alert us to issues (e.g., a disease outbreak) or opportunities arising (e.g., from research) so that we can prepare for them (ultra-stability).
<i>Ad hoc</i> monitoring processes to identify issues not captured by regular monitoring.
Processes for enabling issues or opportunities for improvement to be identified anywhere in the system at any time by anyone, and for potential solutions to be assessed/implemented.
Processes for the promulgation of lessons/innovations/improvements throughout the system.
Underlying information infrastructure designed to provide real- or near real-time data to support decision making. Data must be transformed into information that is accurate, timely, complete and relevant to the decisions that must be made, and presented in a digestible form to the receiver.

for enhancing a manager's understanding of the system they manage and making their efforts more effective.<sup>10</sup> Model-based management is where an organisation's management is supported by formal models, which are abstract representations of concrete systems, which must be of good quality, and are crucial for the management process to attain results.<sup>10</sup> In health, therefore, we need a model that is well-suited to large and complex organisations, and that is capable of learning and adaptation.

The VSM is a good candidate for this task and is well-tested and researched. The VSM has been used widely; for example, in sustainable business,<sup>11</sup> local government,<sup>12</sup> family violence prevention<sup>13</sup> and combatting transnational crime.<sup>14</sup> The VSM has increasingly been applied to health system settings to better understand and improve health system functioning, including to in-hospital residential treatment for stroke

patients in Australia,<sup>15</sup> to assess Switzerland's pandemic response,<sup>16</sup> to establish an Austrian regional oncology service<sup>17</sup> and to find the source of systemic dysfunction in the orthopaedic department of a Norwegian hospital.<sup>18</sup>

## The VSM

The VSM (see Table 2) describes the necessary and sufficient functions (sub-systems) and information flows required to set up the system for viability. Viability refers to the long-term survival of a system within its environment. The "system" refers to formal organisations as well as other forms of systems, such as bee colonies, and may be the whole health system, or any part of it. The model's structure is the same throughout the system/organisation. That is, it applies to the system/organisation as a whole, and to, say, a hospital, department or clinical service.

**Table 2:** Key characteristics of the Viable System Model (VSM).<sup>19</sup>

<p>According to the VSM, a viable organisation must include five sub-systems. The VSM is recursive (where each level contains all the levels below it). Viability requires each sub-system to be present, of good quality and in balance, along with communication and control channels, at each level of the system/organisation. The recursive nature of the VSM enables the management of complexity. Each lower level manages a smaller scope but in greater detail. Each lower level has autonomy to manage its operations within agreed controls, enabling decisions to be made closer to their source. This reduces bureaucracy. The sub-systems represent functions, not positions, in an organisation chart. Some functions may be carried out by the same person or people. The sub-systems are:</p>
<p><b>System 5:</b> Governance/purpose—establishes the organisation's purpose, identity, culture and values and ensures mechanisms are in place for the effective functioning of the entire organisation (i.e., for that level and its lower levels).</p>
<p><b>System 4:</b> Planning/adaptation—considers the external environment for both known and unknown futures and includes links out to research. As the environment is ever-changing, this function is essential for the organisation to adapt.</p>
<p><b>System 3:</b> Management control—manages the stability of the organisation, and brings together operational management, personnel, finance, IT and infrastructure to, for example, deliver to the current plan; and <b>3*</b>: Audit and monitoring—monitors the performance of the operational units (System 1s) against the targets System 3 has set, ensuring the rules and regulations promoted by System 2 are being followed.</p>
<p><b>System 2:</b> Coordination—coordinates the necessary resources across System 1s to ensure that they function harmoniously and promote the rules and regulations set by System 3.</p>
<p><b>System 1:</b> Operations—concerned with implementation, with doing what the organisation exists to do, so what happens here is what matters.</p>
<p><b>Absorbing lessons learnt and necessary change</b></p> <p>System 3 will absorb changes that can be made within the current resourcing. System 4 will consider more significant changes. Plans for significant change must consider the capacity and capabilities of the organisation and its ability to absorb the change. When Systems 3 and 4 cannot agree, System 5 will intervene to help resolve the issue.</p>

This provides a common language for describing and understanding the organisation's functioning across the organisation. Once an organisation or service has a clear understanding of its purpose, it can be critiqued and designed using the VSM to achieve that purpose.

The VSM is a model for organisational structure and information flows, not content,<sup>20</sup> which must be determined by those managing the organisation. It is a model for both diagnosis and design.<sup>21,22</sup> A VSM diagnosis will identify where necessary system elements (sub-systems and communication channels) are absent or inadequate.<sup>19</sup> This then informs the design of the system as a learning system by indicating what must be included, but not the specific content. For example, the VSM indicates that managers at each level must have the information they need to make the decisions they are charged with (e.g., what mix of clinic types should we run), but it does not specify what that information is (e.g., what clinic types do we have and what is the demand for each given the clinical needs of our current patient population).

There is freedom to determine the specifics of organisation or service functioning within the model as long as all sub-systems and communication flows are present and functioning adequately. The VSM requires us to clearly articulate what the organisation does and how it does it. It focusses on delivering services to consumers and expressly caters to local differences within a common national strategy. The model requires us to define what services we deliver and to develop clarity and transparency about service provision (including standards of quality for consistency and equitable care delivery), demand, capacity, resource requirements, constraints, cost and value. We then have the detailed awareness and understanding of the system's functioning required to plan, fund, resource, manage, support, coordinate, deliver and track service delivery, as well as to learn/adapt over time.

The VSM not only identifies the sub-systems and communication channels required but also clarifies their relationship to each other and their environment. By applying the VSM, these aspects—necessary for a learning health system—can be *identified and integrated* into a functioning system. Of particular note is that System 2 (coordination) is a necessary function in its own right,<sup>23</sup> and is often absent.<sup>19</sup>

While focussing on service delivery, the model fully recognises the need for management and support services. The VSM drives the alignment

of the efforts of support services (e.g., people and capability, information technology and finance) with each other, and, most importantly, with the operational delivery requirements. As the VSM drives a clearer, more accurate and complete understanding of service delivery mechanisms and support service needs, it supports a more precise definition of data and IT system requirements.

A key focus of the VSM is that it is a learning system. It is managed through feedback loops designed into the system to provide timely, accurate, complete and relevant information to support decision making. Firstly, through well-specified services, processes and standards, which are monitored both continuously from data capture and through regular and *ad hoc* audit processes, each level of the organisation would have the information it needs to identify where service delivery improvements can or must be made. The model embeds into the core system functioning the processes required for learning and adaptation. These are continuous processes that occur as part of everyday functioning and support improved efficiency, effectiveness, consistency and quality of service provision. Secondly, each level of the organisation would maintain awareness of, and adapt to, changes in its environment. For example, as treatments and technology advance there may be more services that can be provided in the community and/or by lower-skilled clinicians. With a clear understanding of its own functioning at any time, the organisation/service could adapt quickly. This differs from the common situation where the understanding of current functioning is vague. We note that before being implemented, any identified learning or adaptation opportunity must be assessed in relation to purpose and to whether it is ethical, leads to equitable outcomes, builds the resilience and sustainability of the system and does not marginalise or exclude stakeholders including Māori as Te Tiriti partners.<sup>24</sup>

A large complex organisation that relies on central control quickly becomes mired in bureaucracy and ceases to function effectively. The VSM addresses this problem by distributing the management of complexity and the decision making throughout the organisation in a nested structure of operational areas (e.g., a region, hospital, surgical service or clinical specialty such as ophthalmology). Every level of the system (organisation) contains all of the levels below it, and each level is responsible for setting up the conditions for all of its (nested) lower levels to be

successful. This means there is a collective responsibility for service delivery. Each lower level is responsible for, and understands, a smaller scope but in greater detail.

The VSM specifically facilitates local autonomy consistent with overall system coherence and cohesion. It achieves this through “communication and control” rather than “command and control”. In other words, it allows for some decisions to be made centrally (e.g., do we need a new hospital), regionally (e.g., how do we organise our surgical services across the South Island) or locally (e.g., how can we best manage our specialist service delivery to meet local demand). Each part of the organisation, at each level, would have the information it needs to make the decisions that are relevant at that level and for the services it provides. Problems and system weaknesses could, therefore, be addressed closer to their source—providing a faster response, reducing bureaucracy and improving motivation and engagement throughout the system by activating systemic leadership of both clinicians and managers.

Key to the model’s functioning are two-way information flows throughout the system. These information flows and their associated processes (e.g., resource/performance bargaining) address issues such as the *agreement* between organisation levels of both the resources required to deliver services and the performance measures that will track service delivery. Then, as necessary or as possible changes are identified, the resource/performance bargaining process would be undertaken again to allow understanding, agreement and adaptation to continue—to fulfil the purpose of the organisation/service. Without careful design and management, two-way information flows can take on various characteristics that may not necessarily support achievement of the purpose. The VSM’s structure is such that interpenetration of the levels (i.e., where the managers of System 1s are members of the management team of the next level up) can support greater understanding of conflicting priorities and a more collaborative approach to achieving the overall system purpose. The VSM helps to surface issues but still relies on good managers to work these through to a resolution. System 3 (management control) can develop criteria for quality information (e.g., not leading to conflict or sub-optimisation), which are then put into practice by System 2 (coordination). Conflict resolution mechanisms can be established within System 4 (planning/adaptation, including

intelligence), and may need to embody double loop learning to assess adaptive or less adaptive information flows. System 3\* (audit/monitoring) will periodically audit the quality of information flows. We note that, while models are useful, they are not a panacea against all issues an organisation may face and will only be useful if utilised by well-trained managers.<sup>17</sup> Further, strong clinical leadership alongside competent managers at all levels of the organisation are essential for developing and implementing high-performing, quality healthcare services.<sup>25</sup> It is assumed, therefore, that at each level of the organisation, in each clinical service, there is a clinician/manager pair responsible for defining the service’s purpose and setting it up to function to achieve that purpose in line with the aims of clinical governance.

## Method

Our study adopted a case study methodology and was undertaken in 2020–2022 during the COVID-19 pandemic and the latest health system reforms.<sup>26</sup> The case study was of a high-volume clinical service and used insights from cybernetics and the VSM to address health system disconnects between governance, management and operations. The service was a specialist ophthalmology service within a large metropolitan public hospital (serving approximately 500,000 people) facing various governance, managerial and operational challenges.

The VSM was used to structure data collection and analysis through two rounds of inquiry to identify the organisational shortcomings facing the ophthalmology service, and their structural underpinnings. See Paine 2023<sup>21</sup> for how the analysis of organisational pathologies (functional deficiencies) was then used to develop a VSM-inspired management framework.

Eighteen participants were involved in the study, providing a variety of perspectives on health system functioning such as policy, management or data analytics, with most participants holding senior policy, clinical and managerial positions. The first round of inquiry involved interviews and workshops with fourteen participants about the challenges facing the specialist service (including interviews with six health reform leaders and one health system academic). The second round of inquiry involved interviews and workshops with five health reform leaders and nine specialist service managers and clinicians to refine a VSM diagnosis. Most participants were involved in both

rounds of inquiry. For both rounds, the interviews and workshop discussions were audio recorded and transcribed. Transcripts were imported into NVivo12®, a computer-assisted qualitative analysis programme. The data were analysed thematically using the constant comparative method to identify codes and develop themes.

## Results

The results of the study are discussed below under four headings. While the study centred on one specialist service, the issues experienced were symptomatic of wider organisational failings.

### Operational functioning, service specification and delivery

We found that there was an absence of a coherent operational management system within which to define service functioning and a lack of clarity of the parameters of service provision and of the consumer group being provided for. There was also insufficient support provided by the finance, people and capability, and technology support services. This was compounded by a plethora of disparate IT systems that required manual work to enter the outputs of one system as inputs to another. These factors hindered operational efficiency and service quality and limited true understanding of service cost and resource needs. It also made it difficult to capture any lessons learned, so there was much “reinventing of the wheel”.

### Monitoring service provision and managing change

We found that there was an absence of coherent, timely, complete, accurate and useable information with which to monitor and manage the service. While there was access to several *ad hoc* reports, very few of these supported the service to understand its functioning and service provision or to identify and respond to developing situations (e.g., waitlists building up). Furthermore, there was no scope in terms of available time or data to understand and consider external environment changes and their impacts.

### Managing complexity—balancing centralisation and decentralisation

While the health system is largely set up in a nested structure of operational services as the VSM would suggest, *the functioning of and between these levels was inadequate*. That is, the necessary functions and communication channels that the

VSM prescribes were either not present or not working at every level. Our study service had virtually no autonomy to make decisions and no input into its budget. The effect of both of these limitations was to increase the burden of bureaucracy on the organisation—wasting both time and money. As noted above, this severely hindered the ability of the service to learn and adapt by embedding that learning into its core functioning.

### Communication—the importance of data

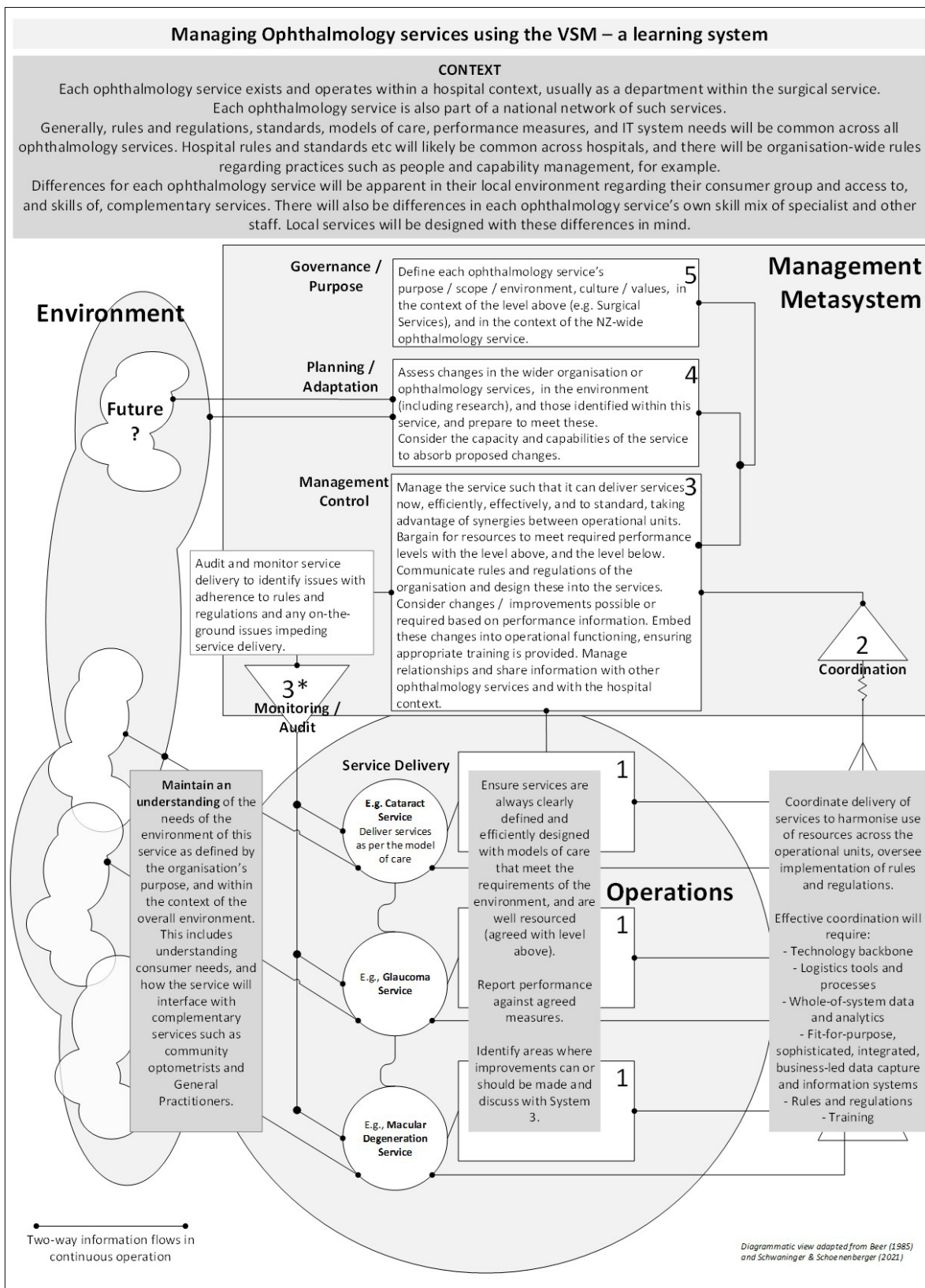
VSM functioning is highly dependent on the continuous two-way flows of accurate and relevant information based on quality data and facilitated through integrated, sophisticated IT systems. We found that the information flows were top-down rather than two-way. Further, the quality and timing of information available were well below what would be required to manage a high-volume clinical service with time-critical service delivery needs if it is to be a high-performing service ensuring quality and equity, and a learning health service.

Three key interrelated issues requiring attention were brought into clear focus as a result of the VSM diagnosis. Firstly, service delivery (System 1) is poorly defined. This impedes the ability of managers (System 3) to identify synergies between System 1s to improve efficiency and service to consumers, and impedes the ability to coordinate service delivery. Indeed, System 2 (coordination) is not recognised as a necessary, coherent function at all. The issues with Systems 1 and 2, combined with the lack of autonomy and inadequate support from adjunct services such as IT and finance, result in the service manager and clinical director (System 3) being drawn into the minutiae of day-to-day functioning.

## Discussion

The VSM is designed as a learning system that adapts to and with its environment. Analysing a system using the VSM makes it possible to identify whether or not the system under examination has the characteristics of, and is operating as, a learning system. Our study revealed that as New Zealand health services are set up and supported at present, they struggle to function, let alone operate as a learning system. The VSM provides the basis for an operating model through which to clearly articulate all the requirements of a learning health system, and one that can persist over the long term (see Figure 1).

Figure 1: Managing ophthalmology services using the Viable System Model—a learning system.



Leveraging the benefits of the VSM would not require services to “start from scratch”. Rather, health system managers (with support from a facilitator) can realign and connect current efforts to build on existing strengths. A pilot project is suggested, perhaps working with Health New Zealand – Te Whatu Ora’s Clinical Network for ophthalmology. The work would be undertaken with staff, including clinical directors and service managers. The pilot would utilise the detailed work (i.e., the development of a VSM-based Clinical Services Management Framework) undertaken through the research from which these views are drawn and act as a guide for other services.<sup>21,23</sup> The only external resource required is the facilitator. Internally, current resources such as the ophthalmology clinical network, decision support, production planning and IT services would be utilised.

The model structure described in this article could be used to identify gaps. For example: Are services clear about their purpose? Are the five basic functions in place and working? Are the support services aligned and supporting the purpose of the operational areas? Is there a balance of autonomy and control supported by appropriate performance reporting? Are services clearly articulated, including details of service provision? This work would lead to a prioritisation of improvement efforts and the development of solutions to address the identified gaps. A recent study in the National Health Service provides an excellent example of this,<sup>3</sup> as do these examples from Australia<sup>15</sup> and Norway.<sup>18</sup>

Outcome measures of a **diagnosis** phase might include:

1. **Service clarity:** detailed understanding of the service’s demand/capacity and general situation (e.g., patient numbers, waitlists, equipment, staffing, funding, processes, IT systems) at any time.
2. **Service functioning:** understanding of the service’s functioning *vis-à-vis* VSM sub-systems and communication channels.
3. **Gap to being a learning health service:** prioritised list of actions/improvements required to achieve learning health service status.

Outcome measures of a **design** phase might include:

4. A fully populated version of the VSM-based

Clinical Services Management Framework (including models of care, reporting, processes for resource/performance bargaining, etc.).

5. An understanding of the IT systems required to support processes and address information requirements.

Outcome measures following VSM **implementation** would include:

6. **Adaptive capacity:** improved ability to adapt to changes and unexpected challenges.
7. **System resilience:** enhanced resilience allowing the service to maintain functionality during disruptions.
8. **Process efficiency:** reduced wait times/no overdue follow-ups.
9. **Patient satisfaction:** improved patient experience and satisfaction.
10. **Clinical outcomes:** patients receiving care on time and therefore not deteriorating unnecessarily.
11. **Resource utilisation:** more efficient use of resources, including staff time and equipment.
12. **Staff satisfaction:** improved job satisfaction and reduced burnout among staff.
13. **A learning health system:** the service will have the processes and mechanisms in place to function as a learning health system and to be part of the wider organisational learning health system.

The pilot could be underpinned with research to better understand the impacts and challenges regarding leadership, culture, capability, data, IT systems, etc.—all of which are issues the system must grapple with.

## Conclusion

Setting up a learning health system is a non-trivial but necessary undertaking. The New Zealand health system is complex and operates in a fast-changing environment. The VSM is not a short-term quick fix, nor is it an attempt at “simplification”. Rather than pretend that the complexity and the need to adapt can be ignored, the VSM provides a way to manage effectively over the long term based on a theoretically sound systems approach. The dependence on data and, therefore, technology cannot be underestimated. By applying the VSM we can improve



our understanding of the data we need and use this understanding to drive technology requirements with greater accuracy and effectiveness. The VSM approach also supports the realisation of the goals of financial sustainability, high performance, distributed decision making, clinical engagement and efficiency—or our understanding of why we are struggling to meet these goals.

In implementing the VSM the messy practicalities of the real world must be considered. While good models are essential for good management, they support rather than replace good managers. Implementation of this approach leverages the knowledge of staff, and through participation in model development for their services the VSM

can activate clinical leadership and help in the development of a deeper understanding of the approach such that it becomes part of the everyday way of thinking. Applying model-based management using the VSM will provide a level of understanding of our health system that we have never had before, but which is necessary if we are to have a health system that is sustainable over the long term and can become stronger by learning and adapting. We may find out that we are unable to afford all the services that we want to provide. Understanding this, however, will be better than the alternative, which is continual politically induced restructuring and inadequately planned implementation processes.

**COMPETING INTERESTS**

Nil.

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