ACCEPTING COMPLEXITY. CREATING ORDER.

Using complexity theory as a lens through which to understand limitations of target-based quality improvement approaches in primary care, and to design interventions for the future.

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Abstract

A strong primary care system is essential for improving health outcomes, and Quality Improvement (QI) science and methodologies are seen as useful approaches for reducing variation in outcomes. QI science has its origins in industrial settings dominated by mechanistic, linear approaches. By contrast, health care (including primary care), is increasingly being understood through the lens of complexity science, as a complex, non-linear system, or more specifically a Complex Adaptive System (CAS). In order to design QI approaches that work in health care understanding the interaction between the system and a QI approach and matching the approach to the environment is important.

This exploratory research utilised a complexity lens as a worldview or metaphor in which to gain an insight into General Practitioner (GP) views of Target Based Performance Programmes (TBPP), as an example of a current QI approach. The aim was to understand if viewing primary care as a CAS could explain limitations of a TBPP approach, and if the same lens could offer ways to adapt and improve QI programmes in primary care, and in complex systems more broadly. More specifically the research aimed to understand if there was a relationship between complexity of problems (which were the focus of a TBPP), and how effective GPs believed the targets were, as well as whether there was a relationship between the complexity and their engagement in achieving targets.

A philosophy of pragmatism was applied in designing the research. The epistemology and methodology (research design and methods) applied in this research were positivist in nature. The research tool used was a single-stage exploratory survey. The participants of the research were GPs. There were 27 surveys used in the analysis, which while small provided rich insight. Quantitative methods were used to analyse the data, with qualitative data providing detail to themes.

The main findings of this research are that there is a relationship between how complex a problem is perceived to be by GPs, and the extent to which targets are believed to be a good QI approach. Targets where the problem-in-focus is understood as complex, are less likely to be seen as an appropriate approach. To a lesser extent there is also a relationship between increased engagement and decreased complexity. More generally the research suggests there may be a negative relationship between target-based approaches and engagement. Complexity is only one component that needs to be considered in developing QI approaches in primary care; strength of evidence, adequate resourcing, knowledge of QI methods, and consideration of social determinants were also highlighted.

This research has shown that a complexity lens provides useful insight into the health system, and that Cynefin, or similar, as a framework for matching problems to approaches could be a useful tool to support and augment QI approaches in primary care. While this research specifically focusses on health care as a CAS, the discussion, approach and findings may be applicable when considering other systems or organisations which can be viewed as displaying characteristics of CAS.

Acknowledgements

I began this episode of my academic career in 2013. It has been slow and steady with a few breaks. When I signed up for my first paper in Quality systems, my 3 children were under 6, I was working part-time gradually working up to being full time. Much has changed, the children have grown taller and less dependent, I have moved roles, organisations, and cities.

My learning throughout my master's programme, which culminates in this paper, has been woven through my work and personal life and changed my worldview in many ways. It has given me access to new ideas, and a language for the characteristics I can see in the system, and indeed the world I live in. It has also provided tools to work in it. Perhaps, most importantly my learning has provided me comfort in the midst of complexity, and a sense of excitement as I view myself as an agent and an observer within a system that dances around me, with changing cadences.

I could not have reached this point without the huge amount of support I have been given. I owe a huge thank you to my husband, Craig, who has encouraged me, and been my biggest champion. This would not have been possible without you. To my family, especially my mother, Jane, who has helped and taught me in so many ways and has been there for my children – thank you.

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Finally, this research which would not have been possible without the anonymous GPs who gave their valuable time, and insights. I hope that this paper does justice to your experiences.

Table of Acronyms

QI	Quality Improvement
CAS	Complex Adaptive System
GP	General Practitioner
ED	Emergency Department
MoH	The New Zealand Ministry of Health
HQSC	Health Quality Safety Commission
PHO	Primary Health Organisation
TBPP	Target-Based Performance Programme
WHO	World Health Organisation
NZ	New Zealand

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Chapter 1

Introduction

"A strong primary health care system is central to improving the health of all New Zealanders and reducing health inequalities between different groups" (NZ MoH, 2019).

QI methods can support and drive strong and effective health care systems. QI can be described as a systematic approach that uses specific techniques to make change that lead to better patient outcomes, system performance and professional development. QI has an aim in healthcare of reducing unwarranted variation (Poynter, Hamblin, Shuker, & Cincotta, 2017). Examples of variation can be found between regions and between ethnic or other demographic groupings across a range of metrics such as screening and access to diagnostics, prescribing and amenable mortality rates (Poynter et al., 2017). An example of a QI approach used widely in New Zealand and internationally to focus on specific systematic improvement has been TBPP. Despite wide deployment there has been variation in effectiveness of QI approaches in healthcare, including performance targets (Pannick, Sevadalis, & Athanasiou, 2016 and Scott, 2009). In relation to the latter, there is some evidence that performance targets have had unintended consequences both in terms of the system performance and clinician engagement (Young, Roberts, & Holden, 2017).

One way to understand why this variation may be the case, is that QI science, and the methods and tools used within that umbrella, have industrial origins. The inherent mechanistic view from which the field developed has meant the QI approaches may use a linear, reductionist methodology or worldview. However, increasingly health care is understood as a complex system. A complex system is non-linear and has emergent and unpredictable qualities (Litaker, Tomolo, Liberatore et al. 2006). Understanding the characteristics of the system, as well as characteristics of the problem or variation which is the focus of QI activity, may help inform how to effectively use QI approaches in primary care.

It is intended that this study contributes to understanding the challenges or limitations of current QI approaches in a complex system through gathering the views of GPs who are central to the primary care system. The aim is to both explore and understand tension between performance targets (as an example of a predominant QI tool) and the environment.

This next section outlines my interest in this topic and provides background on quality improvement as well as complexity theory, and its application in healthcare. It finishes with some definitions of key terms, the aims, objectives and research questions for this study, and finally an overview of each subsequent chapter.

My background

I have included my background in order to provide the context which led me to focus on complexity theory and its application in QI. I have worked in healthcare in New Zealand since 2008. The roles I have worked in include directly supporting general practice teams, programme development and project management, contract improvement and team leadership. While in general my work has been undertaken in a primary care setting, I have also lead quality improvement project work in a secondary care system setting.

The genesis of this research was in interrelated projects which aimed to improve delivery and integration of primary and specialist mental health services. During the process of developing a project plan I was introduced to the Cynefin Framework. Cynefin is discussed and explained further in this chapter, and in the second chapter of this paper. As a brief explanation, it is a framework for making sense of a problem and ascertaining the best approach to take based on the level of complexity present. In the projects Cynefin was used alongside a DMAIC improvement cycle. DMAIC is an acronym for Define, Measure, Analyse, Improve, Control. DMAIC is a core tool of Six Sigma. Six Sigma is a set of tools, which was first introduced in a manufacturing environment. The aim was to identify root causes of variation and remove defects in order to minimise variability.

The challenge in using DMAIC was that root cause in any part of the Mental Health and Addictions service is complex, there are many moving parts in the system, and society itself. It was clear early on that sometimes the root cause is not always evident. For a mental health system, minimising defects would result in improving population outcomes, through a range of activities. But so often we seemed to be measuring activities, in the hope that they have a causative effect, but not real outcomes. Using DMAIC and Cynefin together provided a framework to makes sense of the starting place, and a way to explain the nature of the unknowns and iterative process required - as well as having a logical way to undertake QI. While I was not able to fully see through this process due to a relocation, it piqued an interest in complexity theory and how it could be applied within Quality Improvement work.

The nature of my work has also led me to be involved in TBPP, including development and implementation of tools and processes associated with target-based performance programmes. An example of a TBPP is the national target for ‘‘Better Help for Smokers to

Quit." Which asks that 90% of enrolled patients who smoke have been offered help to quit in any 15-month period. It is easy to see as an observer of these systems that they are not always achieving what they set out to do, and there are some unexpected consequences. However, it is far more difficult to move from a critical viewpoint only, to providing a robust and viable alternative to the current approaches. Originally my intention for this research was to focus on QI in Mental Health Services, however a change in roles back into a primary care setting also meant a change in focus for this research and a return to grappling with a paradoxical relationship with performance targets which I have felt needs to be explored.

Exposure to Cynefin and complexity science provided a theoretical explanation to many of the phenomena which I had observed and went some way toward explaining why performance targets feel at times as though they are not-fit-for-environment. This sense of mismatch of performance targets to environment was a view I had also heard expressed in various ways, and with varying levels of frustration, by GPs and general practice teams. Therefore, it seemed like a natural alignment of timing and interest to explore whether understanding primary care quality interventions using a complexity lens may provide insight and an opportunity to understand how to improve the tools we use.

Primary care and quality improvement

Primary care was a concept elaborated in the Declaration of Alma-Ata in 1978 and can be described as ‘‘first-contact, accessible, continued, comprehensive and coordinated care […] General practice is synonymous with primary care and can be taken to loosely cover the general practitioner, and other personal in the team" (World Health Organisation, 2014). Gray (2017) describes general practice as a unique speciality in that practitioners have developed skills to treat a whole person, whereas specialists may be more focussed on smaller parts. The World Health Organisation, also describes the GP as unique as the ‘‘only clinician who operates at the nine levels of care: prevention, pre-symptomatic detection of disease, early diagnosis, diagnosis of established disease, management of disease, management of disease complications, rehabilitation, palliative care and counselling’’(2014).

General Practice and primary care can deliver most of the healthcare to most people, for most of their life. High quality primary care is important part of maintaining health at individual and population levels, and good QI approaches are integral to improving the system and outcomes. The GP and practice team are central to this, however there is awareness that the primary care workforce is facing challenges, including GP shortages, and high burn out rates. As described by Baignet and Baigent (2018) "increasing workloads, reduced medical autonomy and inefficiencies associated with new technologies create

environments where burnout can flourish'' (p. 472). These inequalities, and workforce challenges, as well as lack of consistent outcomes for QI indicate that there is a need to rethink dominant modes of QI in primary care to ensure they are a match to the environment.

As discussed by Parry (2014), there is not a shared understanding about the definition of QI as it relates to health. He proposes that the science of improvement ''is an applied science, with philosophical underpinnings, calling for action and learning from that action'' (Parry, 2014). The phrase 'the science of improvement' was first used in 1996 in a text building on W. Edward Deming's System of Profound knowledge (Perla, Provost, & Parry, 2013). Deming's philosophical framework encompasses the need to consider system thinking, variation, the epistemology of people, and psychology in terms of the impact of social and interpersonal structures. Alongside these philosophical underpinnings are "improvement methods and tools which are used with the aim of conducting innovation, testing, or dissemination to achieve improvement'' (Parry, 2014, p.196). Deming himself was inspired by, and built on the work of Walter A. Shewhart, who had originated the concept of statistical control. Deming came to apply statistical methods to industrial production and management, and really rose to prominence after WWII when he worked within the Japanese industry. His techniques were used to improve quality and productivity of Japanese manufacturers (Beckford, 2017). Bearing this in mind, the philosophical underpinnings and the practical tools for modern Quality Improvement can be seen as having a basis in industrial manufacturing, an inherently mechanistic environment.

Over the last three decades health systems across the world have looked to QI sciences to improve outcomes (Poynter et al., 2017; Scott, 2009). One of the documents which marked a turning point in America was Crossing the Quality Chasm (Institute of medicine (U.S.), 2001). This report emphasised the need for a fundamental shift in the health care delivery system in a system which ''too frequently and routinely fails to deliver its potential benefits' (Institute of medicine (U.S.), 2001, p.1). 2001 was also the year in which the New Zealand Primary Care Strategy outlined the reform which led to the formation of Primary Health Organisations (PHOs). PHOs were intended to be local structures for which general practices voluntarily joined and participated in, in order to develop and deliver services organised around ensuring the needs of a defined population were met. The vision stated by the MoH was that;

> *People will be part of local primary health care services that improve their health, keep them well, are easy to get to and co-ordinate their ongoing care. Primary health care services will focus on better health for a population, and*

> *actively work to reduce health inequalities between different groups* (MoH, 2001, p.vii).

Two of the six directions for primary care which were identified as being required to reach this vision was the need to ‘‘identify and remove health inequalities’’ and to “continuously improve quality using good information’’ (MoH 2001,p. vii). This clearly signalled the importance of QI in the new heath system structure. Nine years later, the ongoing call for assurance of a safe and effective health system also saw the establishment of the Health Quality and Safety Commission (HQSC). The HQSC was established as a clinically focussed crown entity in 2010. The HQSC had the explicit aim that it works to drive and support quality and safety improvements in the health sector (Health Quality and Safety Commission New Zealand, 2011). More recently the focus of the HQSC has included primary care.

While the New Zealand Health Care System is seen on the whole as performing well comparative to other countries, it is clear that there are still inequalities and unwarranted variation (HQSC, 2018). As an important indicator, mortality from conditions which can be treated has been shown to be variable depending on where people live in the country, and the difference is even more stark by ethnic group, and deprivation level. ‘‘In broad terms, for every 10 points that deprivation increases on the NZDep2013 index of deprivation scale, a further five people per 100,000 population die from treatable diseases’’ (HQSC, 2018, p.13). Likewise, there has been variation in access to treatment in secondary, and access to primary care. Understanding how general practice is funded is important in terms of understanding why access may be variable, and how and why performance-based targets have arisen as a QI approach, as will be discussed in the next chapter.

While PHOs, as relatively independent Non-Government Organisations (NGOs), have a mandated role in primary care and are in general fully funded, general practice remain privately or independently owned, in a mixture of business ownership and delivery models. While most practices are GP owned (estimated 80%), corporate and NGO ownership continues to grow in NZ. Currently 71% of GPs still work in practices which are GP owned (Cassie, 2019). The funding model is bifurcate, that is a mixture of public funding in the form of capitation, and revenue gathered directly from patient co-payments. While for some age groups and in some settings access to general practice may be fully funded, for most it is not free. Secondary health care in New Zealand is fully publicly funded and free to patients.

Despite the ownership, funding model and the unique role that general practice has in the health system, most knowledge of what works in terms of quality improvement has an evidence base which has come from hospital or specialist settings. This leaves a gap in

knowledge of effective quality improvement strategies specific to primary care (Wells, 2017, para. 7). More generally in health, nationally and internationally the increased focus on reducing variation in quality and safety assurance has led to the wide-spread use of quality management frameworks, and continual quality improvement tools. However, despite wholescale deployment and adoption there is mixed evidence on effectiveness and sustainability of programmes (Kaplan, Provist, Froehle, & Margolis, 2012 and Livergren, Gremyr, Hellstrum, Chakhunashvii, & Bergman, 2010). This has led to cautioning that quality improvement approaches should be evidenced before costly and potentially risky wide-scale adoption (Scott, 2009). The research of Kaplan et al. (2016) also focussed on variation in success of improvement initiatives in health care settings, warning that there are major inconsistencies, with some quality improvement activities making gains while others fail to make any gains at all.

There are many possible reasons cited in research for the variation in success of quality improvement initiatives. These include contextual issues such as leadership, resource availability, capability and competence using QI tools, support and team diversity (Kaplan et al., 2012), as well as the suitability of the methodology in the specific environment (Kernick, 2006). An underlying issue regarding suitability, as already discussed, may be that quality improvement tools and theory have risen from industry with an inherent quality mechanistical systems view (Litaker et al., 2006). While some elements of health care can be understood in a cause and effect relationship, in general there are complexities at all levels in health care which mean that a reductionist view and methodology may have limitations. As Young et al. propose there is a built-in assumption that ‘‘a summation of single-disease guidelines accurately describes the quality of work that occurs in primary care” (2017, p.175). This belief can be seen in the use of reductionist or oversimplified performance measures and improvement approaches. The result of this view is that practices may be seen as failing when standardised interventions have not been successful (Young et. al., 2017).

Likewise, Poynter et al., suggest this ‘‘incomplete transition from the industrial origins of QI science’’ (2017, p.5), has led to the pursuit of standardisation which while useful in some ways can be problematic where populations are not homogenous, or their needs differ. This can be seen where some QI initiatives improve outcomes at a population level; however, fail to reduce or even widen equity gaps (Poynter et al., 2017, p. 5-6). It is acknowledged that health care is complex, and that as such innovation and improvement in health care is not a linear process and can be unpredictable, and that this knowledge necessitates rethinking some basic assumptions in terms of understanding and improving services (Litaker et al., 2006, p.30).

Complexity science and health care systems

"…. effective change will need to factor in knowledge about the system's complexity rather than perpetuate the current improvement paradigm, which applies linear thinking in blunt ways" (Braithwaite, 2018, p.1).

Complexity theory or complexity science are used interchangeably and refer to the study of complexity and complex systems. It is an interdisciplinary science drawing from fields such as physics, mathematics, social sciences, biology and anthropology, and as such has broad applicability. It can be understood as an alternate paradigm to reductionism. Healthcare including primary care has increasingly been understood as a complex system, which is a system which "cannot be reduced to the sum of its parts [...] because the whole is not just more than, but different from its constitute parts" (Braithwaite et al. 2017, p.9). During the last 15 years, there has been the practical application of complex system theory to health, at the meta or system level, as a way to understand organisational behaviour, as well as at the meso level of informing the direct diagnosis and treatment of patients (Sturmberg, Martin, & Katerndahl, 2014, p. 72; Bircher & Hahn, 2016 p. 2). More specifically, primary care has been described as a Complex Adaptive System (CAS) (Litaker, et al., 2006 and Leviton, 2011).

As discussed by Ratnapalan & Lang (2019) "a clear definition of what complexity is or the features that distinguish complex systems is not readily available, as complexity is often context dependent and subjective" (p.19). This research does not seek to prove that health systems are CASs. It seeks to test if using the underpinning worldview or metaphor of the health care system as a CAS, a living system - and focussing on the interconnected nature of its parts utilising the science of CAS may help us better understand how to adapt QI approaches. That is to say that the central construct of this research is not to prove that complexity theory is true, but to show that it can helpfully provide insight. In his book 'Images of Organisation' Gareth Morgan encourages the use of metaphor as a way to approach complex situations with new eyes and to better understand characteristics and dynamics of organisations. In this paper the metaphor is extended beyond an individual organisation to the health system. In this vein, CAS presents the potential that if we understand and view health organisations and QI through this lens, we may recognise different possibilities for the way in which we develop and implement QI approaches in health. In Morgan's words;

> *Organizations are complex and paradoxical phenomena that can be understood in many different ways. Many of our taken-for-granted ideas [...] are metaphorical [...] we frequently talk about organisations as if they were machines designed to achieve*

> *predetermined goals and objectives and operate smoothly and efficiently. As a result [...] we often attempt to manage them in a mechanistic way, forcing their human qualities into a background role. By using different metaphors to understand the complex and paradoxical [...] we are able to manage and design organizations in ways we may not have thought possible (p.13).*

And so, to the worldview or metaphor of the CAS. Central ideas in the theory and study of CAS do vary between researchers (Sage, Ring, & Sheard, 2010), and have a large cross over between different areas of the broader science of complexity, and study of complex systems. Sage et al. suggest that to understand what distinguishes CAS from other kinds of systems it is useful to compare CAS with definitions of traditional and chaotic systems. All systems they suggest have ‘‘context, structure and behaviour’’ (2010, p.36). A traditional view of a system considers the system as technological or mechanical. In this viewpoint humans are the operators and observers sitting outside of that system. In these systems gradients may be adjusted but they do not adapt or co align without engineering or intervention from the operator. Chaotic systems are unpredictable, with changes in conditions and input producing disproportionate outcomes. A CAS operates between order and chaos. Importantly CAS theory includes human activity as an agent within the system. In this case complexity ‘‘lies not within the system being observed nor within the observer but in the nature of the relationship between the two” (Sage et al., 2010, p.37). The parts in a CAS are constantly interacting and reacting to each other, this creates a pattern of adaption, emergence and change. While a CAS has non-linear behaviour, patterns can be seen to emerge. In a CAS there are many autonomous components known as agents, these agents are linked through many interconnections and can act and learn (Braithwaite et al. 2017). As such CAS are not controlled centrally and change and evolve to meet changes in the environment (Bircher et.al., 2016, pp.3-4, Young et. al., 2017). While the system can be described as a CAS, within the system there are a range of activities, processes and interactions which present different levels of complexity. Understanding and being able to make sense of behaviours of a CAS and the different types of complexity may be useful in applying quality improvement interventions, and integral in ensuring that quality improvement activities are effective and do not have unintended consequences.

Currently there do not appear to be extensive literature on frameworks or models which can be, or have been practically utilised to define or categorise complexity. This was confirmed by a 2017 meta-analysis which found that in health literature complexity theory ‘‘has yet to

transition from application in theory to practice" (Rosoja, 2018, p. 605). However, for this research two frameworks were identified as having applicability. The first Cynefin, has become more popular because of its ability to be used to both categorise the current 'place' in terms of complexity, and from there provide guidance on how to proceed in order to change the dynamics. Cynefin was originally devised to support business decisions, it has five domains simple (can be interchanged with obvious), complicated, chaotic and ordered (Snowden, 2019). An assumption is that any given problem or issue will fall within one of the domains. Each domain has properties which require specific insights and mode of action to manage the issue or problem appropriately (Kempermann, 2017, p. 1). Cynefin has been used to support consultancy work in a wide range of business and commercially related areas such as management training, cultural-change and other commercial areas. It has also been shown to have some application in health (Kempermann, 2017, p. 1; Kurtz & Snowden, 2003 p.465). However in general utilisation academically appears to be more theoretical, no emperical studies on its effectiveness were surfaced in the literature review. Likewise, literature on application of the Cynefin framework to quality improvement appears sparse with only one surfaced.

The second framework found was that developed by Kannampallil, Schauer, Cohen, & Patel, (2011). They found that while the characterisation of health care systems as complex systems has increasingly occurred, it has been often been loosely defined. They propose an approach to understanding complexity using a ''degrees of interrelatedness between system components'' (Kannampallil et al., 2011, p.944). Using this framework, level of complexity can be defined through understanding the combination of components and the unique interactions between those components (Kannampallil et al., 2011).

In summary there is general acceptance that primary care can be usefully understood within the lens of complexity science and it follows that quality improvement activity within the system may also benefit from being seen through that lens. There is currently a limited evidence base to support the utilisation of complexity theory to design and implement quality improvement activity in primary care. This may be because there is no consistent complexity-based framework which has been used to inform design, implementation, and measurement of improvement activities. This gap in evidence alongside mixed proof of efficacy of current quality improvement activity in primary care means that there is scope to enhance current quality improvement methods and that research in this area may be beneficial.

Definitions

Table 1: *Definitions*

PRIMARY HEALTH	Primary health in New Zealand can be described as *"the professional health care provided in the community, usually from a general practitioner (GP), practice nurse, pharmacist or other health professional working within a general practice* (MoH, 2017)*."* In this paper primary health specifically refers to care provided in a general practice setting.
QUALITY IMPROVEMENT	There is no single agreed definition of what is meant by ''Quality Improvement'' in the context of health. It can be described as a ''systematic approach that uses specific techniques to improve quality" (The Health Foundation, 2013, p. 8), however this does not adequately address what is meant to be quality in a health care system. The broader definition suggested by Baltalde & Davidoff (2007) provides a better sense of scope. ''The combined and unceasing efforts of everyone……to make the changes that will lead to better patient outcomes (health), better system performance (care) and better professional development" (Batalden & Davidoff, p. 1). Combining these a definition which fits the utilisation of Quality Improvement in the context of this paper is; a systematic approach that uses specific techniques to make change that leads to better patient outcomes, system performance and professional development.
TARGET-BASED PERFORMANCE PROGRAMME (TBPP)	Target and goal are used interchangeably in this research and refer to performance measures set outside of a general practice (i.e. by the MoH or PHOs) which are specifically designed with the intention to improve the performance of health services and represent organisational and government priorities. A programme refers to the infrastructure and process supporting the achievement of the target or goal.
COMPLEXITY THEORY/SCIENCE	Complexity theory is described as a set of ''concepts, heuristics and analytic tools'' (Litaker et al. p. 531). Complexity theory offers a way of

	thinking about the world and the complex systems within it.
COMPLEX ADAPTIVE SYSTEM	A Complex Adaptive System is a system which adheres to the principles of complexity theory (Litaker et al., p.32), it has a mostly permeable boundary between itself and its environment and different parts within the system interact with each in a non-linear way, this can impact on the parts and gives the system an unpredictable quality. This interaction also allows for adaption and learning within the environment (Bircher et al., 2016, p.3).

Problem Statement

The key problem identified is that Quality Improvement (QI) methods and philosophies have not been consistently effective at decreasing variation and improving outcomes in healthcare. One of the reasons posited for this is that many QI tools/approaches are underpinned by a reductionist worldview. It is argued that a paradigm underpinned by a worldview of holism, specifically viewing healthcare as a Complex Adaptive System, and QI problems in terms of their level of complexity may,

- provide an alternate way to understand the characteristics of health systems,
- offer an alternate lens in which to understand why current QI approaches have had variable impact,
- offer ways to augment and improve current QI approaches in healthcare, and by extension in any complex system.

Complex Adaptive System theory identifies several important characteristics which influence non-linear behaviours, these include the autonomous, interconnected, and self-organising nature of agents. Interaction of agents in non-linear ways can result in emergence and co-evolution. Within a CAS feedback loops play an important part in this evolution, emergence, and ability to adapt. Applying these characteristics to a current QI approach may help understand why variation occurs.

An example of a predominant QI approach in healthcare in New Zealand and internationally is Target Based Performance Programmes (TBPP). TBPPs articulate success as the meeting of single proxy[1] measures. As with other QI approaches there is evidence that these programmes have had variable impact and have not consistently improved outcomes. While there is literature which examines the reasons for variation and impacts of TBPP, there was no literature surfaced which specifically examined the limitations of TBPP from a complexity or CAS lens.

[1] Proxy measure in this case refers to the fact that often a single measure will stand in place of unobservable measures; or as a summation of a range of expected inputs. For example a measure of number of people provided brief advice for smoking assumes that quality advice will increase probability of a quit attempt. The measurement of the proportion of diabetic population with HBA1C levels within a safe band assumes that to achieve this a care plan is in place and effective for the diabetic patient; that care plan could include diet, exercise and pharmacotherapy. A measurement of the percentage of eligble population who have had a Cardiovascular Risk Assement (CVRA) completed assumes systematic screening has occured, and the outcome of that would be identification of concerns and initiation of appropriate intervention.

It is acknowledged that having an approach which is aligned with the environment is important for meeting the goals of a QI programme; and for engaging workforces effectively towards achieving them. GPs are an important workforce in primary care as they deliver care, but also are often owners and/or have a role in leadership of the health system at many levels. Applying a complexity-based framework to understand current QI approaches through GP experience provides an opportunity to provide evidence a CAS lens may be able to help understand the current limitations of approaches. It may also offer a firm position that QI approaches that acknowledge both complexity and the characteristics of a CAS offer a way forward for QI in healthcare and other settings.

Aims and objectives of the research

Aim

The aim of this research is to use a complexity lens to explore GPs views of TBPPs in order to understand firstly if complexity and the nature of CAS can provide an alternate way to explain limitations of a current quality improvement approach, and to understand ways in which approaches can be adapted to improve outcome and clinician perception of match to environment.

There are two parts to the aims which lead to the below research questions.

Research questions

Part 1: To understand if complexity and the nature of CAS as a worldview can explain limitations of a TBPP [as an example of a current quality improvement approach]

1) Is there a relationship between:
    - How complex the problem is perceived to be by GPs and whether targets are viewed as an effective measure of clinical input (how well-matched targets are to the complexity of the problem)?
    - How complex the problem is perceived to be and engagement in achieving the target?
2) To what extent can the characteristics of a CAS be seen to influence effectiveness of a TBPP?

Part 2: To understand ways in which approaches can be adapted to improve outcome and clinician perception of match to environment.

3) What do the findings of the research suggest about how TBPP and more generally QI approaches in healthcare could be improved in the future.?

Objectives

The objectives of the research are to:

- Develop a framework to explore GP perspectives of a TBPP through a complexity lens.
- Examine GPs perspectives of TBPPs using a complexity framework.
- Determine whether there is a relationship between complexity and GPs perceptions of the effectiveness of a TBPP.
- Determine whether there is evidence that variation in outcomes of a TBPP could be attributed to the complex nature of problems and/or the behaviours of a CAS,
- Justify an underlying assumption that understanding healthcare as a CAS may provide new insights into how best to manage and lead improvement activity.

Chapter overview

- **Chapter two** is a further review of the literature which expands on the evidence and discussion presented in the introduction.
- **Chapter three** provides information on the research methodology and methods employed for this paper.
- **Chapter four** outlines how key concepts were used to develop and design the research tools.
- **Chapter five** is a presentation of the results of the research.
- **Chapter six** is a discussion of results and findings.
- **Chapter seven** is the concluding chapter which includes a summary, strengths and limitations, and recommendations.

Chapter 2

A review of the literature

This literature review seeks to broaden understanding of the limitations of current approaches to quality and provide the groundwork to develop a complexity informed research framework and tool. It starts with an explanation of reductionism versus holism and expands and builds on the information presented in the introductory chapter. There are five key areas explored, firstly which methods/approaches of QI are predominant in primary care, and the factors which are seen to contribute to the success or failure of current approaches. Secondly, it reviews how engagement in quality improvement can be understood and therefore measured. Thirdly, it looks to understand to what extent complexity theory is currently being used to understand primary care generally, and more specifically how complexity theory is being used to describe quality improvement activity in primary care. This literature review then aims to understand which frameworks could be used to define and measure complexity, and how this could integrate quality improvement and complexity. Finally, the literature review looks more specifically at the properties of a CAS and how these can be defined.

Reductionism and holism

This research pivots around an underlying assumption that viewing and understanding the health system as a CAS, a holistic approach, may provide insight into why current approaches of QI on health have variable impact. It also argues that some of the underlying principles of current QI approaches may be seen as reductionist in nature. This literature review does refer to these tensions, and so at the outset it is useful to outline the characteristics of the two paradigms of reductionism and holism as I they relate to systems. A summary of these differences can be seen in Table 2. This becomes a reference point for understanding the extent to which any QI approach be understood as either reflecting a reductionist or holistic worldview

Table 2: *Holism vs Reductionism*

HOLISM	REDUCTIONISM
• Emphasises the whole rather than the parts of a system. • Look for how entities form part of a larger whole • The whole is more than a sum of its parts, there is emergence. • Implies that phenomenon and systems must be understood within their context, and knowledge will not derive from understanding component parts • The individual or scientist is not a passive observer but has a participatory relationship. There may be valid explanations, which may be understood by gaining different perspectives and synthesising them. • There can be downward causation, that is that macro level change can affect formation of parts in a continuous dynamic. • Oriented in nature	• Analyses and describe phenomenon in terms of parts • Tries to explain world by reducing it to set of parts and explaining phenomenon as combinations of these parts • Implies any higher-level phenomenon can be understood as a combination of lower level phenomenon • The individual or scientist takes an objective approach, that is that reality exists independent from the individual and can be understood empirically. There can be one right answer. • There is upward causation, i.e you can understand root cause and extrapolate at multiple levels • Static
References: Systems Innovation, 2020	

Having established the difference between these world views current QI methods are now discussed. It is useful to consider the extent to which each method represents either a reductionist or holistic worldview.

Current QI methods and effectiveness

There is agreement that QI interventions have great potential to improve health care delivery (Pannick, Sevadalis, & Athanasiou, 2016). QI approaches, to be seen as successful need to be able to be consistently effective, and be able to replicate success at scale, and across levels/variation in focus. However, this is not the case. Internationally there are research

findings which point to difficulty replicating successes of QI activity outside of their original settings, and variability of impact with some changes proving to be unsuccessful and unsustainable (Pannick et. al., 2016; Livergren et al., 2010, and Kaplan et.al., 2012). Likewise, in the New Zealand context Poynter et al. (2017), found very few reported initiatives which reduced variation equally between population groups. This has the impact of increasing inequity. Understanding why improvement strategies succeed or fail is important to ensuring sustainability of quality improvement programmes and to encourage adoption. In considering effectiveness of QI, Scott (2009) suggests that while some patterns have emerged in the literature regarding strategies which are more effective, i.e. patient or practitioner driven strategies being more likely to be successful; there is insufficient evidence to really draw conclusions about methods which would be successful systematically.

In their research Kaplan et al. (2012) found that they could summarise twenty-five different factors which impact the success of quality improvement methods in health care settings. These included factors associated to the external environment, organisational context, the microsystem, and the quality improvement team itself as well as the trigger point and strategic priority. These two pieces of research were framed differently; One focussed on the efficacy of types of improvement activity and the other focused on the context which makes interventions succeed or fail. What both had in common is an agreement that understanding context in the evaluation and execution of quality improvement strategies is essential. And that the complex nature of healthcare influences outcomes and must be reflected in improvement approaches. Kaplan et.al (2012) specifically assert that;

> *[…] in order to make progress in understanding the role of context in the evaluation and execution of QI efforts, explicit conceptual models, frameworks, and taxonomies are needed to focus and align research and to help practitioners learn how to manage key contextual factors that influence QI success (p.13).*

When considering QI initiative from an equity perspective, Poynter et al. (2017) agree that context in terms of non-homogenous populations, with varying needs must be considered. And that application of standardised and evidence-based approaches should be coupled with an understanding of the context, including levers outside of the health systems control Poynter et al., 2017).

Specific QI approaches in primary care and their effectiveness

This section specifically looks at two common QI approaches. Lean, Six Sigma and the current evidence for them in health.

Lean

Lean concepts were originally developed to improve car production. The key principle is the desire to eliminate waste (Brandao de Souza, 2009). That is steps in a process that do not add value. In lean thinking waste is anything that a customer would not willingly pay for. This is achieved through creating standardised and stabilised processes in learning environments where employees are respected and have autonomy to contribute (Terry, 2020). The transition of lean from industry to use in health care began in the early 2000s. A 2009 literature review found that case studies on the application of lean in healthcare could be divided into four categories:

- Manufacturing like case studies – these were case studies which referred to departments of health care organisations, such as pharmacy or laundry, which typically dealt with the physical flow of materials
- Managerial and support case studies, in areas of hospitals which mainly dealt with the flow of information for example finance and IT.
- Patient flow case studies where attempts are made to streamline how patients flow through the system, while ensuring patient safety is not compromised.
- Organisational studies looking at the strategic implementation of lean into a organisation (Brandao de Souza, 2009)

Lean uses a range of tools to eliminate waste, but value stream mapping breaks requires the mapping and redesign of process. The 5ys, a iterative interrogative technique, asks for the identification of a root cause through the use of the question ‘why’. The root cause can then be problem solved though a QI process. The underpinning worldview is that a process or problem can be broken down into its parts and changing parts will improve the whole. This works well in processes which can be viewed as mechanistic. However, as Kuziemesky (2015) notes;

> *While approaches such as LEAN have provided process efficiency in the automotive and manufacturing industries, its success lies in the ability to decompose processes, identify issues, and then*

> *reassemble the processes. Such functional decomposition cannot be used in a CAS such as healthcare because of the degree of interrelatedness (p.5).*

It is possible for the reason of applicability and fit to problem that Dellifraine, Langabeer and Nehmbard (2010) found that most studies of Lean (and Six Sigma) in healthcare focused on processes of care rather than clinical outcomes. They concluded that while there was potential for this QI approaches in health care there was "weak evidence that [six sigma and lean] improved health care quality" (Dellifraine et. al., 2010, p.222). In the last decade literature has continued to report low levels of success for Lean (Leite, Bateman, & Radnor, 2020). Barriers to success have been identified in a number of studies, and Leite et al. (2020) recent study on application of Lean in health care identified 6 restraining forces these imcluded:

- Physician influence within the process,
- Patients behaviour [in emergency areas],
- Constraints related to resource management,
- Impact on physician work – i.e. more bureaucratic work,
- Influence of staff behaviour, for example resistance to change, communication and lack of lean knowledge. (p. 11)

Lean also includes Key Performance Indicators (KPI) as a way in which to measure success. This is important to note as TBPP are essentially a KPI.

Six Sigma

Six Sigma was developed by the American telecommunications company, Motorola, in the Mid 1980s. It was an improvement approach which focussed on "reduction of errors by establishing aggressive goals for quality" (Dellifraineet et al. p. 213, 2010). In Six Sigma the measure of quality is the number of defects in any product or process. With the core philosophy being reducing variability by controlling process. The five processes for this are Defining, Measuring, Analysing, Improving and Controlling (DMAIC). Like Lean, Six Sigma first began to emerge as a QI approach in health in the early 2000s. The key difference between Lean and Six Sigma is that Lean "focuses on doing the right things (value added activities) and Six Sigma focuses on doing things right (with no errors)" (Dellifraine, Langabeer, & Nehmhard, 2010). Six Sigma uses more statistical and analytical techniques,

whereas Lean focusses more on process and cultural change; however, both require the collection and analysis of data as a core component to improving performance.

Challenges of implementing Six Sigma include:

- Availability of data during implementation phases.
- Resistance to change.
- Sustainability of results over-time
- Insufficient resources/ budget constraints.
- Inadequate knowledge of Six Sigma and statistical methods.
- Complexity of current practice.
- Lack of leadership commitment/culture (Antony, Palsuk, Gupta, & Barach, 2018).

With its focus on identifying an end goal and using core tools to reach this goal, Six Sigma has been understood and referred to as a reductionist or hard approach, and it is this that has led to a number of criticisms; particularly around its capability to deal with soft issues such as people and culture which are less able to be measured (Douglas, S, & Antony, 2009).

Performance-based targets

As a QI tool/approach performance-based targets are a feature of both LEAN and Six-Sigma. In LEAN they are known as Key Performance indicators or performance metrics. Six Sigma has performance metrics at its heart, being that it is a metric itself (defect reduction) as well as a methodology and management system. In health the use of targeted metrics to foster QI improvement has become widespread as a QI approach in itself.

Generally, targets or goals are developed using best-evidence available (Hughes, 2018), and through a process of ensuring validity and capability to collect data as well as testing. There are different types of targets such as;

- Process measures which measure activity which measures activity – an example of this is a Diabetes Annual review
- Outcome measures which measure the effect that care has had on a patient – an example of this is measuring HBA1c levels of diabetics,
- Patient experience measures
- Structural measures, an example being uptake of an Electronic Patient portal.

The targets are and can be used in a range of ways including:

- Benchmarking internally (i.e. between GPs).
- Benchmarking externally (i.e. between PHOs).
- To identify opportunities for improvement work, and to see where improvement activity is working.
- As the basis for performance-based payments.

The rationale behind this approach is that the performance against targets is a reflection of good-quality practice and that comparison encourages improved performance (Hughes, 2018)

A national PHO performance-based programme was first introduced in NZ in 2007. The programme drew on similar approaches in England and the USA, with a principle of paying bonuses to providers for the attainment of predefined targets. While the national targets have changed over time, with less now in place than in 2007, goal-based approaches continue to be a common QI approach.

A HQSC report has found that while variation persists there have been pockets of success with targets, such as the childhood immunisations programme, which has been successful from both a population and equity perspective (Poynter, Hamblin, Shuker, & Cincotta, 2017). However, target based approaches have not always been striking the right balance with National data showing that while there were initial and significant improvements there were also unintended consequences. For example, the Emergency Department (ED) length of stay targets; the drive to sustain these after the first 18 months saw virtual and real structural changes to ED departments such as short stay facilities. This 'perverse' behaviour has been described as hitting the target but missing the point (Tenbensel, 2018, p. 18). A 2019 paper confirmed that gaming ''in the form of 'clock stopping' and decanting patients" (Tenbensel, Jones, Chalmers, Ameratunga and Carswell, 2019, p.1) was common across sites as a way in which to ensure targets were met. A systematic review of TBPP, with payments associated, concluded that while there was an association between performance programmes and improved processes in ambulatory care ''consistently positive associations with improved care had not been demonstrated in any setting" (Mendelson, Kondo, Damberg, Motúapuaka, Freeman, O'Neil, Relevo and Kansagara, 2017, p. 341); Young et al., (2017) suggests that the misaligned metrics have contributed to burnout amongst clinicians, and note that there is paradoxical belief amongst general practitioners that existing metrics (in the American setting) encourage a poor quality of care. In 2016 the System Level Framework replaced the targets approach. These are high level measures

which require a collaborative and local approach to improvement. Regional areas are asked to collaborate to develop contributory measures. Which in some cases resemble previous targets.

Clinician Engagement in QI activities

Clinician engagement is important to the success of QI activities in the primary care context because the clinician is the interface between the system and the patient as well as the therapeutic tool. The development of the Model for Understanding Success in Quality (MUSIQ) tool confirms the importance of some contextual factors such as leadership, culture, QI maturity and data infrastructure in influencing success of QI (Kaplan et al., 2012). However, clinician engagement and microsystem motivation to change were studied less frequently (Kaplan et al., 2012). This is also reflected in the difficulty in finding a definition of clinician engagement in literature. On the basis of their literature review, and the iterative process to design a contextual framework by the expert panel Kaplan et al, hypothesis that QI success is influenced by ‘‘microsystem and QI team factors which are interdependent and mutually reinforcing’’(p.17, 2012). They saw staff motivation and capability as critical. Kaplan et al. also hypothesised that ‘‘external pressure and/or incentives and project sponsorship by outside entities encourage organisational QI leadership” (p.17, 2012).

A limitation of this study is that it is based on evidence of what motivates the leaders but not necessarily how these external nudges are perceived by the clinicians. Incentives in the form of performance-based payments, which have often been used in target-based QI schemes in part rely on the principle that health professionals are inherently motivated by a financial incentive. The challenge is that health care professionals are ‘‘highly specialised workers, who have been exposed to and socialised by a strong professional culture and who are used to making complex, knowledge-based (not functional-based) decisions” (Janus, 2010, p.60). And very importantly these health professionals ‘‘are at the core of the health care production and determine the level of output quality…’’ (Janus, 2010, p.60). Janus (2010) suggests that if rather than being extrinsically motivated, clinicians are predominantly intrinsically motivated, then the use of extrinsic motivators could ‘‘crowd out’’ intrinsic motivation as it shifts control from inside to outside of the person. This has the effect of undermining intrinsic motivation and may reduce work morale (p.60).

In the context of this research, understanding clinician engagement (being active participation as well as motivation both extrinsic and intrinsic), and the balance of that motivation is important.

Complexity science and QI approaches

As discussed in the first part of the literature review, complexity theory is providing an alternate frame for understanding context in healthcare. Complexity theory or complexity science is its own field. While quality improvement has become widespread in health care over the last thirty years, complexity science has peaked more recently in health care literature. A systemic review of health related literature between 2002 and 2015 found that during that period the number of articles incorporating complexity science has generally increased each year (Rosoja, 2018).

Many of the gains which have been made in health and indeed quality improvement methodology have come from a reductionist view which assumes that order can be created and imposed on a system. However, there are calls to reconsider this paradigm. Young et. al notes that in transactional health care systems ‘‘a reliance on a reductionist paradigm is now exposing its disadvantages…. yielding slower advances at greater costs” (Saini, 2018, p. viii). A reductionist view could be encapsulated in a belief that by deconstructing a system into smaller components or elements improvements can be made, with single-disease guidelines being an example of this (Young et. al., 2017). At the patient level of care, it must take account of a myriad of factors beyond the disease such as social determinants and beliefs which also impact outcomes. As Braithwaite et al. state ‘‘we know in our bones that delivering high-quality services in such a complex environment will not be achieved merely by following a standard operating procedure, inserting the results of a randomised control trial of adopting the seven habits of highly successful people” (p.v 2017). While Young et al. are proponents of complexity science as an idea whose time has come, they acknowledge that complexity science cannot resolve all the ‘‘tensions and paradoxes in contemporary health care systems’’ (2014, p.180). Because those are the very traits which are inherent to the nature of complex systems. What instead is sought is an understanding of how the principles of complexity science can be applied and help to improve health systems through accepting the nature of the complexity inherent in those systems.

As discussed in the introductory chapter, complexity theory provides a perspective of a complex non-linear system shifting from the metaphor of a system as a ‘‘machine to an eco-system of co-evolving elements” (Kernick, 2006, p. 386). This has implications in many aspects of health care delivery including the application of improvement, and as Kernick (2006) and Litaker et al. (2006), both conclude, may help to understand the limitations in current design implementation and analysis of improvement interventions. Complexity theory finds that complex systems have a number of important characteristics. They are made up of many parts, elements, or agents, and those agents interact in a dynamic way with each

other. The way they interact is non-linear and cannot be predicted (Gorzen-Mitka, 2014). They evolve through time, so their past influences their current state. In a complex system there is no centralised control, all agents act freely, but their actions are interconnected so one agent can change the context in a system. Within the system, there is always tension between the status quo and the need to survive and adapt to an ever-changing environment (Litaker et al., 2006).

Complexity theory has been broken into two subfields; complex physical systems (CPS) and CAS. CPS focussed on ‘‘geometric arrays of patterns” (Holland, 2014, p. 8), in these systems the impact of interaction is only felt by near neighbours. By comparison CAS are made up of agents which are not fixed, and those agent’s interactions allow the CAS the ability to change and learn from experience over time (Holland, 2014). The properties of a CAS are further discussed in the next section of this chapter. CAS operate as a whole, but are more than the sum of their parts, importantly the agents which interact can learn, this allows adaption to the environment and the ‘emergence’ of new qualities if a CAS fails to adapt, chaos and crisis can occur or the CAS can cease to survive (Bircher et al., 2016). In considering the learning element of adaption, it is understandable that when faced with a patient with co-morbidities, and impacting social issues, a GP may choose to adapt their ways of working rather than adhere strictly to disease-specific guidelines. However, this could be treated as a failure against a metric which assumes that breaking down component parts of a system, including indeed the human body, will improve outcomes. There has been interest in using complexity theory to improve efficacy of quality improvement activity in health care. Litaker (2006) discusses how current quality improvement methodologies can miss the opportunity to understand context and localised unanticipated circumstances. This challenge of undertaking QI work in a CAS is echoed by Leviton (2010) who refers to the constraining elements of attempting to create generalisable knowledge in a complex environment. Unfortunately - while complexity science has a large theoretical base, and while there are conversations about its implications in understanding the primary care environment - there appeared in researching the topic to be little evidence base for practicality or efficacy when applied to quality improvement. A systematic research of literature found that while many complexity informed interventions in health care were positive it was ‘‘not feasible to confidently evaluate the efficacy” (Brainard, 2016, p.9) of the interventions. One of the reasons discussed for a lack of evidence for the efficacy of complexity-informed interventions in general is that there is that there is no conceptual framework for design and implementation research (Brainard, 2016).

A similar gap is present for complexity-informed quality improvement activity and it is identified that there is no widely used conceptual framework or classification system which

would allow the collection, comparison and analysis of quality improvement activity to enable a better understanding of what works (Leviton, 2019). Berswick (2008) in a similar vein identifies that there is a gap between the local reports of success and the findings of formal research. However, he points to a deep epistemological gap, and questions the concept of scientific-evidence hierarchy. In considering how it might be possible to find out what is working and to generate understanding of emerging patterns for improvement activity undertaken in primary care, the literature reviewed does suggest the need for a way to categorise and create collective meaning.

Describing and measuring complexity

Two possible frameworks for describing or attributing levels of complexity were identified; Cynefin framework (Snowden and Boone, 2017) and the degrees of interrelatedness framework described by Kannampallil et al. (2014) The Cynefin framework provides a sense-making framework dependant on the complexity of a situation whilst Kannampallil et al. describes a way in which to measure and understand complexity. These are described in more detail in this section.

Cynefin

Cynefin can be considered useful as a framework because of its ability to be used flexibly both to guide decisions, provide a lens to consider problems and potentially as a framework to guide the design of research. Cynefin is useful in settings where ‘‘complexity challenges the quality of insight, prediction and decision” (Kempermann, 2017p.1). It is described as a sense-making framework which can help provide a new way to look at difficult problems (Kurtz & Snowden 2003). The authors do caution that Cynefin is not a categorisation framework in that no domain is more desireable than another – rather the framework is to be used to consider the dynamics of the situation (Kurtz & Snowden 2003).

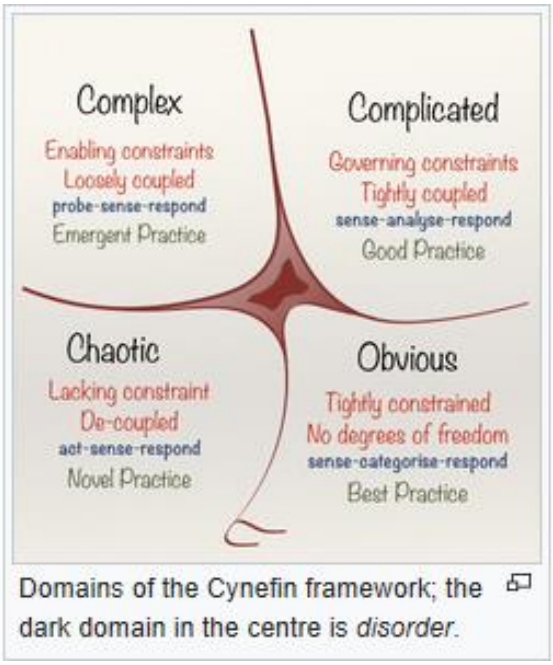


Figure 1: *Domains of the Cynefin Framework. Source: Snowden, 2014, Licensed under CC by SA 3.0*

Cynefin may be useful in the context of understanding where, when and how to effectively apply quality improvement in primary care. The framework could help identify in which domains quality improvement activities lie; and contribute to understanding which tools or approaches are more likely to work to create

a ‘clockwise drift’ as the dynamics of a system are shifted. Cynefin has been applied in a range of literature, both exploring how as a framework it can be used to understand and explain situations; and as a way to consider tailoring the associated intervention. Examples include process modelling (Lepmets et.al, 2014), biomedical research (Kempermann, 2017) and as a way to describe the complexity of primary care in New Zealand (Gray, 2017). In all these papers Cyenfin is seen as complimentary but not replacing scientific-evidence or evidence based practice. Cynefin rather becomes a way of making sense of complex systems and could be seen as augmenting a broader framework (Gray, 2017). These papers while lauding the utilisation of Cynefin, all see it as useful alongside other methods.

It is also imortant to note that Cynefin has two classification systems, domains and dynamics. Snowden notes that there is frequently disagreements about what is, or is not complex. He is very clear in reminding users that the ‘‘essence of Cynefin is to improve decision making by making people aware of different contexts’’ (Snowden, 2019, para 3.), he suggests that if there is a competing hypothesis and there is no evidence base to resolve the conflict one way or another ‘‘within the time frame for decision making then the situation is complex’’ (2019, para. 3)

The question that comes to mind of course is - is there a way to strengthen evidence and define complexity? This is a question the Kannampallil et al. (2011) explored.

Interrelatedness framework

In considering complexity Kannampallil et al. (2011) found that most work on complexity in health care settings was descriptive and ‘‘provides limited insights for researchers and practitioners on how to understand complex systems (p.943). In an attempt to bridge the gap, they proposed a theoretical lens to help practitioners understand and manage complexity. While they were specifically interested in a way in which to understand settings such as ‘‘intensive and emergency care environments’’, it is possible that their concept (shown in figure 2) could be applied to quality improvement

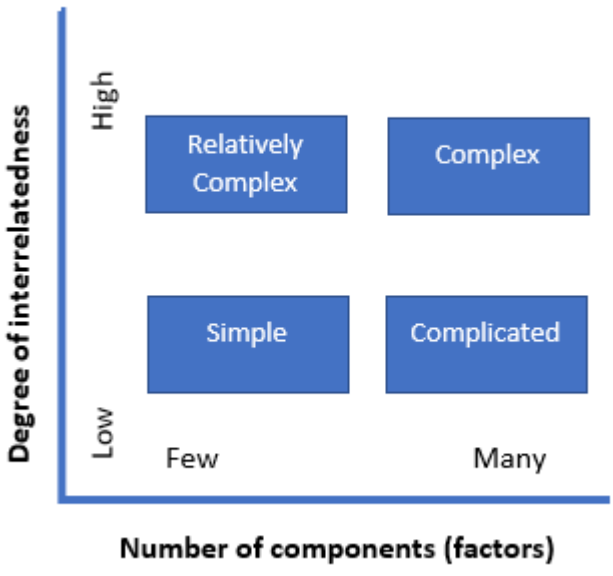


***Figure 2**: Interrelatedness framework. Adapted from Kannampallil et al., 2011*

problems in health systems. Kannampallil et al. (2011) defines complexity in terms of the interrelatedness of components of a system.

> *By interrelatedness we mean the influence of a system components on each other. In this sense complexity is relative: it increases with the number of components in a system, number of relations between them and the uniqueness of the relations (p.944).*

There are three properties which need to be understood regarding interrelatedness. Non-decomposability, emergence and non-linearity. Non-decomposability means that a "systems cannot be understood by attending to their individual components in isolation" (Kannampallil et al., 2011, p. 944. Linearity would mean that the behaviour of a system in response to external factors would be predictable and proportional, non-linearity means that complex systems have more freedom from direct response to environmental factors (Kannampallil et al., 2011). The implication of this is that reactions could be smaller or larger and this characteristic can give complex systems more resilience. An important outcome of the behaviour of the complex systems, because of their characteristics and non-decomposable behaviour is 'emergence'. Emergence and non-linearity are further discussed later in the next section of this chapter.

These two tools provide technical systems to help identify the domain the problem is in now, and the potential way forward, but there is a broader context which is the properties and dynamics of a CAS, and how these influence QI work.

Describing the properties of a CAS

In order to understand the implications of CAS theory when applying it to quality improvement in general it will be important to understand the key behaviours or elements of a CAS. Because CAS study is still relatively young, it is still evolving as a theory. Holland found that ''the pieces that do exist do suggest the possibility of an overarching theory'' (2014, p.32). Wallis examined 20 concise theories of CAS and found the 6 most conceptual components were non-linear/unpredictable, co-evolution, many agents, interrelated/interacting, goal seeking, emergence surprise happens (2008, p.6). When analysed via their causal relationships he defined the core of CAS theory as;

> *[…] agents, with schemas interacting over time. The results of those interactions are maximised at the EOC [Edge of Chaos] and are subject to a fit test with the environment. The result may be changes in schemas.*

> *Changes in interactions, the creation and maintenance of larger systems, increased stability and increased instability. Finally, the status of EOC may be changed by the creation of new agents or schemas (2008, p.13-14).*

Holland states this in a different way

> *One characteristic common to all CAS points the way: The behaviour of a CAS is always generated by the adaptive interactions of its components, and the hierarchical structure characteristic of CAS is also generated – particular combinations of agents at one level become agents at the next level up […] such hierarchical generative processes characterise all CAS (p.32)*

While not all literature uses the same words to describe the following key characteristics/ behaviours of CAS can be used to describe the core elements of CAS. It is noted that it is because of the non-decomposable nature of CAS that its characteristics or elements can also not be seen individually, and distinctions between elements are not necessarily clearly delineated. Table 3 provides a summary of CAS characteristics.

Table 3: *Core CAS Characteristic*

CORE CAS CHARACTERSTIC	ALSO CALLED OR ASSOCIATED WITH	REFERENCES
Autonomy of agents	Also described as agency or referring to many agents	Wallis, 2008; Holland, 2014; Braithwaite et al. 2017; Hollegnal et.al. 2013;
Interconnectedness	Also described as interrelatedness/ interactions. Or could be schemas inclusive of goals, rules of interactions/ networked nature, degrees or fanout	Wallis, 2008; Kannampallil et al, 2011; Braithwaite et al. 2017; Braithwaite, 2013; Johnson & Rossow, 2019.
Self-organisation	Incorporates concept of hierarchy	Braithwaite et al. 2017; Johnson & Rossow, 2019.
Emergence	Or 'surprise happens'.	Wallis, 2008; Kannampallil et al., 2011; Braithwaite et al. 2017; Holland,

		2014
Co-evolution	Related to interconnectedness, also referring to ability to adapt	Wallis, 2008; Braithwaite et al. 2017;
Feedback loops	May simply be called loops	Wallis, 2008; Braithwaite et al. 2017; Holland, 2014; Swinburn et al. 2019

Time is not included in the list as that is intrinsic to the idea of CAS being dynamic, adaptable and changing over time. These characteristics are now defined and explained in relation to health care.

Agents or agency

Braithewaite et al. describe a health care system as being made up of a diverse range of people and their roles such as ‘‘policymakers, managers, doctors, nurses, allied health staff and patients, who run, act on, work in, provide care in organisation such as […] general practice or community-based providers or sub-groups… “(2017, p. 9) . These people and organisations are agents. A CAS is made up of these agents (or nodes), at different levels, who interact over space and time (Hollegnal et.al. 2013). Agents are information processors; they are capable of exchanging information amongst themselves and also interacting with their environment. This ability to process information and interact allows the adjustment of behaviour over time (Johnson & Rossow, 2019).

Braithewate et al. (2017, p.10) describe the ability to process and learn about conditions and contexts as a sense-making process. While agents have the ability to learn and adapt, they have tendencies to have internalised rules (schemas). Importantly these rules are not necessarily shared, and they are not fixed. The side effect of dynamism of agents is as that as Holland discusses:

> *It is unusual for CAS agents to converge, even momentarily to a ‘‘optimal’’ strategy or an equilibrium. As the agents adapt to each other, new agents with new strategies will emerge. Then each new agent offers opportunities for further interactions, increasing the overall complexity (p.9).*

It is important to note, while agents may not all have an equal role, all have a role, and this is what makes a CAS unique in terms of control of the system. As Braithwaite, et al, discuss “the ‘‘Queen Ant’’ phenomenon has been observed and discussed in literature, whereby the

observer of a large system will assume that someone, or something is in control. But this is not the reality, and while at upper levels of systems there may be the illusion of control the ‘‘in-control folks’’ can’t ultimately control many, or even most things that matter” (2017, p.27). The NZ director of health has also commented on the limited direct control there was over the system, due to the nature of the system and the highly skilled and autonomous workforce. This meant that the approach required is one of ‘‘convene and coordinate not control and command’’ (Bloomfield, 2018). The autonomous nature of CAS, alongside self-organisation and emergence, which are discussed next, help to explain as Braithwaite et al. discuss (2017), why regardless of ownership or business model, or funding mechanism, many health care services look similar across the world. Likewise, even where major organisational restructures occur, real changes to service delivery and culture at the front line are rare.

Interconnectedness

The New Zealand Health care system is made up of multiple embedded CAS’. The formal structure of the New Zealand Health System in Figure 3 shows the interconnectedness of different key organisations, functions and formal relationships i.e. funder, service provider.

This gives one schema or perspective of the health care system as centrally controlled. However, when viewing the health care system as CAS we would see that that this structure is only one small element of what makes the health care system work. Funding, reporting, and audits for example help create shared understanding through loops and the strengthening of signals over time (Braithwaite et al. 2017). However, looking closer, each CAS within the greater health care system is made up of agents, which can be understood as nodes on a network. Each node leads to another (or other nodes). How many connections there are to each member within a set or cluster determines the tightness of the community. The richness of agents’’ interconnectedness

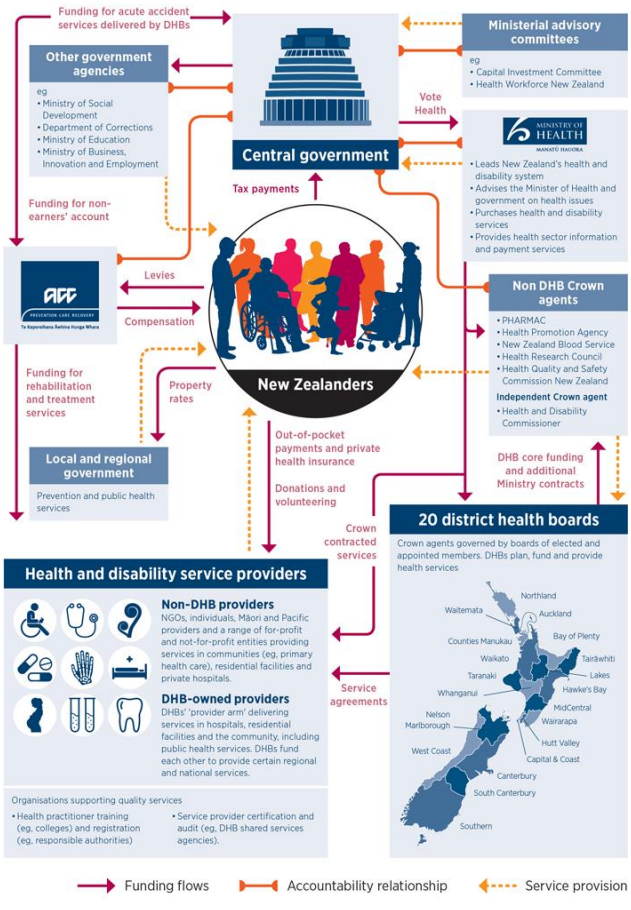


Figure 3: *Structure of the New Zealand health and disability system, 'Turning Strategy into Action', MoH, 2016. Licensed by CC under 4.0.*

is understood by the number of connections it has to other agents (Holland, 2014). So, from this viewpoint we may see the health system more like a network map. This is important in understanding the interconnected nature of the system, and why small changes to one part of the system can have broader impact.

Agents interact in non-linear ways with each other, and structures emerge and change over time as agents adapt, react, and learn over time (Braithwaite et al. 2017). Interconnections are dynamic and ever changing, and agents within the system find ways to bridge and navigate the system. This non-linear and dynamic interrelatedness means that inputs are often not proportional to output. Small changes can have a big impact, and big changes can have small impact, positive and negative.

Interrelatedness means that understanding relationships amongst agents is a key to working within a CAS. Relationships in this sense can be understood in a spectrum from non-existent/weak to strong. It is also understanding the agents who link nodes or agents together. These agents can be known by many names but Long, Cunningham and Braithwaite call them ‘‘bridges, brokers and boundary spanners” (2013, p.158). These agents ‘‘facilitate the flow of information between people who have no physical or cognitive access to one another, or alternatively, who have no basis on which to trust each other’’ (2013, p.158). Features and motivations of these agents identified include bridging structural holes, acting as an intermediary providing an overlap between clusters of agents, facilitation between unlinked agents, conflict resolution. They can also act as filters and gatekeepers (keeping out information) (Braithewaite, 2013).

Self-organisation

Agents in CASs are not centrally controlled, rather they self-organise into relatively stable patterns from the bottom up, and as discussed by Johnson & Rossow (2019) any order may be a result of properties of the system, rather than intervention from a single source of control. In a CAS ‘‘coordinated activities and structural characteristics emerge, and forms of order become manifest, without any single source of top down control, to meet system goals” (p.53). This does not mean there is not a need for top-down leadership (Braithwaite, p.29), as this can be important for coordination functions such as financial, and strategic direction. Rather any attempts to tightly control from above may be counterproductive in a CAS.

In health care systems we can see that clinicians often organise themselves into formal and informal groups based on their specialisation. They may also organise themselves by the organisation they belong to, or their area of health (Braithwaite et al., 2018). For example, primary care, secondary care and public health. In New Zealand we also see self-

organisation occurring between model of care, for example mainstream versus kaupapa Māori delivery. They may also organise based on trust, friendship, support and the integrated nature of pathways. This self-organisation at a systems level allows groups of agents to resist external pressure or influence from other groups of agents within the CAS. There are top-down functions which constrain or enable behaviour and or assign responsibility and accountability to those who provide care (Braithwaite et al., 2018). These agents or functions do not directly provide care or keep things safe but act when errors are made. These authorities may have hindsight bias. Hindsight bias refers in psychology, to the tendency, after an event to occurs, to believe the event could have been more predicable than it actually was.

Emergence

In a CAS it is not possible to understand behaviour by summing the individual parts, rather behaviours emerge ‘‘as the result of patterns of connections among diverse agents’’ (p.53). As discussed by Braithwaite et. al. complexity science helps explain how CAS adapt and change over time ‘‘evolution produces variation and diversity….and complex forms and new adaptive behaviours follow” (2017, p.25).’’ Holland (2014) uses the metaphor of wetness. Whereby individual H_20 molecules are not wet; however, wetness emerges from the interactions between molecules. At a granular lever, the wellness or health of individual agents cannot be ascribed to any one element; rather it emerges from the interactions of many elements or building blocks for health overtime. How these will interact cannot be fully predicted or modelled for in the individual. Although patterns do emerge at a population level. When thinking about a quality improvement initiative then, we can see that input (or intention) versus the outcome at any point in will be the subject of emergence.

Co-evolution

The nature of CAS means that the quality improvement initiative will also co-evolve with the system. Co-evolution means that not only can a CAS change and evolve over time, it will also influence and change the environment around it and vice versa. This creates an ongoing and multi-directional, dynamic tension. A failure to adapt leads to the system or agents not being viable within their context. The interconnected nature of CAS make learning and therefore co-evolution possible. “A system does not evolve independently from its environment and the larger systems it is nested within” (Chaffee & McNeill, 2008).

Feedback loops

Feedback loops play an important role in the co-evolution and behaviour of CAS. And understanding major feedback loops can be important in ‘‘identifying how to reorient the systems towards better outcomes’’ (Systems Innovation , 2020). Feedback loops can be

understood as a ‘‘channel or pathway formed by an ‘effect’ returning to its ’cause’ and generating either more or less of its own effect’’ (Systems Innovation , 2020). There are two types of loops, positive and negative. Negative feedback loops can be understood as relationships of constraint and balance. A good example of a constraint and balancing relationship is supply and demand. It is a process where if one variable is positive the other is negative enabling the maintenance of equilibrium. GP time, and discretionary energy might also be seen as a constraint and balancing relationship. Positive feedback loops are self-reinforcing, so where increase in value of one variable, results in an increase value in another variable. Likewise decreasing the value of one variable will decrease the other. In an ideal world input in a QI approach would create a positive feedback loop, and this is something which will be interesting to probe. Swinburn et al. (2019) also highlight that the reinforcement of feedback loops leads to virtuous or vicious cycles, depending on the outcome, although balancing feedback loops counteract the directions. This is also very important when considering an interaction with a QI approach.

Summary

The literature review has provided the background evidence to support the development of a contextual framework from which a research tool can be developed. It confirmed that while QI approaches and methods, including TBPP, have become widespread in healthcare and have great potential – success has been in pockets. Thus, the attempts to decrease variation and improve outcomes, have in themselves been subject to variation. Many factors are seen as influencing this, and context is seen as highly important. Clinician motivation and engagement is seen as an important factor, however understanding of what constitutes engagement is not easily defined, the literature review suggests that participation as well as understanding the intrinsic versus extrinsic motivation may be important.

Complexity theory and QI Science have developed as separate fields, with complexity theory being more recently increasingly incorporated into health-related literature. Complexity theory is seen as useful in improving efficacy of QI programmes, however there was no empirical evidence of application found, potentially because there is no conceptual framework for design and implementation of the research. Two frameworks or tools were identified which may be able to be used to categorise complexity and therefore support identification of best approaches. These were Cynefin and the Interrelatedness framework. Cynefin provides a way of improving decision making based on helping leaders to identify different contexts, while the interrelatedness suggests a way to measure or identify the level of complexity. Measuring complexity and the implications of health systems as being understood as CAS are two parts of the equation.

CASs have a range of behaviours and characteristics, and as the theory is relatively young, behaviours and characteristics are referred to diversely in the literature. Six characteristics were regularly described in the literature as below;

- The autonomous nature of ***agents*** and their critical role
- The ***interconnectedness*** of agents at many levels.
- ***Self-organisation*** was also highlighted as an important characteristic.
- The evolution of CAS produces emergent properties, and this ***emergence*** is important to acknowledge as it means that while there may be some others emerge the outcomes cannot be predicted in a CAS.
- The nature of a CAS means that resilience and ability to ***co-evolve*** is critical.
- Finally, ***feedback loops*** play a critical part in this evolution and ability to adapt.

The literature review far from simplifying the picture, really made clear the large range of factors and context which can be taken into account when attempting to understand QI in a primary care setting, and also confirmed that although the evidence for use of complexity theory may not be seen as mature, it is still useful.

Chapter 3

Research Methodology and Methods

This research aimed to use a complexity lens to explore GP views of problems being targeted in TBPP and understand whether there is a relationship between complexity and the perceived effectiveness of target-based approaches. This chapter discusses the research methodology, ethical considerations and methods used to collect and analyse data.

Research methodology

There are three components of research methodology. These are the philosophy, research design and methods. Methodology provides a ‘‘series of logical steps from formulating a research problem to arriving at a conclusion” (Tan, 2018, p. 4) .

There are two main branches of philosophies in science, these are causal and interpretive. Causal science looks for the mechanism, or connection which would explain cause and effect. In a causal approach a hypothesis is part of a theory that can be tested. Often the hypothesis is tested through research designs such as experiments, regressions, comparisons and case studies (Tan, 2018). By contrast an interpretive approach seeks to ‘‘discover something new rather than an under-lying mechanism” (Tan, 2018, p. 10). Interpretive researchers see reality as being embedded in, and not being able to be extracted from the setting in which they occur. Causal or positivist paradigm assumes that reality can be understood independent to the setting and studied in a decomposable way with standardised tools (Bhattacherjee, 2012). In interpretive science there is often not a hypothesis, rather an exploratory framework is used to organise ideas and design research. In Interpretivist research while numbers are used, they are used alongside understanding and telling the story, or perceived story behind the numbers.

This research aims to understand GP perspectives using a complexity informed exploratory framework in order to understand limitations of QI. Complexity theory itself poses that systems are not decomposable and must be understood within socio-historic context. As such, a positivist or causal approach would not be wholly suitable for this research. On the other hand, this research sets out not only to explore QI in the context of a complex system, but to also test if there is a relationship between the GP perceptions of targets and complexity. There is a desire to test and understand causal relationships, and this requires quantitative methods. Interpretive research generally relies on qualitative data. However, quantitative data may provide the ability to be more precise and create a clearer understanding of the phenomenon being researched (Bhattacherjee, 2012). In this research to test the relationships, quantitative data and method is used, however the research

framework in itself may be seen as interpretivist in nature. It does assume that generalisation and abstraction can occur, and that a logical fact-based approach (with the researcher detached as an external observer) can be used, which are hallmarks of a positivist approach (Edirisingha, 2012). While positivism and interpretivism provide two extreme philosophies, pragmatism as a research philosophy asserts that there is no single reality, it is the research question itself which defines the approach. Pragmatists can use different approaches within their research. As such the research philosophy which underpins this paper is pragmatic.

Choosing the right method (strategies, processes or techniques) for research is integral to answering the research question. In general, it is acknowledged that a qualitative case study approach allows detailed understanding, but there may be limitations in terms of transferability of lessons (Greenhalgh, Russell, & Swinglehurst, 2005). A quantitative approach would allow for a greater sample size and able to be more generalised, however it may lack the detail to support understanding of context (Clark & Ivankova, 2016, p. 84). The questions for this research require a measurement framework for complexity and engagement in quality activity. It also requires a way in which to measure the relationship between complexity and engagement. This required standardised questions over a range of topics.

The research also aimed to gain the views of many clinicians across a large area. These requirements make the research suitable for a survey method which has advantages in having standardised questions reach a wide sample group and is seen as ideal for canvasing attitudes and opinions anonymously (Nardi, 2014, p. 20). This method presents limitations such as being unable to probe responses to questions and open-ended questions are more difficult to code in a survey (Nardi, 2014, p.20). These components of the research may have been better served in a case study, or mixed-research approach. However, on the balance of need both to meet the answers of the research questions at a level and time, and limitations of the qualification, survey method provides a suitable research approach. As the purpose of the research is to create a deeper understanding of how complexity impacts QI approaches. An area which the literature review established as still requiring further research, this paper can be considered more specifically as exploratory (pragmatic) research using a survey method.

Table 4 below provides an overview of how the design of the research has considered reliability and validity.

Table 4: *Research reliability and validity*

	OBJECTIVE			
DESIGN TEST	Develop a framework to explore GP perspectives of a TBPP through a complexity lens.	Examine GPs perspectives of TBPPs using a complexity framework	Determine whether there is a relationship between complexity and GPs perceptions of the effectiveness of a TBPP.	Determine whether there is evidence that variation in outcomes of a TBPP could be attributed to complex nature of problems and/or the behaviours of a CAS.
Reliability: the extent to which the study's data are consistent and can be repeated producing the same results.	-Complexity framework developed to inform the design of the survey tool. Complexity framework draws from wide range of literature. -Survey undertaken online, with no direct communication between researcher and respondent	-Complexity framework informs survey -Survey tool uses mixture of numerical scales, Likert scales and free text fields -Survey piloted and ambiguous language improved -Aimed for wide sample of GPs to represent multiple regions and demographics	- Use of Inter-item correlation used to ascertain relationships -Likert or numerical scales used to allow for comparison of paired questions -Free-text used to add insight to quantitative findings	-Statistical analysis of data undertaken -Qualitative data themed -Comparison of survey findings with literature
Construct validity: The extent to which the inquiry measures what it claims to be measuring.	-Characteristics (patterns) of CAS identified in the framework which informs survey tool. These predict possible responses. -Survey tool incorporates the characteristics identified in the framework	-Survey tool incorporates questions which provide opportunity to understand perspectives from the complexity framework	-Survey tool incorporates questions which provide opportunity to understand perspectives from a complexity framework - Analysis incorporates pattern matching. That is matching known characteristics of CAS with survey findings identified in the analysis of the survey data.	-Analysis incorporates pattern matching. That is identifying where the identified characteristics of a CAS can be seen as influencing outcomes and/or perceptions of the QI programme
Internal validity: the	Complexity framework	-Survey administered online with no contact		-Analysis incorporates

extent to which causal relationships are justified by minimising systematic error. Inferences are valid if causal relationships can be demonstrated.	developed to inform the design of the survey tool. Complexity framework draws from wide range of literature.	between the respondent and researcher -Survey piloted and adjusted to ensure the questions were easily interpreted -Definitions added where questions could be open to interpretation -Inter-item pairs used -Wide sample of GPs to represent multiple regions and demographics		pattern matching. That is identifying where the identified characteristics of a CAS can be seen as influencing outcomes and/or perceptions of the QI programme.
External validity: The extent to which the study's findings can be generalised beyond the sample to the broader views of GPs and QI in the healthcare context	Complexity framework developed to inform the design of the survey tool. Complexity framework draws from a wide range of health and complexity literature	-Distribution of survey via networks ensure GP sample represents range of demographics and regions and practice types -CAS characteristics identified are the same for all CAS not only health systems. Targets or KPIs identified as central tools in many QI approaches	-Distribution of survey via networks ensure GP sample represents range of demographics and regions and practice types -CAS characteristics identified are the same for all CAS not only health systems. Targets or KPIs identified as central tools in many QI approaches	-CAS characteristics identified are the same for all CAS not only health systems. Targets of KPIs identified as central tools in many QI approaches

Research design

The research design can be understood as ‘‘a plan for translating our research objectives into measurable and valid information” (Nardi, 2014, p. 7). Establishing through literature the aims, objectives and questions for this research were the first step in the research design. The second step was establishing that a qualitative exploratory approach, utilising a survey method be taken.

The third step was the development of the survey tool, informed by an exploratory framework, and the method of distribution and analysis to be used. These are described in the following sections of the chapter. The design of the research tool is described in chapter 4, and the application of the analysis method can be seen in Chapter 5 which are the results and analysis of the research, and interpretation against the exploratory framework. The research was completed through a single point in time survey tool.

The research stages can be summarised as below:

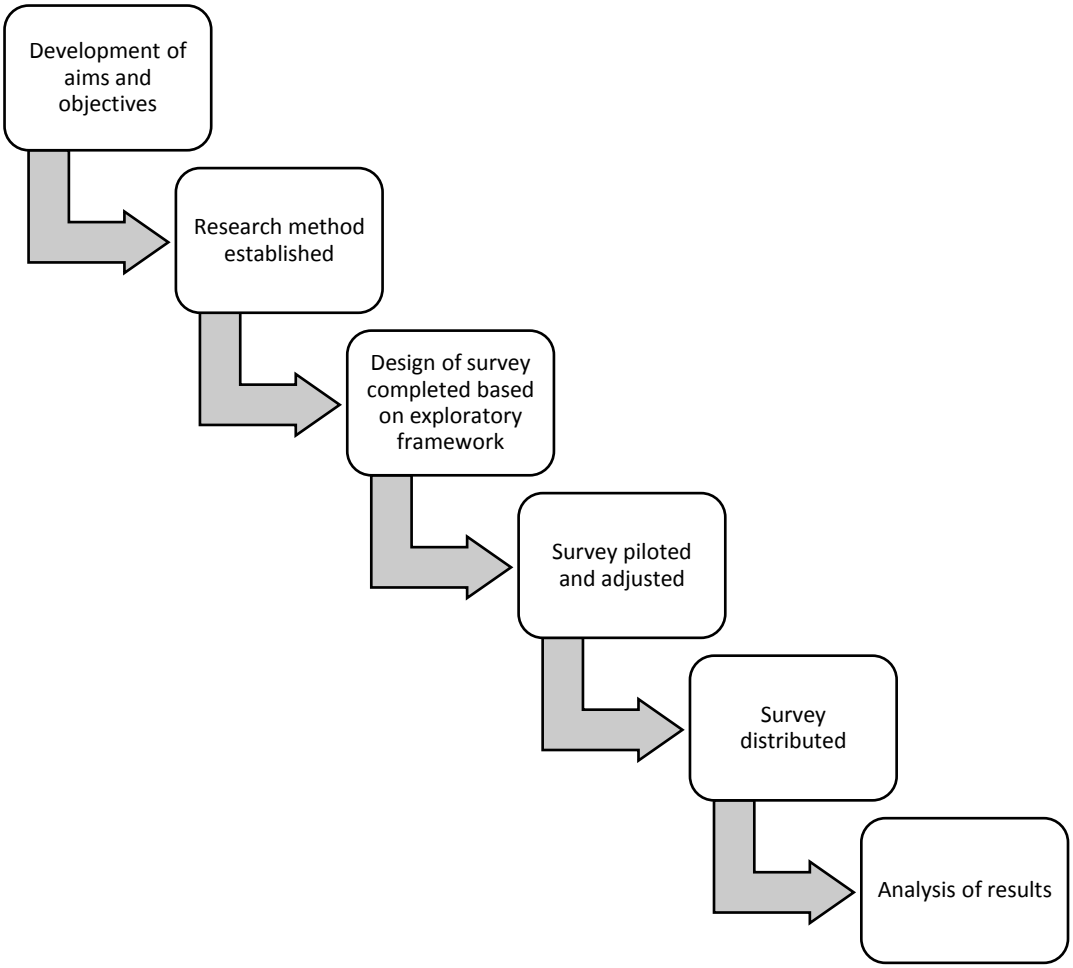


Figure 4: *Research steps*

Distribution and recruitment

An invitation to participate in the research was sent via GP networks accessible to the researcher. The email included a link to the survey, and an invitation to forward the invitation to GPs**.** Both the email and the web-based survey included information about the study, rights of participants, the ethics number and the researchers contact information's (see appendix 4 & 5). Consent to participate in the research can be considered implicit through the participants choosing to complete the survey. The survey clearly stated that inclusion criteria was that the respondent was a GP working in New Zealand. The survey tool would not allow a respondent indicating they were not a GP to progress. Due to the nature of the distribution and recruitment process a specific target population could not be defined, but analysis of the surveys provided an understanding of reach.

Participants

In total 48 responses were received to the survey. Of those six were non-GPs who were unable to proceed past the initial screening questions, only 27 surveys were completed sufficiently to allow inclusion. The GPs responding indicated association to 13 of a possible 31 PHOs in New Zealand. Detailed analysis is included in Chapter 5.

The survey

The 12 – 20-minute anonymous survey was developed in Qualtrics. Qualtrics is a survey platform, which is designed to allow the user to gather and analyse data. This includes the capability to develop web-based interactive survey tools, suitable for distribution online. This method was chosen as it enabled structured and comparable data to be gathered from GPs across New Zealand in a short period of time. The survey collected some demographics and information about the GP such as the PHO they were associated to, employment type, and age. These were included to provide an understanding of the surveys reach.

The survey was structured into five sections of variable length. Questions were grouped into clearly headed sections, with clear instruction and definitions provided. A mixture of sliding, and Likert scales were used, with further probing occurring through open text fields. The addition of qualitative data was included to allow a narrative understanding of it and create deeper understanding of context.

The survey length was clearly announced in the email accompanying the survey link, on the landing page of the survey and indication of number of questions in each section was also included at the beginning of each section. A variety of types or scales were used to increase interest. Standard headings were used throughout.

Skip logic was used to link answers given into subsequent questions. Initially it was planned that the respondent would be able to rank targets in order of perceived effectiveness. However, this approach would not have allowed answers to become text linked through to section two and three. As recommended by Creswell & Creswell (2018, p. 154), the survey was piloted.

Piloting and revision

To ensure rigor, a pilot version of the Survey was tested by four GPs, and two non-GPs. Feedback received where received in written form is attached as appendix 1. The survey was updated based on the feedback received. Changes included the addition of a progress bar, changes in the section breaks to improve consistency, review of working of questions and clear definitions placed at the beginning of each section.

To limit the risk that some words may be interpreted a number of ways, or be confusing, definitions of 'factors' and 'interrelatedness' were included in the survey. In the first iteration two sliding scales were used (numbers of factors, and extent to which the factors were interrelated). Initial responses indicated that this could be interpreted differently by different respondents. To limit this risk a question was also added which asked the respondent to select the statement which best described the situation and best approach based on the definitions outlined in appendix 3 (adapted directly from Cynefin). This provided two ways for complexity to be described by the respondent.

Analysis method

Two types of scales were used in the survey tool. Likert and sliding numerical scales. Quantitative analysis for this research was undertaken using SPSS software (IBM SPSS software, 2018) and Microsoft Excel.

The survey tool used three types of questions.

- Free text open questions for qualitative data
- A sliding scale generating interval data,
- 7-point Likert scales (ordinal data), which has been converted to numbers for analysis.

The scale used was:

Numerical Scale	Description
1	Strongly agree
2	Agree
3	Somewhat agree
4	Neither agree nor disagree
5	Somewhat agree
6	Disagree
7	Strongly agree

While there is some debate around the usefulness, or accuracy of Likert scales being treated as interval data, in this research the main purpose of analysis was in order to establish a comparison between two sub-groups, to achieve this means have been included. However, frequency distribution is also utilised. As already discussed, qualitative data has been used to further interpret and provide depth to the quantitative data. The approach taken allows for an analysis approach to occur to understand whether there is association, or a relationship

between different variables. Being able to do this is critical in terms of answering the research questions set out.

Ethical considerations

The following issues were considered, and reflected in research design, based on review of the Massey University Code of Ethical Conduct for Research, Teaching and Evaluations Involving Human Participants (2013), as well as the Research Policy of the organisation in which the author is a staff member.

Autonomy: Autonomy is the extent to which doing the research will enable others to freely decide to participate in light of their own beliefs and values. Autonomy will be ensured through an informed consent process. In general, the aim is that the research does not include any identifiable information. If during analysis it became evident that individuals, organisations or practices may be identified affected parties would have been contacted and consent sort prior to publication of the research.

Prior to a request for consent, respondents were provided with an overview of the project, and if desired the full proposal.

One consideration was that the research, due to the subject matter, may have been seen as related to the organisation that the researcher was employed by. For this reason (see also avoidance of harm) the respondents could have felt more obliged to complete the survey. To avoid this the survey cover information was very clear that the research was an independent academic pursuit.

Avoidance of Harm**:** Avoidance of harm is the consideration of the extent to which doing/ allowing the research to have the risk of, or cause harm. This needs to be broadly considered in terms of participants, organisations, communities, institutions and researchers. In regard to the consumers/patients, no identifiable patient information was used in this research. The research sought to understand clinicians' views and engagement with QI processes which are in place to improve health outcomes at a population and individual level. This relates to the specific quality indicators primary care providers are measured against. As such the research did not impact patients. For this reason, the research did not require Health and Disability Ethics Committee approval.

Some concerns were raised by the organisation for which the potential participants were members of. These are outlined below with the mitigations to limit risk. In general, an open and transparent process was undertaken.

The key concerns raised was reputational, due to the fact that the organisation has recently undergone a consultation period around its quality improvement strategy. This raised three related concerns. One risk was that the research would be seen as extension of the consultation process. Secondly that it may provide information which is not in line with the approach of the organisation, and thirdly that it may raise expectations for change which may not be able to be met.

To limit these concerns, it was made clear that the research was independent and was clearly labelled as research to fulfilling the requirements of a Master of Quality Systems. The quality plan or approach of the organisation was not specifically mentioned in the survey. The targets which will be discussed in the survey have been selected on the basis that they are consistently used across New Zealand, and therefore are publicly available information.

In general, the research is exploratory only, and while likely to provide insight did not set out to undermine current approaches but aims to augment them. The survey tool was reviewed by organisation representatives before release.

Benefit: Benefit is considered as the extent to which doing this research, will support a likely benefit. In completing this research, it was the aim of the researcher to improve understanding of the impact of current approaches in terms of clinician engagement; and to ascertain if there are improvements which could be made to ensure that the QI methods used in the primary care environment are fit for purpose. There are a number of potential benefits at different levels. This will help improve the researchers understanding of complex adaptive systems and quality functions within them which can be applied within their professional work.

The analysis generated may be useful for primary health organisations and other health organisations in developing and improving quality improvement programmes. Likewise, it may be of interest to national organisations involved in developing QI programmes in primary care settings. For GPs it may be of benefit in creating an understanding of the intended and unintended impact of current approaches, including where they work, and where they may be improved. A well-designed QI approach should aim to engage clinicians in a meaningful way.

Finally, a health system which appropriately uses QI to monitor, measure and improve the way in which the health system consistently improves outcomes and creates value will be of benefit to the end user of the system.

Justice: Justice is the extent to which the benefits and burdens are distributed. This research may be seen as being just in that for the individuals and institutions where there is a small

risk or harm identified, they equally may benefit from the outcome of the research should it be seen as informing ways in which to improve QI approaches. The possible benefits are likely to be seen as outweighing the possible risks identified.

Special relationships: The only special relationship which has the possibility of generating perception of obligation is that of the researcher as an employed staff member of an organisation which some of the GPs to be surveyed are linked to. In considering this relationship, the obligations in terms of ensuring the code of ethics are met are no more or less than would be the case if another organisation was to be the subject of the research. As outlined, caution and care were taken in terms of design and implementation of the research to ensure that it was independent, allows for autonomy of participants and is viewed as just in terms of distribution of risk and benefit.

Treaty of Waitangi Principles: There are four principles outlined within Massey University's Code of Ethical Conduct. Whakapapa, Tika, Manakitanga and Mana.

Whakapapa*:* The purpose of the research will be clearly articulated, and open channels of communication established. All participants were offered the ability to see the research report. And as outlined a process of informed consent undertaken.

Tika: As the research is intended to be exploratory, it is likely to meet its aims. The particular point of interest in regard to Maori health outcomes is that there is evidence that current approaches are not decreasing the equity gap. While the focus of this research is not specifically equity, it is about understanding why there is variation in the efficacy of current approaches, and what could be done differently. One of the variations present is the issue of inequitable health outcomes for Maori.

Manakitanga*:* This is addressed through ensuring peer review at all stages of research, including through a lens of cultural and social responsibility. It is interwoven in the responses to autonomy, avoidance of harm, benefit and justice. The research proposal was reviewed by a Cultural Advisor.

Mana: Mana relates to equity and distributed justice, and 'therefore to the treaty principles of protection. Benefit of the research and the manifestation are described in the ''Tika' and 'Justice' sections.

Summary

This research utilised a survey tool, of which the design was informed by an exploratory framework. Data has been analysed using a statistical and qualitative techniques using a research philosophy of pragmatism. The next chapter outlines in detail the development of survey tool based on an exploratory framework, with the analysis or results following in chapter 5.

Chapter 4

Design of the research tool

This section outlines the framework which was developed to enable the design of the survey tool (see appendix 4).

The framework needed to reflect both the nature of the complex adaptive system and its influence on the environment in which quality improvement activity is undertaken, as well as ensuring that there was a measure for complexity. The development of this framework was a component of the development of the survey research tool.

To answer the research questions the following measurements/factors needed to be operationalised:

1. Performance based targets to be utilised,
2. How to measure the complexity of a clinical intervention (associated with a target),
3. How to measure engagement (intrinsic motivation and active participations),
4. How to identify the occurrence of expected behaviours of agents in a CAS, and how those would manifest in relationship to a quality improvement programme.

This chapter summarises how these were operationalised in four sections. At the end of each section a summary of the survey question numbers related to the section is included; the full survey can be referenced in the appendices.

Performance-based targets

To understand the relationship between complexity, engagement and perceived effectiveness of a target approach it was necessary to be specific to the targets used as examples and referenced in the research. The targets to be used were initially selected as they were in the quality plan associated to a large PHO (who selected them on the basis of national and regional priorities). The development of the quality plan for the PHO followed a robust process, based on evidence available, and encompassing national targets and areas of specific focus.

Breast screening was an addition, based on feedback that there was widespread inclusion of breast screening in performance programmes. It is important to note that the methodology, or evidence which has been used to inform or design the individual targets is not being analysed or debated in this research, nor is the validity of the measures. They are

being used as examples of goals in a TBPP in the context of understanding GPs perspectives on clinical complexity, and the use of targets in a complex environment.

In light of this context, the key factor in considering which targets to include was the likelihood that responding GPs should have been exposed to them or could easily understand the implications of the targets included. The targets included were:

- Childhood immunisations: 95% of children who are aged two years are fully immunised.
- Diabetes: 70% percent of enrolled coded diabetic patients aged 15 years and over have Hba1c<=64mmol/mol.
- Tobacco**:** 90% of enrolled smokers aged 15-75 have been given brief advice to stop smoking.
- Cervical screening: 75% of enrolled woman aged 25 - 69 years have a current cervical screening result.
- Cardiovascular risk: 90% of eligible CVRA patients have had a CVRA in the last 5 years.
- Influenza**:** 70% of enrolled patients 65 and over are vaccinated against seasonal influenza.
- Breast screening: 70% of eligible women aged 50–69 are screened every two years.

Questions in the survey relating to this section are questions 10 - 44

Measuring the complexity of clinical interventions

The literature review identified that there were two frameworks which could be used to measure or define complexity. These were the Cynefin framework (Snowden & Boone, 2007) and the interrelatedness framework (Kannampallil et al., 2011). These were selected to operationalise measurement of complexity as they provide both a scale or way to measure complexity, and a framework to describe the best approach based on the domain (or level of complexity the problem is in.)

They can also be merged based on mutually aligning definitions. The combined version of these tools is included in appendix 2, and definitions used in the survey are included in appendix 3.

The key challenge in operationalising this measure of complexity was ensuring the wording of the questions in the survey could be understood in relation to clinical presentation to the GP respondents, and still maintaining fidelity to the original frameworks.

In designing the survey, it was also clear that it could be difficult translating the interrelatedness scale into a question which would be interpreted the same way by individual respondents or may influence the answers given.

Questions in the survey relating to this section are 13 and 29 (Cynefin Framework) as well as 14-15 and 27-28 (Interrelatedness Framework)

Matching approach to complexity

The research aimed to understand whether the complexity of problems, and the nature of the CASs can explain limitations of TBPP, including whether there are relationships between how effective TBPP approaches are seen to be, engagement and complexity. The inclusion of a question allowing the respondent to select the best definition of the problem and associated approach was a way to capture clinician view on complexity of the problem.

To understand whether clinician view of the effectiveness, and engagement with a specific target had a relationship to the complexity of questions were needed to allow the respondent to identify the target they viewed as most effective, and the target they viewed as least effective. The survey needed to include the same selection of questions for the target selected as most effective and the target selected as least effective. thereby enabling comparison between the two groups.

The survey questions related to this section are 9 & 10 (selection of most and least effective targets)

Measuring engagement

As identified in the literature review, clinician engagement is difficult to measure and define. For the purpose of this research engagement is seen as intrinsic motivation and active participation.

Some of these elements were explored in the MUSIQ tool, and thus questions were adapted for this paper. Other questions were specifically written for the research. The survey needed to include questions relating to:

- Who was championing QI in the practice (active participation)
- Alignment with personal values regarding what improves outcomes for patients (intrinsic motivation)
- To what extent activity is only occurring because of the target-based programme (extrinsic motivation)

- Belief that the input matches outcomes (perception on match to environment)
- Measures are seen as enabling rather than constraining

Survey questions related to this section are;

- Number 5 (active participation)
- Numbers 16-20 and 32 - 36 (extrinsic versus intrinsic motivation)
- Numbers 8, 15 and 31 (match to environment)

Expected behaviours of agents in a CAS

In order to develop questions which would provide an understanding of how the inherent behaviours of a CAS would impactin a QI programme, it was first important to understand how they would manifest as summarised in Table 5. These behaviours are summarised from the literature review.

Table 5: *Core CAS characteristics expected behaviour.*

CORE CAS CHARACTERISTIC	BEHAVIOUR	REFERENCES
AUTONOMY OF AGENTS	Agents in the health system are autonomous and not centrally controlled as they: • Exchange information between each other • Interact over space and time with each other and their environment • Learn and adapt • Have personal internalised schema (world view); and these rules are not necessarily shared or fixed • All agents have a role; some have more influence When applied to this research these factors are important individual agents and will have a different view of a QI programme and a different influence. Any activity in QI needs to take account of the different viewpoints, and the constantly evolving nature of agents. It also means that research can only ever represent a point in time, and the lever points of which can be used to influence a system are as dynamic as the	Wallis, 2008; Holland, 2014; Braithwaite et al. 2017; Hollegnal et.al. 2013;

	individual agents within them.	
INTERCONNECTEDNESS	The health system is interconnected • Organisations and functions within the health system are interconnected within an ecosystem • Functions such as funding reporting and audit create feedback loops and signals that create shared understanding • Agents within the CAS can be understood as nodes on a network • Nodes are interconnected and those connections determine the tightness of the community • Interconnections are dynamic, they can change over time • Because of this input are not always proportional to outputs What these behaviours mean when applied to a QI improvement project is that understanding the strength and influence of relationships is critical.	Wallis, 2008; Kannampallil et al, 2011; Braithwaite et al. 2017; Braithwaite, 2013; Johnson & Rossow, 2019.
SELF-ORGANISATION	Agents in CASs are not centrally controlled, rather they self-organise into relatively stable patterns from the bottom up. In health system this can mean organisation by professional group, place of work or specialist area. Self-organisation means that in a health system attempts to control from top-down can be counterproductive. It does not mean that it is not useful to have top down functions such as strategy and finance, but caution does need to be taken. How this impacts a QI project is that means it is critical that clinicians, and key stakeholder groups are engaged	Johnson & Rossow, 2019; Braithwaite et al., 2018

	and have leadership opportunity.	
EMERGENCE	In a CAS it is not possible to understand behaviour by summing the individual parts. The whole is more than the sum of its parts. • Elements interact and evolve over time • Behaviour of a CAS cannot be predicted by looking at individual parts of a system • Patterns may emerge at a population level This element when applied in this research requires a probing for unexpected change.	Wallis, 2008; Kannampallil et al., 2011; Braithwaite et al. 2017; Holland, 2014
CO-EVOLUTION	A CAS will change and evolve over time, and will influence and change the environment around it • Failure to adapt leads organisations to being non-viable This element is critical for a number of reasons considered in this research, and there are multiple levels of viability to consider in the system, and there are multiple agents and organisations in the system who need to evolve together	Wallis, 2008; Braithwaite et al. 2017;
FEEDBACK LOOPS	Feedback loops play an important role in the evolution and behaviour of a CAS. There are two types of feedback loops - positive and negative. ▪ Feedback loops can be understood as the pathway returning between the cause and its effect and causing more or less of the effect (amplification or attenuation) ▪ Negative feedback loops are relationships of constraint and balance ▪ Positive feedback loops are self-reinforcing Feedback loops are an element that could be seen as modifiable. A Target based quality improvement programme in itself creates feedback loops, and understanding whether they are positive or negative is key, as these are levers for change.	Wallis, 2008; Braithwaite et al. 2017; Holland, 2014; Swinburn et al. 2019

Many of these concepts are woven through the questions, and the analysis of responses. Specific questions in the survey relating to this section are;

- Numbers 9-8 (interconnectedness, specifically exploring strength or relationships)
- Numbers 24-26 and 40-42 (emergence and coevolution)
  Number 43 (feedback loops)

Summary

This chapter outlined the development of an exploratory framework which was used to ensure that key concepts could be operationalised and that the design of the survey tool would meet the needs of the research. This included performance targets, measuring complexity, measuring engagement and identifying CAS behaviours. The next chapter summarises the results of the survey.

Chapter 5

Results

This chapter provides an analysis of the results associated with the part one of the research questions. A mix of qualitative and quantitative data is used.

Summary of respondents

In total 48 responses were received to the survey. Of those six were non-GPs who were unable to proceed past the initial screening questions.

Of the 42 GPs who begin the survey only 25 completed the survey fully. The main point at which survey participants dropped out was the first section [n=8], and at section three [n-8].

Responses 24% (which mean a minimum of section two completed) and above have been included in the data analysis,

The GPs who completed >24% [n=27) of the survey were associated to thirteen different primary health organisations.

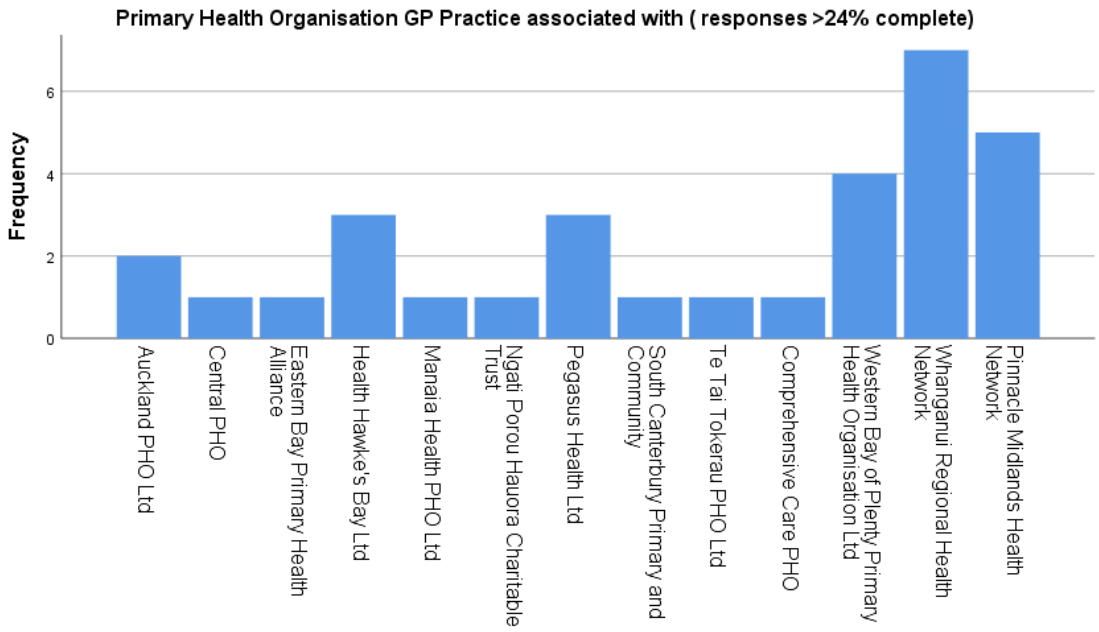


***Figure 5**: Geographic location of responding GPs (by PHO)*

The median age of GPs responding was 50 – 54. This is in line with Royal NZ College of GPs (RNZCGP) data (below right). The survey participants were however on average

younger than the wider GP population with no peak being seen at 55 – 60 which could have been expected (Royal New Zealand College of General Practitioners, 2019).

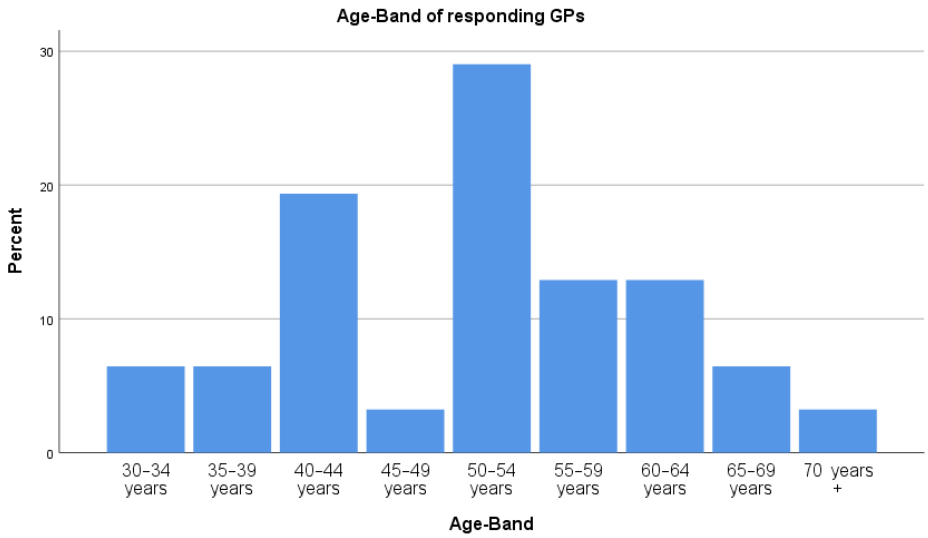


Figure 6: Age band of GPs responding to survey

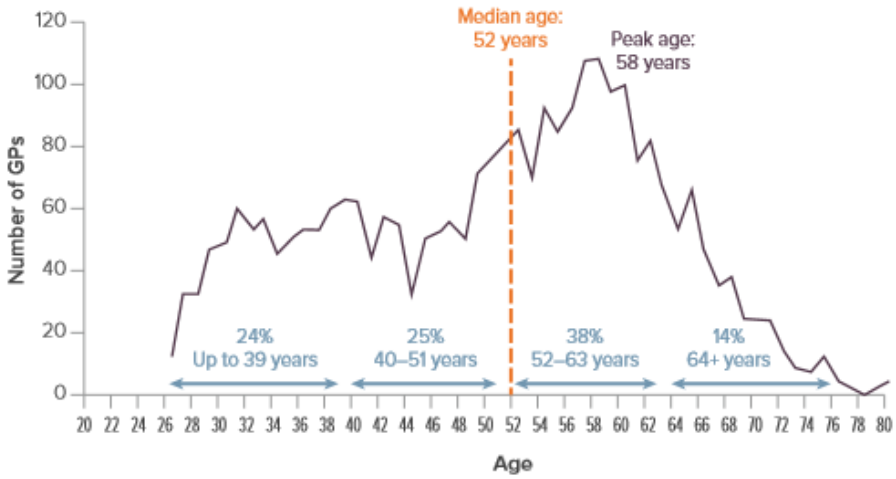


Figure 7: Age of GPs. Source: RNZCGP, Workforce Survey, 2018.

45% of the GPs responding indicated that they were a practice owner, 45% were long-term employees and 10% were short-term employees.

RNZCGP statistics suggest that 36% of GPs are owners, 48% long term employees and 13% short-term employees (2018, p.20). While owner GPs are slightly overrepresented in the survey sample, both age and ownership type of the respondents is relatively comparable to the distribution which would be expected at the population level.

Part 1: Understanding if complexity and the nature of CAS as a worldview can explain the limitations of a TBPP.

The first part of the first research question asks is there a relationship between;

- how complex [a] problem is perceived to be by GPs and whether targets are seen as an effective measure of clinical input (how well-matched targets are to the complexity of the problem)?

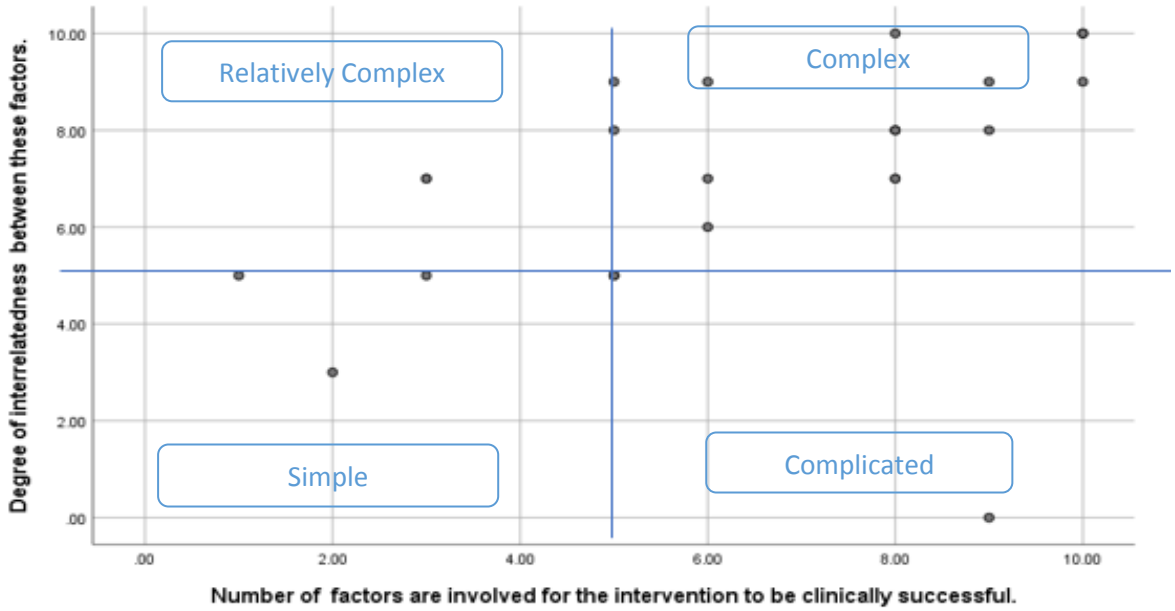
To measure perception of complexity this research used both the interrelatedness framework and Cynefin and assumed mutual alignment.

Interrelatedness scale

The interrelatedness framework was operationalised as two questions. These were sliding scales for number of factors and degree of interrelatedness of these factors. These questions were repeated twice. Firstly, for the target selected as most effective, and secondly, for the target selected as least effective. The responses given are shown in figure 8 and 9.

Number of factors and their interrelatedness

Most effective quality target



Least effective quality target

***Figure 8**: Scatterplot - most effective quality target*

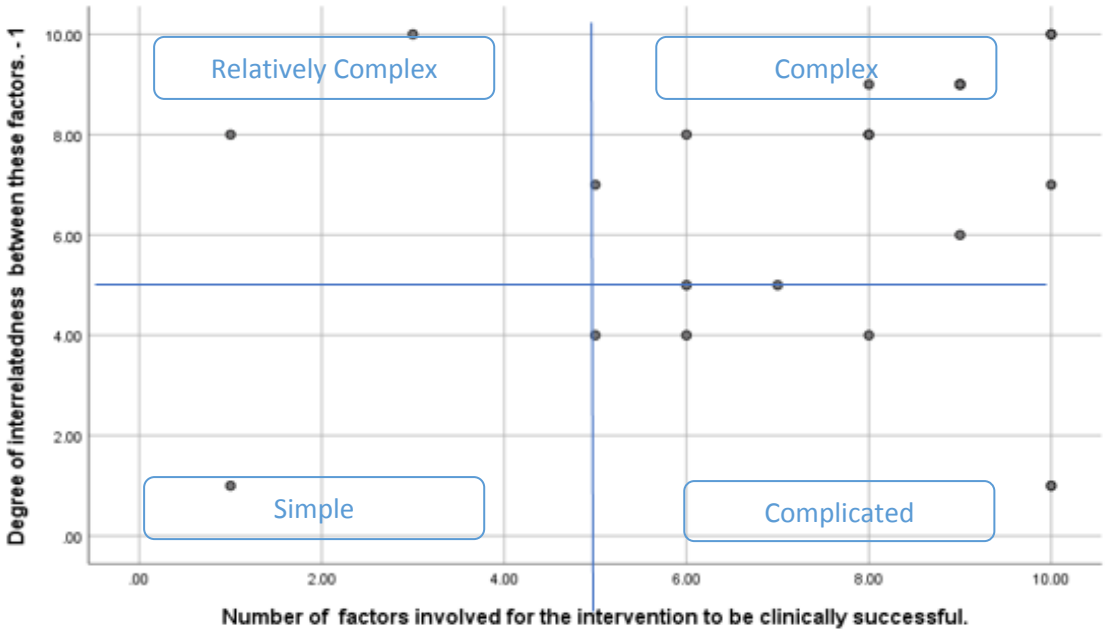


Figure 9: *Scatterplot - least effective quality target*

For the target selected as 'most effective' the mean response for number of factors was 6.5 whereas for the 'least effective' the mean response for factors was 7.4. Indicating that there were a higher number of factors for 'least effective'. The mean interrelatedness score of factors for the 'most effective' target was 7.1, while for the 'least effective' it was 6.8. The difference in the mean scores is only marginal. As is shown on the scatterplots, overall we can see that for both 'most effective' and 'least effective' targets GPs perceived that there were a high number of factors influencing outcome, and that these were seen as moderately to highly interrelated, therefore complex.

Cynefin framework

The respondents were also asked to select the statement which best described the nature of the problem being targeted by the goal. For most effective goal 50% of respondents believed the goal they selected was an 'simple problem.' For the least effective goal 55% or respondents believed the goal they selected was a 'complex problem'. Overall perception of complexity is shown in figure 10.

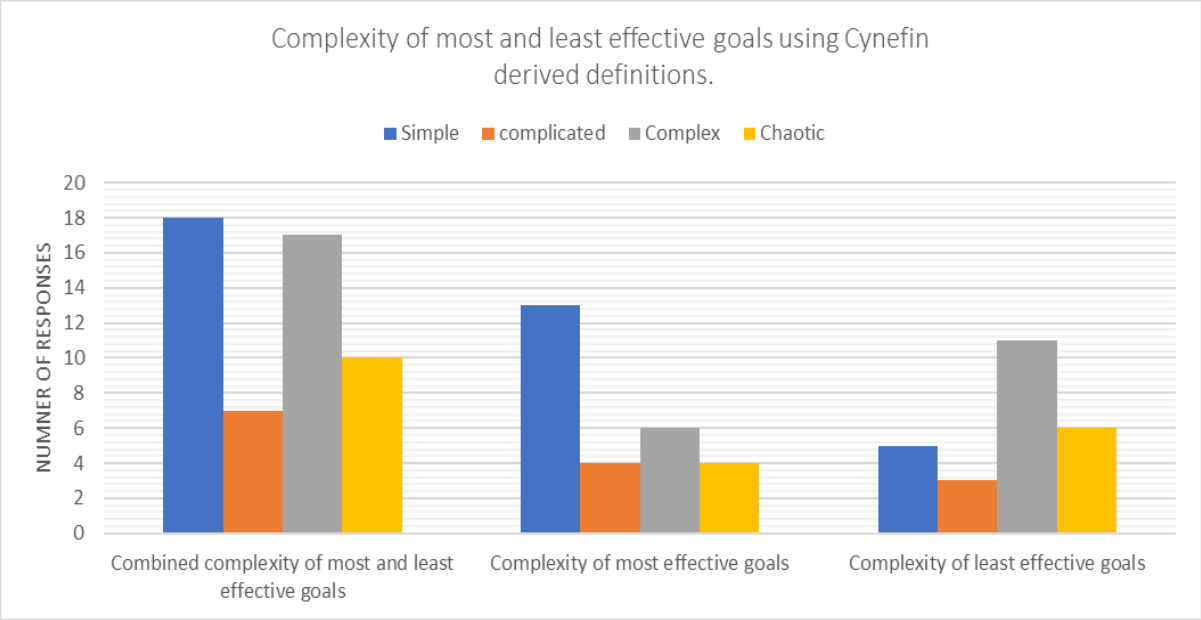


***Figure 10**: Complexity of most and least effective goals [using Cynefin]*

Using the Cynefin framework based definitions 52% of respondents believed the problem they selected as either the least or most effective was complex or chaotic. 68% of respondents believed the target they selected as the least effective was complex or chaotic. Only 32% of respondents believe the target they selected as most effective was complex or chaotic.

It is important to note that although the interrelatedness and Cynefin frameworks can be seen as having mutually agreeing domain definitions, when operationalised in this research they did not match. There were a higher number of responses in the complex and highly complex domains of the Interrelatedness framework (which used a numerical scale) than was corroborated by the multi-choice description based Cynefin questions.

GP views on TBPP as a quality improvement approach

To establish a baseline of views on targets-based programmes respondents were asked to indicate the extent to which they believed that target or goal-based activity is an effective way to improve population outcomes. As can be seen in figure 11, five out of ten was the mean score. Indicating there was very much a mixed view of TBPP as overall QI approach.

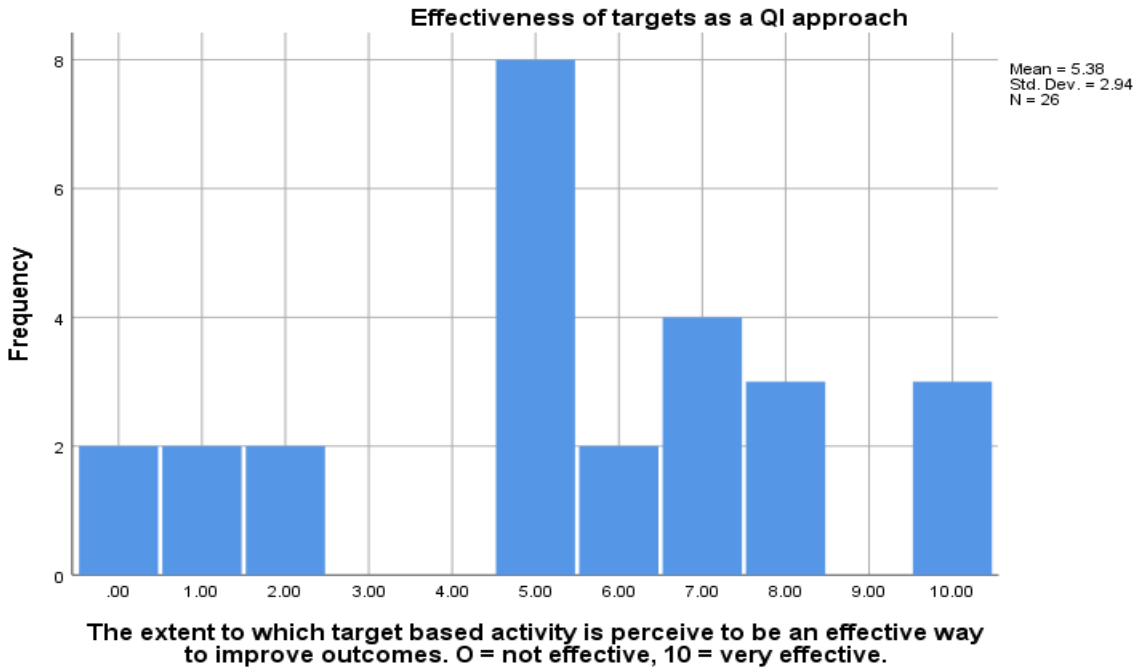


Figure 11: *GP views on the effectiveness of targets as a QI approach*

It is clear on this histogram that there are outliers in terms of those who are strong believers in quality targets, and those who do not believe they are effective all. In the survey, GP respondents were asked to select a most effective and least effective target. Reflecting on these targets they were asked to indicate on a 7-point Likert scale the extent with which they agreed to the statement 'the use of this target to drive improvement activity for this problem is a good approach.' The mean score overall was 3.4. The data was also analysed in two sub-sets of the data. For this analysis the Cynefin Framework related questions are being used as the proxy for complexity and are broken down into the two sub-sets below.

- Responses related to targets selected as **non-complex** (either simple or complicated),
- Responses related to targets selected as **complex** (either complex or chaotic).

There was two responses which indicated targets were non-complex, and 25 that indicated they were complex. From this section onward, where targets are described as complex or non-complex it is using these sub-sets of data.

Figures 12 and 13 show the non-complex, and complex responses separated into two categories. Respondents were asked the extent to which they agreed with the statement; ' the use of this target to drive improvement activity for this problem is a good approach'. The mean score for targets selected as non-complex was 3.0, compared to 3.8 for complex. The

standard deviation was 1.8 and 1.9 respectively. The P value for these two groups is 0.1566, which is not considered statistically significant. This supports the interpretation that regardless of complexity there is not strong agreement that using targets is a good approach.

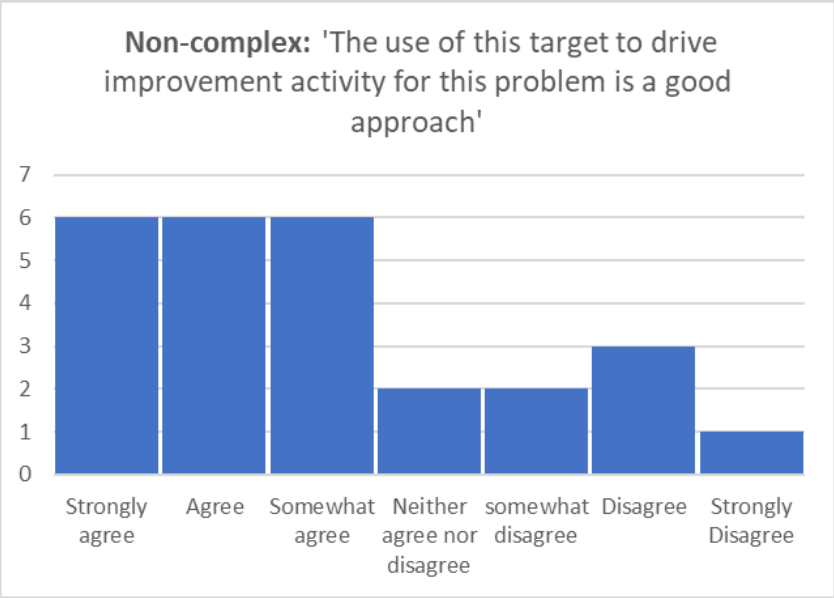


Figure 12: *GP perceptions of targets as an approach - non-complex*

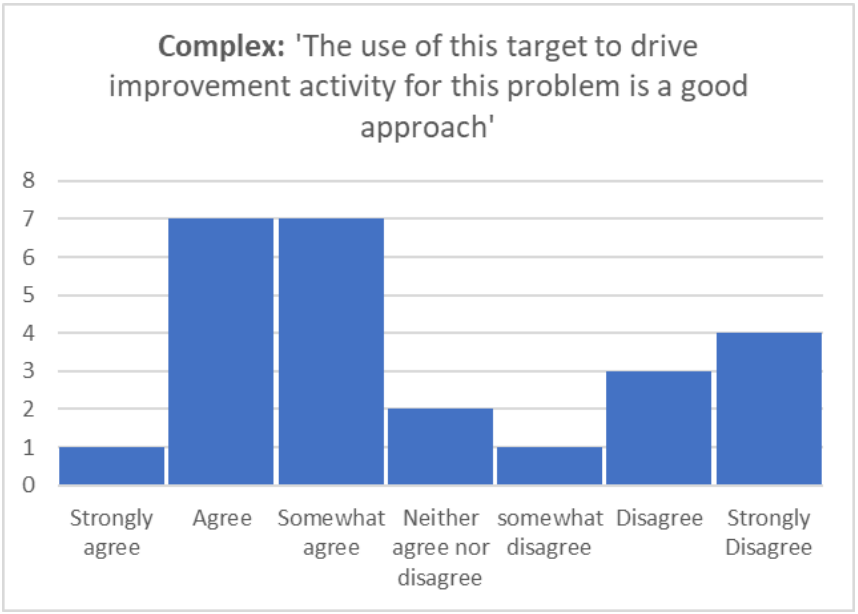


Figure 13*: GP perceptions of targets as an approach - complex*

Respondents were also asked the extent to which they agreed with the statement shown in the table 4 in relation to the targets they had selected. These were also a 7-point Likert scale.

	Non-complex targets		Complex targets			
Statement	Mean score	Standard Deviation	Mean score	Standard deviation	Difference in mean scores	Unpaired T Test (two-tailed P value)
Activity undertaken toward this target has or will improve outcomes for our patients.	1.8	1.3	3	1.8	1..2	0.0124
This target has been effective at improving equity.	2.9	1.5	3.8	1.9	0.9	0.0658
I consider that the cost of the resources used to meet the target is justified due to the improved health outcomes the activity towards this target achieves.	2.4	1.8	4.2	1.9	1.8	0.0002

***Table 6**: Outcome questions -non-complex and complex targets*

These responses show that while overall there was moderate agreement that activity undertaken for the targets would improve outcomes by patients, agreement was stronger, and the difference statistically significant between the complex and non-complex target mean. The difference between the mean score of the non-complex and complex targets effectiveness at achieving equity was not quite statistically significant by conventional standards. The most significant difference was in relation to resource costs. The histograms labelled as figures 14 and 15 show that 77% of the responses in relation to targets selected as non-complex were agreeable to some extent (strongly agreed, agreed, somewhat agreed) with the statement. This compared with only 40% responses in relation to complex targets. The P value shows that the difference between the mean scores for non-complex and complex targets can be considered as very statistically significant.

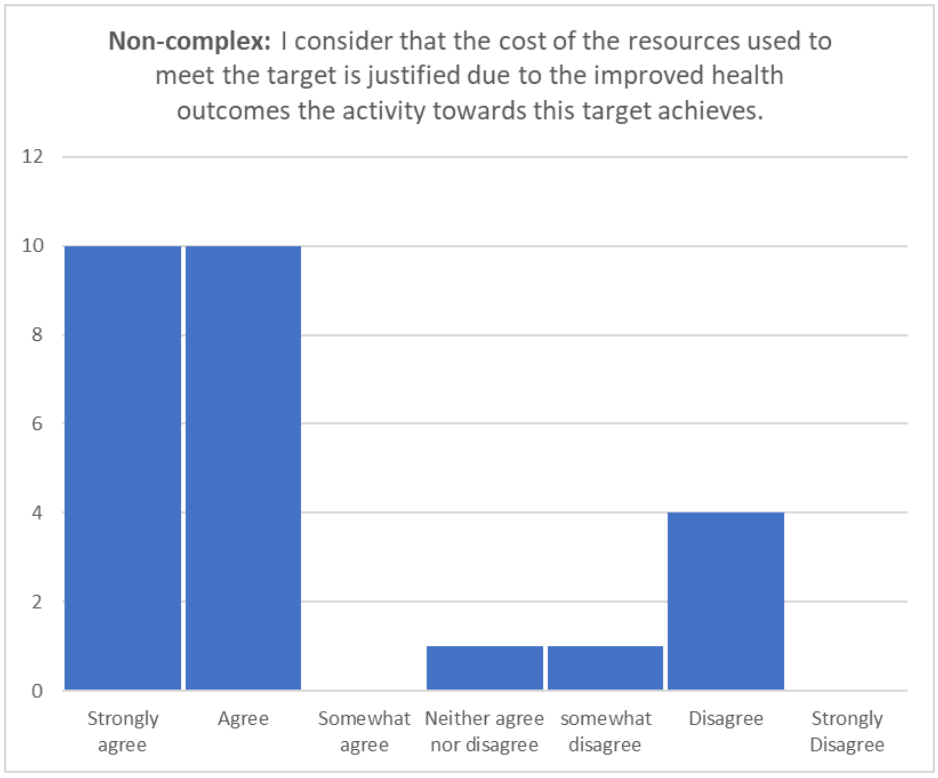


Figure 14: *Resource input versus output -non-complex*

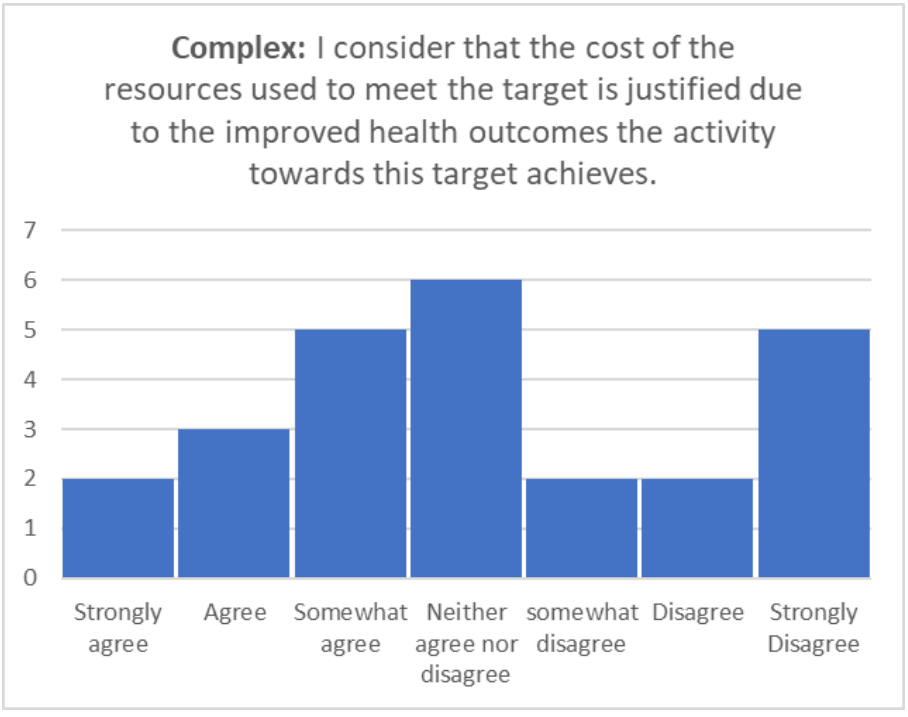


Figure 15: *Resource input versus output -complex*

In addition to the quantitative data, some specific comments were made by respondents in relation to their views of targets these include.

- *"Financial incentives to improve quality have shown no effect on primary care."*
- *"Measuring targets is a waste of precious time, better spent clinically managing patients as a professional"*
- *"We have so much work, the targets are impossible."*
- *"Incentives or payments are a professionally embarrassing and inefficient means of achieving funding to provide quality patient care. They are associated with achievement primarily by necessity."*
- *"Targets are important to allow feedback monitoring and constant reassessment of goals and strategies."*

Perceptions of complexity and relationship to effectiveness

As already discussed, GPs were asked to select their goals they perceived as most effective and the goal they perceived as least effective.

As is shown below. For the most effective goal 76% [n=22] GPs chose childhood immunisations.

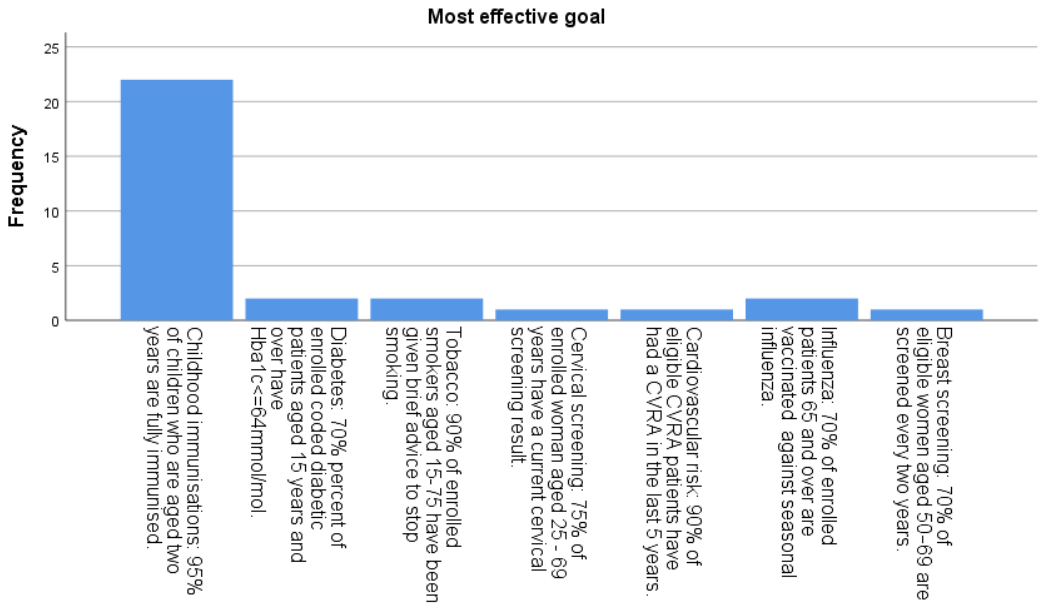


Figure 16: *Most effective goal*

Least effective was a far more split response as shown below, with cardiovascular risk, and tobacco brief advice being selected the most often.

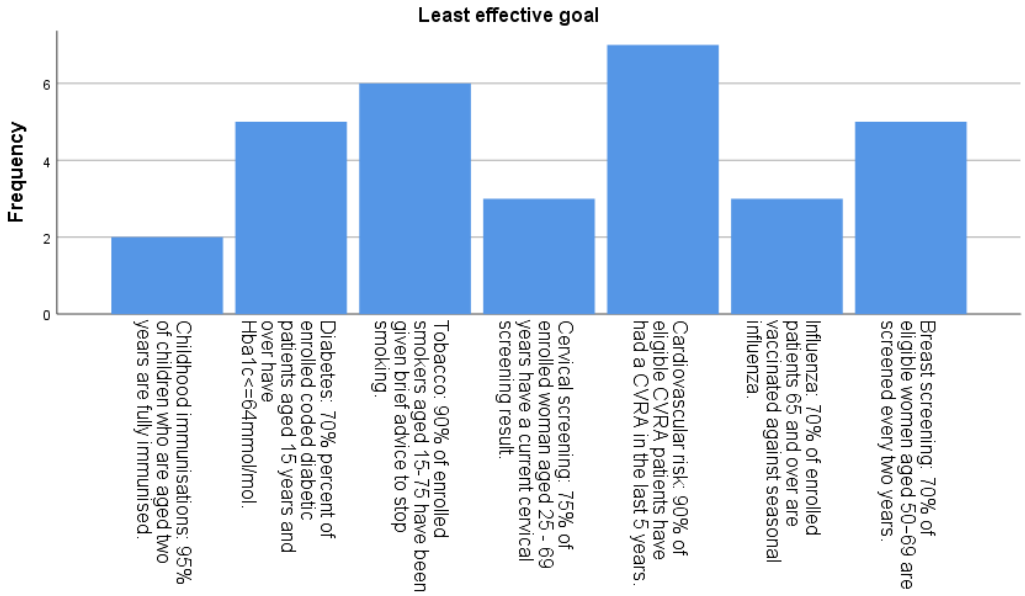


Figure 17: *Least effective goal*

As already discussed, respondents were asked to select the statement which best matched the nature of the problem for the target they had chosen. These responses are shown in figure 18 and 19.

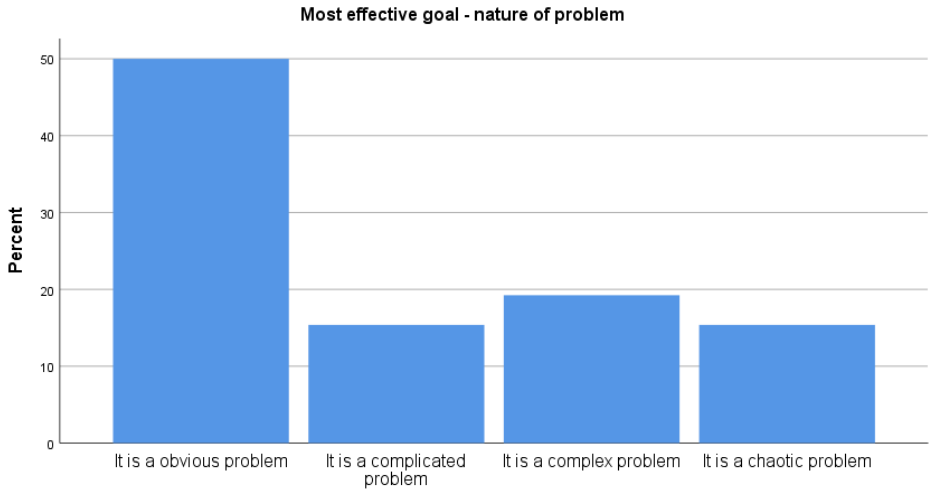


Figure 18: *Most effective goal - nature of problem*

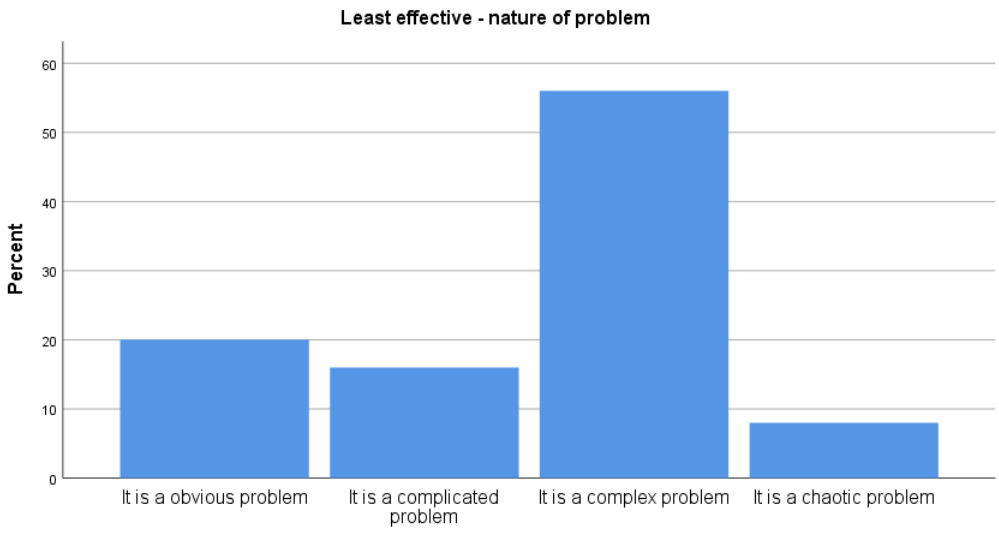


***Figure 19**: Least effective goal - nature of problem*

Despite the targets selected as least effective being quite mixed, almost a two-thirds of respondents viewed the nature of the problem as complex or chaotic. To understand whether there were any patterns by target, table 5 breaks down individual targets by whether they were selected as most or least effective, and how complex the nature of the problem was perceived to be.

	Childhood imms		Diabetes		Tobacco		Cervical		CVD		Influenza		Breast screen	
	Most	Least	Most	Least	Most	Least	Most	Least	Most	Least	Most	Least	Most	Least
Simple	9					1	1	1			2	2	1	1
Complicated	2				1				1	2				1
Complex	3	1	1	1	1	3		1		2				3
Chaotic	3		1	4		1		1						
	17	1	2	5	2	5	1	3	1	4	2	2	1	5

***Table 7**: Patterns by target - Cynefin*

In this chart, blue (simple and complicated) are non-complex, and yellow (complex and chaotic) are complex.

- Childhood immunisations was selected the most times. 17 of the 18 (95%) respondents who selected childhood immunisations chose it as the **most effective target**, and 11(60%) of respondents indicated it was **non-complex**

- Diabetes annual review was selected seven times. Five of the seven (71%) respondents indicated it was the **least effective** target, and 100% of respondents indicated the problem was **complex.**

- Tobacco brief advice was selected seven times. Five of the seven (71%) indicated it was the **least effective** target**.** Five of the seven (71%) also indicated the problem was **complex.**

- Cervical screening was selected four times. Three of the four (75%) indicated it was the **least effective** target. Complexity level was evenly split between in between **non-complex** and **complex**

- CVRA was selected five times. Four out of five (80%) of the respondents indicated it was the **least effective** target. Three of the respondents saw it as complicated, and two as a complex problem. Making it **non-complex**

- Influenza vaccination was selected four times. Half of the respondents indicated it was the least effective and half as the most effective target. All agreed it was **a non-complex** problem

- Breast screen was had six responses. Five of the six (indicated it was the **''least effective.** Complexity level was evenly split between in between **non-complex** and **complex**

The interrelatedness scale also reveals a similar pattern regarding perceived
Complexity. As shown in table 8, diabetes and tobacco were seen as having the highest number of factors, followed by cervical screening. Influenza, childhood immunisation, breast screening and cardiovascular risk scored notably lower.

***Table 8**: Patterns by target -Interrelatedness scale*

	Number of factors (low - high/ average)	Interrelatedness (low - high/ average)	Average score (number of factors and interrelatedness)
Breast screening: 70% of eligible women aged 50–69 are screened every two years.	5	5.6	5.3
Cardiovascular risk: 90% of eligible CVRA patients have had a CVRA in the last 5 years.	4.9	4	4.45
Cervical screening: 75% of enrolled woman aged 25 - 69 years have a current cervical screening result.	6	8.75	7.4
Childhood immunisations: 95% of children who are aged two years are fully immunised.	5.2	5.6	5.4
Diabetes: 70% percent of enrolled coded diabetic patients aged 15 years and over have Hba1c<=64mmol/mol.	7.8	6.4	7.1
Influenza: 70% of enrolled patients 65 and over are vaccinated against seasonal influenza.	4.8	5.4	5.1
Tobacco: 90% of enrolled smokers aged 15-75 have been given brief advice to stop smoking.	7.25	6.25	6.7

Narrative comments suggest that there are other factors which may have influenced views on effectiveness of targets, including availability of tools, evidence base for the targets, and the broadness of the target group.

> *"Lack of a suitable CVD risk calculation tool makes using this target difficult, and uncertainty about the predictive value of the calculated risk means I do not have confidence to use it to guide patient management"*

> *"Breast screening is a complex screening tool and has uncertainty and requires careful clinical consideration, patient understanding, clinical competency, society education etcetera"*

In summary, this analysis has shown that there is a relationship between how complex a problem is perceived to be by GPs, and whether they are seen as an effective measure of clinical input. TBPP are more likely to be seen as an effective or appropriate measure for non-complex (simple or complicated) problems than complex when used in isolation(complex or chaotic targets) .

Complexity and engagement

The second part of the first research question asks is there a relationship between

- how complex the problem is perceived to be and engagement in achieving the target?

To answer this, five specific questions were included in the survey. These were repeated for the target selected as the most effective, and the target selected as the least effective. As described in the previous section, responses were then grouped by complex and non-complex. Two types of survey questions were used, a sliding scale and a 7-point Likert scale. Table 9 shows the mean score for each question by group, the difference in score between complex and non-complex, the standard deviation as well as the P value.

Table 9: *Engagement questions - non-complex and complex targets*

	Non-complex targets		Complex targets			
Statement	Mean score	Standard deviation	Mean score	Standard deviation	Difference in mean scores	Unpaired T Test (two-tailed P value)
Please use the slider below to indicate how enabling or constraining you find the target *	4.1	2.9	6.5	2.8	2.4	0.0036
The target aligns with my personal beliefs about the best approaches to improve outcomes for my patients.	2.3	1.3	3.4	1.8	1.1	0.0167
Pressures or incentives from within my workplace are the main motivation to undertake activity in relation to this target.	4.1	1.9	3.9	2	-0.2	0.7250
Pressures or incentives from outside of my workplace are the main motivation to undertake activity in relation to this target.	3.8	1.8	3.5	2.1	-0.3	0.6088
I would undertake activity associated with meeting this target to the same degree, even if it were not being formally monitored outside of my workplace.	2.5	2.2	2.4	1.6	-0.1	0.8621

**please note this question used a sliding scale. 0 being enabling and 10 being constraining. All other questions in this table used a 7-point likert scale.*

This analysis provides a number of insights; firstly, there are only two questions where there is a there is a statistically significant difference in responses between non-complex and complex target groups. These related to how constraining targets were, and inherent personal beliefs. Targets for complex issues were on average seen as more constraining. That means that they were seen as decreasing clinical autonomy in deciding the best approach for the situation. Complex targets were also less likely to be seen as aligning with personal beliefs about best approaches that improve outcomes. However, the response was for the majority still positive, with 65% of responses indicating agreement to some extent (i.e. selected strongly agree, agree, somewhat agree). This was 60% where targets were complex and 70% where targets were non-complex.

The mean score for pressures or incentives from within the workplace, or external to the workplace being the main motivation to undertake the work were relatively similar between complex and non-complex groups. And the difference was not statistically significant. A

closer analysis of scores indicates that of the 41 responses to these questions 22 (43%) agreed to some extent that pressures within the organisation were the main reason for undertaking the work associated to the target. This can be compared 32 (63%) of the responses which indicated that they agreed to some extent that pressures external to the organisation is the main reason for undertaking the work associated to the target. Despite the pressure being more likely to be external in 80% of the responses there was agreement of some extent that the GP would continue to undertake activity associated to the target, to the same degree, even if were not being monitored. This positive response rate was 84% where the target was complex.

Characteristics of CAS

The second question related to part 1 of research question is:

- To what extent can the characteristics of a CAS be seen to influence the effectiveness of a TBPP?

Agents or agency

Agents or agency relates to the concept that agents (people) in the health system are autonomous and not centrally controlled, and they exchange information between each other, interact over time with each other and their environment, and have their own world view (which is not necessarily shared or fixed). Some agents within a system have more influence than others.

Agency is clearly seen in figure 11, where we can see that not all GPs share the same schema and worldview in terms of their belief of the effectiveness of targets. As is discussed in the first section of this chapter, five out of ten was the mean score, indicating there was very much a mixed view of targets as a QI approach. To analyse further the beliefs of the GPs, particularly those with strong views either that a goal-based approach is very effective, or not very effective outliers were identified, and their responses further analysed

Outliers were taken as:

- Those indicating 0 – 3 as the effectiveness of quality goals (n=10)
- Those indicating 7 – 10 as the effectiveness of quality goals n= 10

CAS behaviour would predict that some agents would have stronger influence. To help analyse whether this behaviour could be seen, figure 20 shows the mean response of the

two groups of outliers in the questions about influence of peers, PHO staff and the perceived relationship between the PHO and improvement goals.

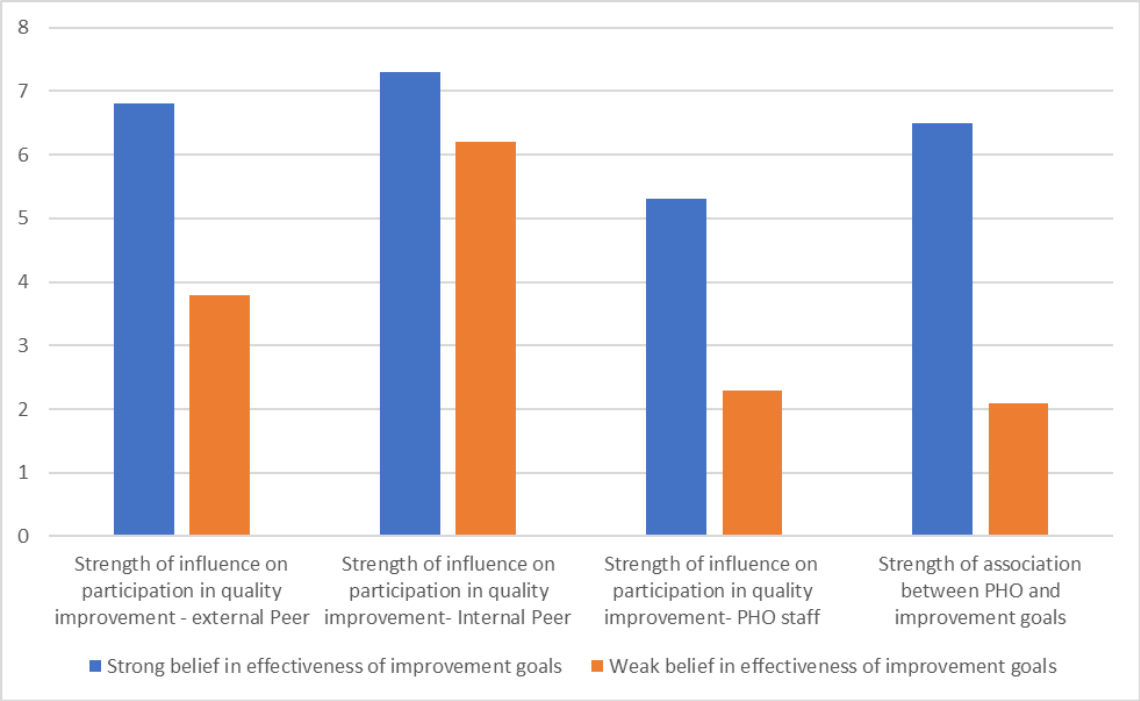


Figure 20: Influence by strength of belief

The starkest difference between the outliers was the strength of association given between PHOs and improvement goals. This suggested a correlation between perceived relationship between a PHO and improvement goals and belief in effectiveness. This correlation can be seen on the plot graph (figure 21). This showed that GPs who have a stronger belief in target-based goals are more likely to be influenced by external peers, as well as PHO staff. In addition to the plot graph, a two tailed Pearson's correlation was also completed, which confirmed a correlation of 0.683. As the Pearson's correlation statistic is closer to 1 than 0 there can be considered a positive relationship between how strongly quality improvement targets are associated with the PHO and the extent to which they are seen as effective.

These two findings, acknowledging a small sample, suggest strength of relationship with a PHO has an impact on perceptions of TBPP as a QI approach. While there was not significant enough data to understand this in more depth it does highlight that all agents have different schemas and understandings, and that strength of relationships are important in ability to influence.

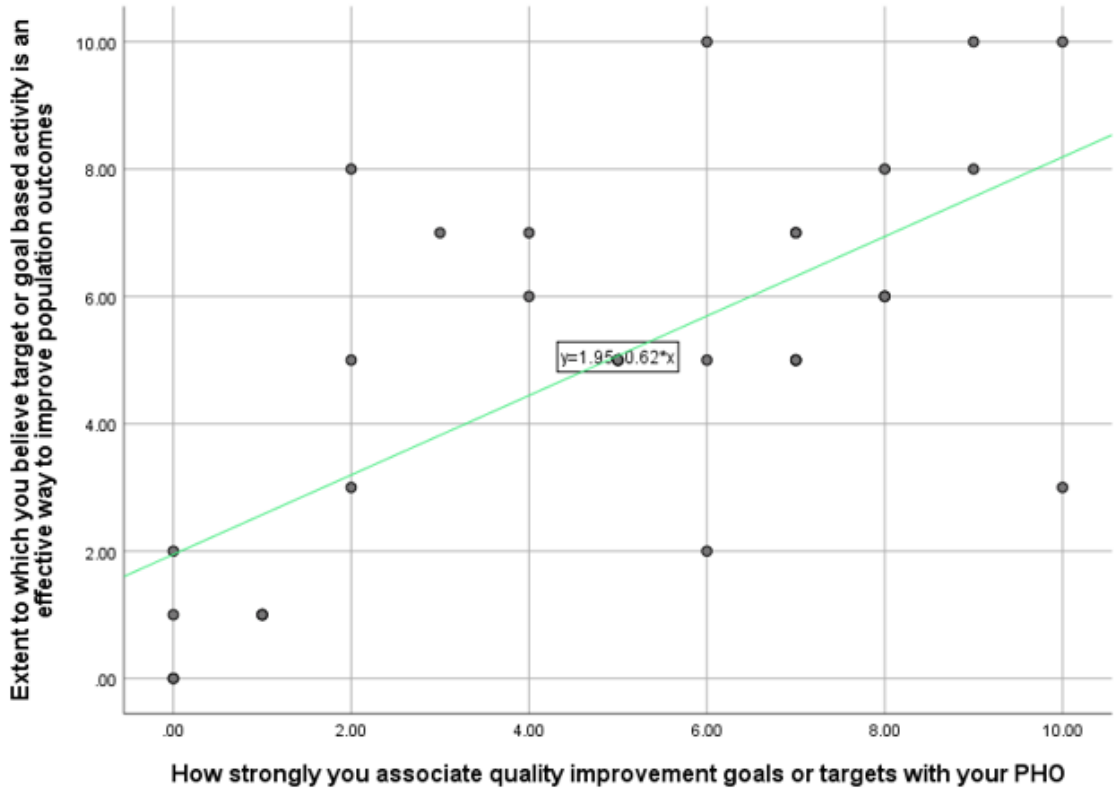


Figure 21: *Belief in targets versus relationship with PHO*

Interconnectedness and self-organisation.

The findings highlighted in the previous section also highlight the CAS feature of interconnectedness and self-organisation. Interconnectedness meaning that all functions of the health system are interconnected within a broader health system in this context of a QI programme and connects a PHO and practices to a shared understanding and creates dynamic feedback within the system. Agents in a CAS are interconnected in networks. The closeness of networks (communities) can influence behaviour. Because there is a constant dynamic input and output is not always proportional, this will be discussed further in relationship to feedback loops. Self-organisation means that agents self-organise from bottom-up without top-down control. While top-down leadership (co-ordination) is important, too much control can be counterproductive. Relationships form the critical components of both interconnectedness and self-organisation

The feature of interconnectedness and self-organisation can be seen in figures 20 and 21, and this has shown that there is a relationship between whom influences GP and their beliefs about the effectiveness of quality improvement targets. It is also possible to see that the top-down co-ordination that TBPP represents, can be seen as constraining or not a value

match to the individual GP. This is more prevalent where the approach is not matched to the complexity. This is a critical learning from this research, as it is amenable.

Emergence and Co-evolution

A feature of a CAS is that it is not possible to understand behaviour by summing up the individual parts. This is why it is also difficult to clearly define the different expected behaviours and features. The whole of a CAS is always more than the sum of its parts. Emergence means that because there is a dynamic interaction between parts over time how a CAS evolves cannot always be predicted. Co-evolution means that a CAS evolves as it interacts and responds to its environment. A failure to adapt leads to non-viability. In relationship to a TBPP, or any QI approach this means that just the QI approach will create evolution and emergence, and also that the QI approach will need to in time adjust in response to its environment.

In this research GPs were asked if their approaches had changed and also if there had been any unexpected consequences in relation to the TBPP. Overall 50% of responses in relation to non-complex targets, and 60% of response in relation to complex targets indicated that approaches had changed within their practice in order to achieve targets. Some of the key themes highlighted through the qualitative questions were;

1) Association between targets and increasing and unmanageable workloads/ challenges managing workload expectations

> *"I have five jobs: two of them charitable…. I'm constantly asked to do more with less …… I do 12 hr days. I love medicine …… …I'm no longer able to work for free"*
>
> *"we have so much work the targets are impossible"*
>
> *"Wasting time in the majority of the cases. Measuring targets is a waste of precious time, better spent clinically managing patients as a professional."*
>
> *"Time to spend on actually interpreting the data and the causation or impact within the time available is a key issue. I am measured and there is good data I can use but I don't get the quality improvement time as the appointment book is constantly pressured."*
>
> *"The workload is overwhelming […] waste of time measuring targets if there is no man left in the trench."*

"Primary care continues to be asked to take on more work from secondary care without being adequately funded for this. In the end it will make the GP owner model unsustainable."

2) A shift or change in resources to undertake work associated with targets. This could be seen as positive i.e. ''*relevant nurse did more training" or* negative *"loss of nurse time in other areas".*

3) Repeated approaches to patients creating frustration for patients and causing them to change their behaviour or responses.

''Some families are strong anti-vaccinators and can express annoyance.''

''Asking old ladies in rest homes if they smoke wastes their time and our time. Smokers are normally addressed and advised. Asking repeatedly needs to be done subtly, annoying to say the least to the patients. They start to lie to me.''

GPs were also asked about emerging issues and recommendations. These could also be understood as changes which could help the evolution/improvement of TBPP. These are summarised below:

- Increase general practice teams of awareness and understanding of quality improvement science; and ensure that the time, resources, and data is available to enable and support general practice teams to embed quality improvement approaches.
- Ensure that there is adequate financial compensation and resource for work undertaken.
- Ensure that quality improvement approaches are clinically sound, and evidence based.
- Approaches should acknowledge the different needs of populations, and be designed based on local needs.
- Approaches need to balance both clinical effectiveness, and the practicality of implementation within the primary care setting.
- There could be improved patient experience measures
- Consideration could be given to decreasing the number of targets, and support through PHOs or other organisations to decrease the cost to practices.

- Look at ways to decrease the compliance burden for practices through increasing the support and management undertaken by PHOs – taking advantage of structured systems and processes larger organisations offer.
- Increased investment in areas which will improve determinants of health
- Improve public perception of value of GPs and medication.

The following were suggested as areas which should be a focus of QI:

- Older persons health (over 65s and over 85s).
- Mental health prescribing.
- Integration, i.e. better coordination between primary and secondary care for complex needs/long term condition patients and a focus on the patient journey.
- Poverty, unemployment, and the socioeconomic and cultural determinants of health [including racism], colonisation and the impact on Maori health.
- Obesity.
- Educating public about preventive medication, adherence/compliance.
- Colon cancer screening.

Feedback loops

Feedback loops play very important roles in a CAS, and can have an amplifying or attenuating effect, depending on whether they are positive or negative feedback loops. A QI programme creates feedback loops. Feedback loops were broadly explored in this research and are now discussed.

At a high level a reinforcing (positive) feedback loop would be that improvement in target results also corresponds with improvements in population outcomes. As shown below in table 10, respondents indicated a stronger effect with non-complex targets than complex targets. As has already been discussed in this chapter, the difference was even larger when considering the input of resources versus improved outcomes for the population. In relation to targets selected as complex, only 40% of the responses indicated agreement that the cost was justified due to improved outcomes (compared with 77% indicating agreement for non-complex.)

Table 10: *Feedback loop questions*

	Non-complex targets		Complex targets			
Statement	Mean score	Standard Deviation	Mean score	Standard deviation	Difference in mean scores	Unpaired T Test (two-tailed P value)
When we improve our target results, we see a corresponding improvement in outcomes for our population.	2.5	1.7	3.5	1.8	1	0.0502
I consider that the cost of the resources used to meet the target is justified due to the improved health outcomes the activity towards this target achieves.	2.4	1.8	4.2	1.9	1.8	<0.0002

There are several other features which are or can be used as feedback loops in primary care. A number of these were included on a sliding scale to ascertain the extent to which they positively influence participation in target or improvement activity. As shown in figure 22, while all features had medians between 6.5 and 8, the system feature which was seen as most positively influencing was funding to reduce cost to patients, while the least was electronic prompts and guidelines.

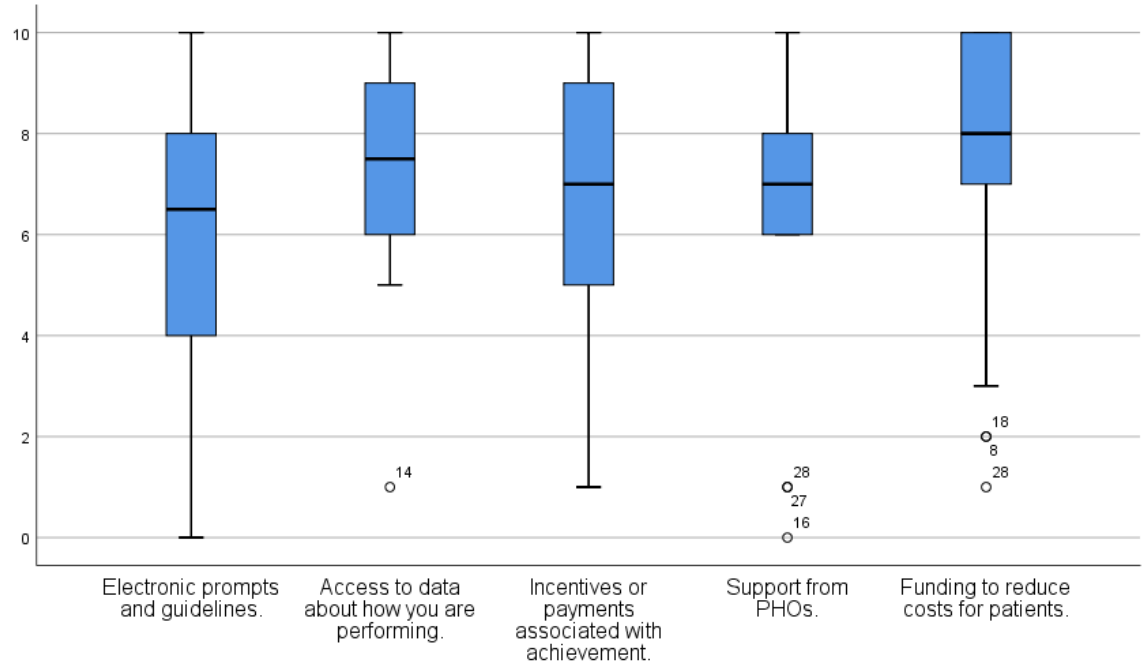


Figure 22: *System features by influence*

Summary

Chapter 5 has provided an analysis of data in order to understand if complexity and the nature of CAS as a world view can explain limitations of a TBPP. This research has shown that there is a relationship between how complex problems are seen to be and whether targets are seen as an effective measure. Targets are less likely to be seen as an effective measure where problems are understood as complex. Likewise, for some engagement indicators, specifically how constraining approaches are, and the match to personal values shows there is a relationship. More complex problems are more likely to be associated to lower engagement indicators. This chapter has also highlighted where features of CAS can be seen as influencing perceived effectiveness. Chapter 6 furthers these discussions and aims to highlight how these findings can be used to suggest changes and adaptations to the QI approaches.

Chapter 6

Discussion

Part 2 of the research questions for this paper was to; understand ways in which approaches can be adapted to improve outcome and clinician perception of match to environment.

The research question being:

- what do the findings of the research suggest about how TBPP and more generally QI approaches in healthcare could be improved in the future?

This chapter is a more detailed discussion of findings and how they relate to the implications and learnings in relation to a TBPP QI approach.

GP views on level of complexity present in problems associated with TBPPs.

While the Interrelatedness and Cynefin framework results did not match each other, both of them confirmed the perception of a high level of complexity in relation to clinical problems which were the focus of a TBPP. Using a modification of the interrelatedness scale, for both the most effective, and least effective targets selected by the GP, it was perceived that there was a high number of factors, and these were moderately to highly interrelated. Using definitions adapted from the Cynefin framework 52% of the targets selected (either least or most effective) were perceived as being complex or chaotic problems. The other 48% were either seen as simple or complicated. This highlights that GPs perceive and understand that while there is a high number of factors in most areas which are the focus of a QI approach, these can be categorised in varying ways. The data also indicates that there is an understanding that approaches need to be flexible to need. As one respondent noted “one size does not fit all”, the respondent went on to say that what is reasonable for a person living in the city is not reasonable for someone living in poverty in a caravan in a remote area.

This finding supports the view that TBPP, which may be seen as reductionist, have disadvantages in that the approach does not overtly acknowledge the range of factors which increase complexity, such as social determinants, belief systems (Young et al. 2017), and the interrelatedness of these. It is also important because it highlights a gap between GPs belief [personal schemas] and the work environment. Given that there is some evidence that misaligned metrics may contribute to burnout, and perception that they may contribute to

poorer quality of care (Young et al., 2017) this finding is important. Similarly, the perceived impact on workload, particularly work understood as bureaucratic by clinicians, was identified as a barrier to the success of Lean in healthcare by Leite et.al (2020).

GP views on target-based QI approaches.

A number of questions were asked in the survey to ascertain GP views on quality targets, specifically how effective they are seen to be as a measure or approach. At the beginning of the survey GPs were asked on a sliding scale of 1 to 10 how effective they believed targets were as a QI approach. The median response was 5.34. GPs were also asked to select on a 7-point Likert scale the extent to which they believed a target approach for the specific targets they chose as their least and most effective targets was a good approach. For both the mean score translated as 'somewhat agree', while there was a difference in the mean scores, they were not significant.

When asked whether the activity undertaken toward the target would improve outcomes there was a statistically significant difference between the mean scores of the non-complex, and complex targets, with the means being 1.8 (agree) and 3 (neither agree nor disagree) respectively. While there was not a statistically significant difference in regard to GPs views on whether targets improved equity; the means of 2.9 (non-complex) and 3.8 (complex) confirm that there is not strong agreement that targets improve equity. The largest difference of means between the non-complex and complex groups was seen when GPs were asked to select the extent to which they considered that the 'cost of the resources used to meet the target is justified due to the improved health outcomes the activity towards this target achieves'. The mean scores were 2.4 (agree) for non-complex and 4.2 (neither agree nor disagree) for complex.

Overall, these findings highlight that there is ambivalence about the effectiveness of targets individually and as QI approach in general. There was a slightly more favourable view of targets where they were associated to simple or non-complex problems. Resources used towards achievement of complex targets were less likely to be seen as justified where the targets were viewed as complex. This, alongside the finding that complex targets were seen as less effective as non-complex targets is useful to consider from the viewpoint of a QI programme creating feedback loops. Some targets may be understood as negative feedback loops, that is that they have an attenuating or dampening effect (resource and input not balanced with the outcome) rather than an amplifying effect which would be the hope of a QI programme with positive impact. System enablers also create feedback loops and there are a number of system features which have been designed to support the reaching of targets. The enabler highlighted as having the greatest influence was funding to reduce costs. The

lowest scoring were incentives and decision support tools. This again highlights a mismatch between the beliefs of what works from a GP perspective and the QI approach.

There were outliers present in the data who were strong proponents or opponents of target-based programmes. Qualitative comments help understand why there is variation in viewpoints. GP comments in free type fields suggested that views on targets are influenced by a number of factors, including perceptions that they add to an already high workload, are imposed, do not reflect the needs of the community and patients served, and require access to appropriate tools.

It may be interpreted that they have come for some GPs to represent a top-down approach which does not reflect the on-the-ground experience as indicated by excerpts below.

- *Funding is given to the PHO and does not reach patients […] I am so angry about this […] structural racism may contribute to childhood and maternal mortality and morbidity [paraphrased].*
- *"Current proxies are not always the main feature in the patient journey"*

On the other side, highlighting the diverse range of views, one respondent was very clear that targets provide important feedback loops within the system. In addition, strength of evidence was also seen as an important factor:

- *"[…] improvement areas need to be clinically sound and evidence based not theoretical."*

These responses highlight the range of issues and considerations which need to be considered when developing QI programmes, and the importance of understanding that agents within a CAS have their own worldviews and schemas. As described by Holland (2014), and reflected in these survey results, it is rare for agents in a CAS to converge. Agents can and do self-organise to resist external pressure and influence other agents. What this means in the context of a QI programme is that that those agents who strongly disagree with an approach may have the capability to influence others, and certainly have the capability to resist fully participating in a QI programme that does not match their values and beliefs. This is further explored in the next two sections.

In addition, while this research has not looked at the outcomes of the QI programme at a population level, GP views do suggest that there is awareness that TBPP do not adequately address the underlying reasons for inequitable health outcomes. As discussed by Poynter et. al "standardisation can be problematic when pursued to the point of uniformity […]

populations are not homogenous in their composition and needs, therefore uniform approaches often fail to deliver to those in most need." (2017, p.19). Adaption is critical, as is the underlying knowledge that achieving equitable outcomes in non-homogenous groups requires an acceptance that a focus on decreasing variation equitably means accepting the need to increase variation in QI programmes.

Relationship between complexity and perceptions of effectiveness of targets

As has been highlighted, this research finds that there is a relationship between the complexity of a problem which is the focus of a quality target, and how effective the target is seen to be at improving health outcomes. Complex problems are more likely to be seen as less effective targets, and therefore a poorer match to TBPP as a QI approach. This relationship was most starkly seen in relation to childhood immunisations and Diabetes Annual Review (DAR).

76% of respondents selected childhood immunisations as the most effective target, 60% of respondents indicated it was non-complex. Given 40% of respondents saw the issue as complex, there is certainly not full agreement. This may be because of interpretation of the question and because there is not a shared understanding of what constitutes different levels of complexity. It may be interpreted that while we know immunising children is highly effective at preventing disease, it can be difficult to engage some families, and that the reasons that people do not engage with the health system, or believe that vaccines are not safe are complex. On the other side of the equation, 5 of the 7 respondents who selected DAR, identified it as least effective. While there was not full agreement on whether it was least or most effective all respondents agreed it was a complex problem.

While there may be nuance to the reasons that specific targets were chosen by respondents, a pattern was clear. Targets selected as most effective were seen by 66% of the respondents as non-complex. Targets selected as least effective were seen by 63% of respondents as complex. The other pattern which was identified with the use of the interrelatedness framework alongside Cynefin was that all problems were seen to have a moderate to high number of factors, which were moderately to highly interrelated. However, there were notable differences in average scores between targets. Despite this, the differences between the answers given on the Cynefin scale and the Interrelatedness Scale show that it is not solely the factors and their interrelatedness that influenced how complex a problem is understood to be. The structure of this research did not allow the reasons for the

differences in the responses between the interrelatedness scale and Cynefin framework to be explored however. That could well be a useful topic for future research though.

Relationship between complexity and GP engagement

Engagement is an important factor in the success of QI programmes, and while measuring clinician engagement is not simple, this research included a number of questions to form a view on whether there was a relationship between how complex a problem is perceived to be, and clinicians engagement in achieving the target. The key areas where there was a significant relationship (or difference) in engagement shown between complex and non-complex targets was firstly that targets for complex problems were more likely to be seen as constraining and less likely to be a match to personal beliefs on approaches that improve outcomes. Overall pressure to undertake work associated with targets, whether they were complex or non-complex, was more likely to be seen as coming from outside of the workplace than within it.

Despite external pressure being a driver, nearly all respondents indicated for both targets they selected, that even without the formal monitoring outside of the workplace they would undertake the work associated to the target. This does suggest that there is some relationship between complexity and engagement. However, it also confirms that there is high intrinsic motivation amongst GPs, and as suggested by Janus (2010), the use of TBPP may have an impact on intrinsic motivation. This is highlighted by the fact that in 65% of the responses there was agreement that the approach was a match to personal beliefs [about approaches which improved outcomes] and in 84% of the responses there was agreement that activity would occur even without monitoring of the target. Despite the above in 63% of the responses there was agreement that the main motivation to undertake activity was external pressure. Indicating a potential ‘‘crowding-out’’ of intrinsic motivation.

The crowding out of intrinsic motivation is an important finding and an unintended consequence of TBPP. Unexpected or unpredictable outcomes can be understood as emergence when we are considering core elements of CAS. Therefore, crowding out of intrinsic motivation may be seen as an emergent property of a QI programme. The impact of the QI programme on clinicians in terms of motivation can also be related to burnout. Studies suggest that while there are personal factors which can be predictors of burnout, the work system itself is also a major causal factor. Workload and loss of autonomy are factors identified in literature as creating environments where burnout can flourish (Baigent & Baigent, 2018).

Mismatches in the following areas were all seen as predictors of burnout - workload, control, reward, fairness and values (Baigent & Baigent, 2018). QI approaches touch on all these.

This research suggests that the GPs who responded were likely to experience a mismatch in these domains. For examples in the qualitative and quantitative targets the following is highlighted for some respondents:

- Targets seen as adding to **workload.**
- Incentives **(reward)** seen as unnecessary for intrinsically motivated professionals
- Targets not aligning with personal **values.**
- Desire to have more **control** – i.e. work on the need from practice up, not top down, and the higher agreement that targets (where the problem was complex) were likely to be seen as more clinically constraining.

A 2018 GP survey found that 26% of GP respondents considered themselves to be burnt out (RNZCGP, 2019). Ensuring that work systems are not contributors to burnout should be seen as critical in a system where the clinician interaction with the patient and whānau determines to a large part the quality of the output and over time the outcomes of the system. Matching quality improvement approaches to the values of clinicians may be important both in terms of establishing effective QI programmes, but also for ensuring safe environments for GPs to work within and thrive. Baigent and Baigent (2018) recommend that autonomy- being a work system which allowing GPs to put their patients first - may be the antidote to the building protective cynicism which accompanies discomfort, unhappiness and burnout in GPs.

Possible contribution to burnout has already been identified as an unintended consequence of a TBPP, in addition to this GPs highlighted shift in the way resource was used. This could be a positive or negative depending on whether the resources input was seen to have a positive impact on patient outcomes, or a “box ticking” exercise in order to achieve the target. Responses also suggested that the targets being in place over time had an impact on the behaviour of patients, i.e. patients being annoyed, or lying.

GPs were also asked about emerging issues and recommendations. GPs provided a number of suggestions to improve current approaches, such as ensuring they were appropriately funded, and evidence based. Suggestions for areas which should be a focus of QI were older persons health, mental health, integration, approaches that address social determinants of health and obesity. This indicated a desire and willingness to focus in areas which are often seen as difficult and complex, but to address any of these issues, QI approaches would need to reflect the complexity and nuance of the problem. Approaches should consider the intrinsic motivation of clinicians, ensuring there is a focus on maintaining clinician autonomy.

Other CAS behaviours

When outlier responses in the dataset were analysed there were two findings which strongly illustrated the CAS elements of agents with schemas (interconnectedness) and self - organisation. These were:

- Respondents who had stronger belief in targets were more likely to associate them with PHOs.
- These respondents also reported that they were more likely to be influenced by peers outside of their practice and PHO representatives.

These findings are important as they highlight the nuance of the personal schemas of agents, and also the impact of types of agents Braithewaite refers to as “bridges, brokers and boundary spanners” (2013, p.158). According to Braithwaite these agents help to coordinate the flow of information between people who may not have any access to each other, or whom have no relationship in which to form trust in each other (2013). It may be that for those respondents who were more influenced by peers outside of their practices and by PHO representatives were more closely networked, i.e. they have closer working relationships, or possibly more direct involvement in the development of QI approaches. The Survey based approach did not allow for a more detailed probing to clarify this. Regardless, this finding provides an insight into the importance of proximity of relationships in a CAS, and the influence that agents have on each other.

Influence of relationships is important because while agents have schemas which are internalised those schemas are not necessarily fixed and can change over time. It is this dynamism of agents (which we can consider in this case to be highly skilled and autonomous GPS) which is critical to understand. Tightness of relationships may be critical both to influence (as is shown in the outlier data), and in order for a QI programme to appropriately adapt. Changes in schema are highly like to occur when a QI programme interfaces with clinicians and patients. Having mechanisms to hear this feedback could be considered critical to adjusting approaches to suit the environment. Where feedback from agents does not lead to adjustment, the side effect may be the ambivalence and frustration expressed by GPs responding to this research. As Braithewaite describes this is in fact systems resilience;

> *Those on the frontline of care (clinicians, staff, patients) navigate change through their small part of the system, adjusting to their local circumstances, and responding to to their own interests rather than to top down instructions. Thus, healthcare is*

naturally resilient, always buffering itself against change that does not make sense to those who are on the ground, delivering care (Braithewaite, 2018, p.2).

Failure to adapt leads to non-viability- if we view a QI programme as a nested CAS, then this principle would equally apply at a programme level as it does at a health system level where non-viability means a failure to achieve intended outcomes.

Because of the emergence, and non-linear nature of CAS, non-viability could have a greater affect than the QI programme. For example, agents who see the QI programme as not aligned with their personal schemas may self-organise and form close networks in order to resist external pressure. That would be self-organisation to resist the pressure of meeting the targets, and against the organisations and systems who are perceived to have imposed them.

While the last scenario is an example of a less than optimum possible outcome, the value in understanding the nature of a CAS is that programmes can be designed to take into account the behaviours, both in terms of designing to maximise positive impact and monitor for negative impact. For a QI programme this means ensuring that there is an understanding of networks, and people who act as bridges and boundary spanners. Proximity of networks is likely to only hasten resistance to a QI programme if it is not well designed. Kaplan et al. discussing their research on contextual factors impacting QI activities noted that "microsystem and QI team factors are interdependent and mutually reinforcing" (p.17, 2012). While their research was not framed from a complexity viewpoint, they too describe the dynamics of a non-linear system, and the dynamism of agents as they act, react, and adapt to their environment. Given this, any programme of work operating in a CAS environment should ensure there are mechanisms in place to regularly hear and understand the view of clinicians.

Summary

The discussions chapter has highlighted that the use of a CAS metaphor to observe the system, and a complexity framework as a practical way of understanding the limitations of a TBPP, can yield interesting insights. It has helped to provide a platform for how QI approaches could be improved in the future. It has shown that there is value in understanding the limitations of linear or reductionist world views and associated approaches. The next chapter provides conclusions and recommendations.

Chapter 7

Conclusion

This section is broken down into four sections - a summary, strengths, limitations, and finally recommendations.

Summary of research

In the introductory chapter of this paper it was identified that the pursuit of standardised approaches to improvement in health had failed to deliver consistent outcomes. In the NZ context, QI initiatives have at times shown improvement at a population health level, while increasing equity gaps between Māori and non-Māori (Poynter et al, 2017). Internationally and in NZ there have been calls for the “rethinking of basic assumptions“ (Litaker et. al., 2006). There has been increasing volume of voices, such as Braithewaite (2018) who ask that we factor in knowledge of complexity and shift the paradigm. This research aimed to add GP voices, experience, and views to the existing evidence.

This research set out to achieve five objectives:

- develop a framework to explore GP perspectives of a TBPP through a complexity lens,
- examine GPs perspectives of TBPPs using a complexity framework,
- determine whether there is a relationship between complexity and GPs perceptions of the effectiveness of a TBPP,
- determine whether there is evidence that variation in outcomes of a TBPP could be attributed to the complex nature of problems and/or the behaviours of a CAS,
- justify an underlying assumption that understanding healthcare as a CAS provides new insights into how best to manage and lead improvement activity.

A research tool was developed which used a complexity framework. While the number of GPs responding was small, a unique and rich insight was provided. It found that GPs experience and acknowledge complexity in relation to TBPP’s. They understand that not all clinical problems have the same level of complexity, and they are at times frustrated and negatively impacted by the blunt tools they are given. They are often intrinsically driven, and they want the QI approaches to reflect the problems they see.

GPs perceived that focus areas which have targets associated have a high number of factors that influenced the outcome, and that these were highly interrelated. Using Cynefin as a basis for sense-making domains, targets selected as most effective were more likely to be understood as non-complex, while targets selected as complex were more likely to be seen as less effective. Overall, there is not a strong view amongst GPs that targets are an effective approach to improving health outcomes, and there is a relationship between complexity and targets being seen as being least effective as clinical measures. The use of a complexity lens to understand why TBPP may not work adds further weight to previous research which has found that some targets, such as immunisations (Poynter et. al. 2017) have been effective, while others such as ED length of stay can in fact drive perverse behaviours (Tenbensel et.al. 2019).

The analysis indicated there is also a relationship between complexity and engagement, but also a more general relationship between TBPP and the potential ‘‘crowding out’’ of intrinsic motivation. This can be seen as an unintended consequence of the TBPP. This is important to consider in light of high burn out rates of GPs. Matching quality improvement approaches to the values of clinicians may have value, both in terms of establishing effective QI programmes, but also for ensuring safe environments for GPs to work within and thrive. Unintended consequences in a CAS can be understood as ‘emergent behaviour’, and this was only one of the elements of a CAS which was an expected behaviour. One of the other elements which can be seen in the analysis is the autonomy of agents. This is particularly noticeable in relation to the idea that agents have an internalised schema or world view which is not necessarily shared, and different agents have different levels of influence. Interconnectedness and self-organisation are also important, and understanding the strength of relationships is critical. As Janus (2010) discussed, our GPs are highly specialised, and have a strong professional culture – they are trained to make complex decisions, and the decisions they make on a daily basis contribute directly to quality of care and outcome for patients (Janus, 2010). Creating the conditions, based on the needs of their patient and their specialist knowledge, without arbitrary constraint is critical.

This research indicated that the strongest influence on belief around targets was peers internal to workplaces, followed by peers external to workplaces and then PHO representatives. Interestingly, where there was a stronger influence from external peers and PHOs, there was also a stronger belief in targets as a QI approach. This is an example of self-organisation whereby clinicians form formal and informal groups from the bottom-up. It was clear that some of the outlier clinicians were more influenced by PHO representatives, and this was correlated to stronger belief in target-based programmes. Understanding the link between dynamic relationship between agents, their networks, and a QI approach, will

be important for any QI programme. This adaption to the environment, is known as co-evolution. A CAS adapts and evolves as agents interact with each other. Feedback loops play an important role in adapting and evolution. While only touched on in this research, there is evidence that feedback loops in relation to targets are more positive when the targets are perceived as simple. Additionally, a system feature which is seen as having the strongest influence is funding that allows patients to access services without cost. This points back to a fundamental design feature of primary care in NZ in which income for practices is partially derived from patient co-payments. This could be described as an attenuating feature, in that it may limit the number of people able to access primary care services, particularly those in lower socio-economic groups.

Socioeconomics is a major determinant of health, and when GPs were asked what issues were emerging and what areas could be a useful focus of QI activity, this was a feature for several respondents. The frustration of working in a system which is not aligned to personal values, and not always meeting patient needs was evident in their responses. If we view TBPP in the context of the health system as a CAS, it is clear that it is critical to understand if and when to apply targets as an approach, to ensure that its interaction and impact within the system is positive in terms of patient outcomes, as well as impact on relationships. What this analysis has shown is that the use of complexity theory to develop a conceptual framework and tools in which to better understand a problem, provides opportunity for insights from a range of angles and may be useful to inform both understanding of point in time and designing new effective approaches. The GP respondents proposed a number of improvements and areas for consideration. Examples being older persons health, socioeconomics and cultural determinants of health, integration and obesity. Not one of these will be considered a non-complex problem.

If we know that targets or approaches may not be well matched as methods to improve variation of outcome for complex problems, which approach do we take? Alongside understanding the behaviours of a CAS, this research has supported the view that part of resolving the tension between a QI programme, its environment, and the level of complexity, is the use of a complexity-informed approach to match the issue. Table 11 is an abridged version of appendix 2. It highlights definition of complexity, best practice response and whether TBPP is appropriate.

Table 11: *Abridged approach by level of complexity*

DOMAIN	DEFINITION AND RESPONSE	WOULD A TBPP BE APPROPRIATE?
SIMPLE	A simple problem/situation is one where there are few components and low interrelatedness. This means that the problem/situation can be decomposed, and the linear cause and effect relationship established. A **best practice response** will have a predictable outcome.	An appropriate TBPP could be used.
COMPLICATED	A complicated problem/situation is one where there are many components but that have low interrelatedness. Because of the number of components, it will take some expertise and judgement to decompose the problem. There is likely to be more than one way to manage the problem/situation. A **good practice** (i.e. a range of options) approach is likely to provide a predictable outcome.	An TBPP could be used, but it would need to be used alongside other tools.
COMPLEX	A complex problem/situation is one where there are few components, but they are highly interrelated. This means that there is low decomposability, and the system will need to be studied as a whole. There will be no single good answer. Multiple approaches will need to be tried. **Safe to fail** probes or experiments should be used. Outcome will be unpredictable and subject to properties of emergence (the path is created as you go). Situation should be monitored to gain knowledge.	TBPP should not be used, results are too un- predictable and causation difficult to ascertain. Interventions/experiments will need to understand context and environment and be monitored for unintended outcomes. Using TBPP is this domain is likely to have a negative influence on clinician behaviour and engagement and therefore effect relationships creating unintended emergent properties.
CHAOTIC	A chaotic problem/situation is one where there are many components and high interrelatedness. There is no known relationship between cause and effect, and It is too confusing to know what the right response is, but action must be immediately taken to reduce risk. The first step is to **take action to reduce risk** and move the problem to another domain where it can	TBPP should not be used in this domain. QI techniques are unlikely to succeed, there is a need to understand more about the problem in order to move it to another domain where established approaches can be taken.

	be managed with an established approach.	
DISORDER	Disorder occurs when there is no way or agreement on how complex a problem/situation is. The components of the situation should be broken down and then each component assigned to a domain.	
References: Snowden & Boone, 2007; Kannampallil, et. Al 2011		

The analysis indicated that while complexity of problems in focus may certainly be a component, there are other elements to consider as well. Other research has explored QI approaches which are more effective (Scott, 2009) and factors which improve likelihood of success (Kaplan et al. 2012). However, the relationship between the complexity, the behaviours of a CAS, QI and effectiveness has not been studied. This research, while only exploratory, suggests that complexity and the behaviours of a CAS as factors warrant consideration. Indeed, augmenting approaches using a worldview which accepts that health is a CAS, and that problems should be viewed in terms of their complexity, may provide opportunity to transition QI approaches from their industrial origin. In addition, a focus on equity enhances the need to ensure context is understood, and that moving from standardised approaches to approaches that incorporate the need for variance in QI approach may yield improved health outcomes and less variation. While primary health may not be able to transform the global food systems, by viewing the problem through a complexity lens, and developing appropriate QI approaches, it may be able to contribute meaningfully to reducing the impact of obesity. Importantly this research also shows that complexity informed approaches to research provide an opportunity to create deeper insight and understanding.

Strengths

The use of a survey method supported the ability to gather responses from a wide geographical area, and using an online survey made this practical to implement. The survey design allowed for analysis using a number of methods and created opportunities to interpret

and analyse relationships. The GPs who responded were generous in providing useful and insightful narrative.

The respondents showed diverse views, and represented various age groups, regions, ownership, and duration or practice. This has ensured a diverse range of worldviews and experiences are reflected in the research.

Limitations

The most obvious limitation is the broadness of the area of complexity as well as QI science, the challenges of developing a single research tool to encompass such a broad range of elements, and which was practical to implement, i.e. not too long or complicated.

Distribution was also a limitation. The distribution method originally planned was to be a direct email to GPs who had been members of a large PHO for one year or more. This period of time allows a GP a fair opportunity to gain knowledge about the current QI programme, and understand how this is operationalised with the practice the GP works in. Initially consideration was given to also include nurses and practice managers, but this was decided against for two reasons. Firstly, the viewpoint of each group is quite disparate and would have required consideration of questions which worked for all groups (considerably increasing the scope of research). Initially GPs from a single PHO were to be invited to complete the survey (300 GPs). Ability to directly contact may have increased likelihood of completion. Unfortunately, the request was not able to be processed in a timely manner, therefore a decision to distribute via GP networks, allowing any GP regardless of PHO to complete. This created limitations as it relied on third parties to distribute the survey, there was no way to know the potential population size or therefore the percentage of the population that the samples represent. It also limited the ability to follow-up with individual GPs to encourage completion. On the other had it did ensure that there was a wider geographic representation which is a positive.

Finally, in terms of analysing data was the limitation that the researcher had not previously used the software programme, and it took some time to learn basic functions. The lack of knowledge also means that the software may not have been used to its full potential. The dataset collected in Qualtrics was able to be directly imported.

The research method itself may also be conceived as a limitation, and in hindsight the exploratory nature of the research as a qualitative or mixed method approach may have been more appropriate. It is acknowledged that it could be perceived as paradoxical to use a research method which may be positivist and reductionist to attempt to strengthen the

evidence that complexity theory is relevant to understand and design QI approaches fit for a complex environment. This in terms of worldview may be the tension between essentially two paradigms or worldviews of holism and reductionism. My position on this is that they are not mutually exclusive, but it is the dominance of reductionism as both a worldview and more specifically a corresponding scientific method (in healthcare and Quality Improvement) which is to be challenged.

It is also possible to argue, as this paper has, that complex does not mean completely random. While non-linearity may limit the ability to predict outcome - patterns can still be evident. Thus, the challenge of this research, and more broadly the health sector, is to understand if the developing knowledge of the laws of Complexity can be used to find ways to discern patterns and the context in which they occur. And to understand what this tells us about our systems, and interventions we use, or could use within them.

It certainly is not possible within the scope of a masters to fully unpick these tensions. But in any case, as George Box notes:

> *[…] it would be very remarkable if any system existing in the real world could be exactly represented by any model…..For such a model there is no need to ask the question 'Is the model true?'. If 'truth' is to be the 'whole truth' the answer must be 'No'. The only question of interest is 'Is the model illuminating and useful? (Box, 1979)*

Recommendations

This paper has explored complexity theory, CAS literature, and GP views. It has found that there is no single approach which will be effective in all contexts. However, understanding the context of the health system as a CAS may allow modification of approaches to give them the best chance of success. While there are some quality improvement tools others identified as more appropriate for CAS, it is not the intention of this paper to explore those. Rather it is the intent to find out if applying a CAS lens to a current QI approach adds weight to the call that using complexity-informed approaches to understand the systems and problems will help QI practitioners and health leaders to ensure approaches are compatible and effective. While further research would be useful to scale-up the findings, and also to develop a framework to help health professionals match approaches to the environment and test application, the following are the key recommendation resulting from the findings of the paper:

1) **Acknowledge agency first.**

Any QI programme must acknowledge that human agents are at the core of the health system. Both as indirect and direct recipients of services and as individuals and groups who produce and deliver the quality of output. Outcomes are a complex interaction between these agents, the technical tools and the environment. They each impact and can change each other over time. So, all elements must be carefully considered and balanced.

2) **Reducing variation in outcomes across non-homogeneous populations means increasing variation in QI approaches*.***

The pursuit of standardisation is not the best approach when focussing on equity of outcome. This is because equitable outcomes require consideration of contextual differences, this is aligned with understanding Health as a CAS. A QI programme that aims to deliver equity needs to build in an acceptance that QI approaches should be adapted for different needs and contexts. This could include considering interventions that incorporate cultural paradigms and other determinants of health outcomes.

3) **The complexity of a problem, and its context, should inform the approach taken.**

This acknowledges that there is not a one size fits-all approach, the application of a linear/ mechanistic approach to a complex and non-linear problem is unlikely to succeed.

Understanding the context should inform the tools used, and the way outcomes are monitored. It is necessary to further develop ways to understand and accept the nature of the problems we are faced with - and the wider environment. And then having established the nature of the problem, and the context of the environment, apply the optimal method. This means accepting that the appropriate method is likely be on a dynamic spectrum between reductionism and holism.

4) **Target-based approaches should not solely be used as a primary mechanism for improving variation for complex problems, or problems where there are inequitable outcomes.**

Target-based approaches can be used for non-complex (simple, linear and complicated) problems where cause and effect are easily identified and therefore a reductionist approach is likely to work. Even in this situation unintended consequences should be monitored for.

The use of a target-based approach for complex problems is unlikely to succeed and could also cause negative unintended consequences.

5) **Strength of relationships and networks are critical for QI to be effective in a CAS.**

In a CAS a top down approach alone is unlikely to be effective, CAS are made up of agents with different level of influence, but always with autonomy. They self-organise and co-evolve, understanding relationships and networks is critical to understanding how to leverage and effect change. It is also critical to understanding the effect of QI programmes over time.

6) **Looking and planning for unpredictability, emergent and adaptive behaviour, and unintended consequences should be a core feature of a QI approach regardless of the complexity of the problem.**

Agents change and adapt to QI approaches, just as QI approaches should adapt to agents. This means QI approaches should:

i. *Consider any unintended negative impact on GPs (as well as other clinicians and service-users).*
ii. *Feedback loops should be carefully designed, and their impacts should be monitored. A QI programme should incorporate capability understand which feedback loops should be attenuated and which should be dampened.*
iii. *QI programmes should encompass ways to monitor for emergent behaviour, specifically considering ways to hear and make sense of feedback from the frontline.*

iv. *Any QI programme should plan to and be ready to adapt always.*

7) **Shift the way in which the health system is viewed and led. This could occur though development of workforce understanding, and co-ordinated QI approaches that are underpinned by a worldview of holism and acknowledge complexity.**

Actions would include:

i. *Increase utilisation and understanding of complexity theory as a paradigm in which to consider opportunities to decrease variation and improve outcomes in primary care, and in broader health and social system.*
ii. *Increase workforce knowledge of; and development of QI tools which reflect the nature of problems and the basis of their complexity, and health as a CAS.*
iii. *Use Complexity frameworks such as Cynefin to augment current QI approaches, by providing a starting place, and encouraging the most appropriate approach for the level of complexity.*

8) **Future research could test the application of, and barriers to using complexity informed approaches, with a focus on using this approach to reduce inequity.**

This his would help in understanding which are effective at working with different levels of complexity and creating dynamic change.

The research suggests that careful consideration should be given before using TBPP or QI approaches. Target-based approaches are likely to be most suited to non-complex domains. Complex and chaotic problems will require more nuanced approaches. Wherever targets are used (regardless of complexity) consideration should be given to potential unintended consequences of the targets and the emergence of new outcomes unforeseen based on the knowledge of the characteristics of CAS. The definitions of complexity, and types of approaches adapted from Cynefin and the interrelatedness framework can be referred to in appendix 2 of this document.

In a Complex Adaptive System, be it a human, society as a whole, or the health system, detailed knowledge of individual parts cannot translate to understanding the whole. These are living systems that adapt, change and learn in ways that are non-linear and often unpredictable. But that does not mean there is a complete absence of pattern. Indeed, patterns have emerged in this research. Many of which may be known, but from different perspectives. The critical component for organisations responsible for the coordination and dissemination of QI approaches within primary care is to ensure they consider all impacts of programmes, and hear and respond to the feedback from the system in the myriad of forms it takes. Misaligned metrics have a negative impact on GPs, and they may also fail to deliver improved health outcomes. Complexity theory teaches that failure to adapt to environments leads to a decreased capability to survive and thrive. Adaption is key - QI approaches support strong primary care, which is critical for improving the health of populations, and reducing inequities. QI programmes need to be seen as contributing to thriving and sustainable primary care which in turn contributes to the thriving communities it has agency within.

Finally, in the introductory chapter the definition of QI was discussed. It was identified that there was no shared definition for QI as it relates to health. Parry suggested QI is a science that calls for "action and learning from that action" (Parry 2014). In that spirit I propose that through this process I have learnt than rather than the definition of QI I suggested on page 18, a better definition for QI would be:

> **…a systematic approach that uses specific techniques which are aligned with, and adapted to the environment, as well as to the complexity of the problem in focus; in order to make changes that lead to the goals of better and equitable patient outcomes, better system performance, and the adaption and evolvement of personal and system schema.**

This definition encompasses the idea that we do not need to throw out the old, but rather that by **accepting complexity,** as a metaphor or a truth, we **create a new order** in QI. One where holism is a worldview, and reductionism is reflected as a set of tools and techniques to be applied if the problem is a match. This would mean in the place of TBPP we see a Complexity Informed Performance Programme (CIPP), one that adjusts to non-homogenous populations, and which may still include TBPP for some non-complex problems. What a CIPP would not do is avoid really tackling, intractable, complex problems like obesity because the 5Ys reveal no single root cause to control.

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Appendices

Appendix 1
Feedback from survey pilot

Respondent 1 (GP)

Just completed this my comments below I have cut from the survey – overall looks good, I think it will get engagement – I like the sliders

The survey took me 13 and a half minutes to complete. I think the wording of some of the definitions could be clearer - at one stage you say 'could be taken to mean' for example - perhaps having a plain English review of the questions might be useful. I could not leave one of the sliders at zero - it made me redo the question (to what extent to internal people influence...) in the positive section the question about a target being a good measure is doubled up, and I think misses out a question which is there in the negative section - hope this helps

Respondent 2 (GP)

a good questionnaire though I had to think a bit! I can see what you're after and it will be interesting to learn from this. It took 15 mins though I could have gone in 5 mins if I didn't think over best response too much.

It might be good to say ''you're one third finished. You're two thirds finished. ''I liked it when I got to ''nearly there''''

I didn't understand the forced choice re best / worst target until the end. I could have chosen several so maybe the wording could be: ''choose one of the best: one if the worst ''
''Enabling'' or ''constraining'' might need work.

I chose imms and indicated 8/10 constraining as the activity is prescribed for us but we can defer to another time in some circumstances. Maybe constraining is not the best word? Are you trying to find our if the chosen target is straightforward with target resulting in specific action?

Is it flexible versus fixed response to targets you are after? I may not have fully understood.

The question ''When we improve our target results we see a corresponding improvement in outcomes for our patients.''
For imms the outcome is not getting the disease so it's a not seen outcome. Maybe wording could be 'When we improve our target results are aware that there is a corresponding improvement in outcomes''

I'm not sure about ''for our patients ''as the imms improves population health with minimal apparent individual benefit.

I chose diabetes for least

I haven't found having a diabetes target relevant, so it required a lot of thought on how to answer the questions. However, I think I responded in a way that was consistent with that target bring not that useful.

I'm not sure if you can see my answers - that might help decide if the issue was with the questions or with the respondent!

Respondent 3 (non-GP)

I think your idea of making the PHO a drop-down box (Q2) is a good idea

Q3 if the intent is to expand this to other PHO''s – does Q3 add value – would it add the same value if you asked how long have they been at their current practice – for Pinnacle practices if they have been there for more than 12 months – they would have been a member by proxy..

Q4 – great – when I opened it in a browser it didn't show the question with the sliding scale unless I scrolled down – should they be on their own page (although given they are mandatory you can't move on without answering)

Value of targets – good question - again just wonder whether to have them on separate pages (downside is it might make the survey feel longer so up to you)

For the least effective target you have 'what changes…' and 'Have there been unexpected' on the same page, however for the most effective they are on their own page, probably need a consistent approach

The only other thing I'd mention is the progress bar – now being a boy I pay attention to this – over the first few question it seems to move quite quickly and they are short questions, then because there are 5 questions on a page you start to move quite slowly..

But overall is a really good set of questions – look forward to seeing the results.

Appendix 2

Cynefin and Interrelatedness framework- merged definitions

DOMAIN	CYNEFIN	INTERRELATEDNESS FRAMEWORK	PROPOSED MERGED DEFINITION.
As per Cynefin 'disorder' domain. Prior to utilising either Cynefin or the Interrelatedness framework it is necessary to identify firstly the components of the situation or problem at the most appropriate level of granularity, and then the level of complexity of those components can be determined and appropriate action taken. *Note: therefore, when a simple approach is taken to a complex problem because there has been a failure to identify the number of interrelated factors this would be a mismatch between the problem and the measure.* References: Snowden & Boone, 2007; Kannampallil, et. Al 2011			
SIMPLE	• There are rules in place • Situation is stable and there is clear relationship between cause and effect. • Once facts are established response is to follow rules or apply best practice	• Few components, low interrelatedness • Readily decomposable (can be broken down to parts) • Exhibit near-linear behaviour • Can describe, predict and manage	A simple problem/situation is one where there are few component and low interrelatedness. This means that the problem/situation can be decomposed, and the linear cause and effect relationship established. A **best practice response** will have a predictable outcome.
COMPLICATED	• There is a relationship between cause and effect but understanding it will require refined judgement and expertise. • There is more than one right answer therefore response is to assess facts, analyse them	• Many components, low interrelatedness. • More components need to be considered • Readily decomposable (can be broken down to parts) • Can describe, predict and manage but takes more	A complicated problem/situation is one where there are many components but that have low interrelatedness. Because of the number of components, it will take some expertise and judgement to decompose the problem. There is likely to be more than one way to manage the problem/situation. A good **practice** (i.e. a range of options) approach

	respond with good practice.	time and effort that ‘‘simple’’ systems.	is likely to provide a predictable outcome.
RELATIVELY COMPLEX/COMPLEX	• Cause and effect only understandable in retrospect • No right answers but patterns may emerge • Impervious to a reductionist approach…cannot be taken apart • Actions change situation is unpredictable way • Safe to fail experiments needed	• Few components, high interrelatedness. • Amenable to description, but more difficult to predict or manage. • Low decomposability • Possible to study system as a whole rather than subcomponents • Likely to be erratic and unpredictable	A complex problem/situation is one where there are few components, but they are highly interrelated. This means that there is low decomposability and the system will need to be studied as a whole. There will be no single good answer. Multiple approaches will need to be tried. **Safe to fail** probes or experiments should be used. Outcome will be unpredictable and subject to properties of emergence (the path is created as you go). Situation should be monitored to gain knowledge.
COMPLEX/CHAOTIC	• Cause and effect unclear • Too confusing to wait for a knowledge-based response • Action must be taken to ‘‘staunch bleeding’’. • Need to look for patterns to and act to establish order	• Many components, high interrelatedness • Challenging to describe, and much more challenging to predict or manage • Erratic and unpredictable	A chaotic problem/situation is one where there are many components and high interrelatedness. There is no known relationship between cause and effect, and It is too confusing to know what the right response is, but action must be immediately taken to reduce risk. The first step is to **take action to reduce risk** and move the problem to another domain where it can be managed with an established approach.

DISORDER	• No way to understand which domain applies • Multiple perspectives may be present with no agreement • Way to progress is to break down the situation into constituent parts and then assign them to one of the domains	• N/A	Disorder occurs when there is no way or agreement on how complex a problem/situation is. The components of the situation should be broken down and then each component assigned to a domain.

Appendix 3
Descriptions for survey

	DESCRIPTION
GOALS OR TARGET	These words are used interchangeably and refer to performance measures set outside of the practice (i.e. by the Ministry of Health or by your PHOs) which are specifically designed to improve the performance of health services and represent organisational and government priorities.
QUALITY IMPROVEMENT	Quality improvement activity in this survey relates to activity in your practice towards achieving goals and targets.
EFFECTIVE	Effective means that the goal or target has been successful at encouraging and measuring activity which improves performance in the areas of focus. E.g. there is a correlation between the activity and desired patient or population outcome.
FACTORS	Factors are a circumstance, fact or influence which may contribute to an outcome for the patient or population. For this survey factors do not include finding or inviting patients, or their guardians to attend appointments. Please assume the patient is attending appointments.
INTERRELATEDNESS	Interrelatedness is the degree in which factors are mutually related and can be affected by each other.
ENABLING	Enabling means that the goal allows clinical autonomy in deciding the best approach for the situation
CONSTRAINING	Constraining means that the goal decreases clinical autonomy in deciding the best approach for the situation.
IT IS A COMPLICATED PROBLEM	There is a relationship between cause and effect, but there is more than one approach which is known to be effective. It might require some analysis or expert knowledge to find the best solution. (2)
EQUITY	Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically.
IT IS AN SIMPLE PROBLEM:	There is a clear relationship cause and effect and a best practice approach will work. (1)
IT IS A COMPLEX PROBLEM:	It's not always possible to immediately identify cause and effect. Following guidelines does not always ensure the best outcome.

	There is a need to trial different approaches and evaluate the outcome in order to find an approach that works for the patient
IT IS A CHAOTIC PROBLEM:	There is no easily visible relationship between cause and effect. The presentation may be too confusing to apply a specific known approach. I need to act immediately to stabilise the situation before deciding the way forward.

Appendix 4
Survey

Please note this is a word version of a survey which was administrated online. As such the formatting is not as would have been viewed by the respondent.

Accepting Complexity, creating order

Start of Block: Introduction

Accepting complexity, creating order
Using complexity theory to understand current quality improvement approaches in primary care, and to design interventions for the future.

Dear General Practitioner,
The survey is designed to capture the viewpoint of General Practitioners working in Primary Care. It contains five sections of variable length. There is a total of 45 questions. It should take 12 to 20 minutes to complete. While the survey can be answered on a mobile device, it will be easier to complete on a larger screen.

Your time, expert opinion, and desire to contribute to this research is greatly appreciated.

This research is being conducted to fulfil the requirements of a ‘‘Masters of Quality Systems’’ through the School of Food and Advanced Technology, Massey University. The data collected via this questionnaire will be used for the purposes of this research only, and the anonymity of the respondents will be preserved at all times.

This research is for academic purposed and is independent of any health organisation. This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director (Research Ethics), email humanethics@massey.ac.nz.

Section 1 of 5: General Questions

This section contains four questions. These ensure you qualify for the study and provide some demographic information which will help determine the reach of the research.

---

1) Are you a General Practitioner (GP) working in a primary care practice?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If 1) Are you a General Practitioner (GP) working in a primary care practice? = No

2) Please select the Primary Care Organisation (PHO) that the practice you work at is associated with.

▼ Alliance Health Plus Trust (3) ... Other/None (33)

3) Please select the age-band you belong to.

▼ 25–29 years (1) ... 70 years + (18)

4) Please select the option which best describes your employment type.

▼ Practice owner or partner (1) ... Other (7)

End of Block: Introduction

Start of Block: TARGET__COMPLEXITY_GEN

Section 2 of 5: Quality improvement in your practice.

This section contains six questions about quality improvement activity in your practice, and your general views. Please note the definitions below before answering the questions.

Goals or Target: These words are used interchangeably and refer to performance measures set outside of the practice (i.e. by the Ministry of Health or by your PHOs) which are specifically designed to improve the performance of health services and represent organisational and government priorities.

Quality Improvement: Quality improvement activity in this survey relates to activity in your practice towards achieving goals and targets.

Effective: Effective means that the goal or target has been successful at encouraging and measuring activity which improves performance in the areas of focus. E.g. there is a correlation between the activity and desired patient or population outcome.

---

5) Please select the statement(s) which best describes the person, or people who are the main champions of improvement activity in your workplace. *You may select more than one statement.*

- ☐ I am the champion for quality improvement. (6)
- ☐ Another GP in the practice champions quality improvement. (7)
- ☐ Our practice manager or administrator champions quality improvement. (1)
- ☐ We have a nurse lead who champions quality improvement. (2)
- ☐ It depends on the improvement activity. (3)
- ☐ We do not have any specific champions. (4)
- ☐ Other (please state) (5) _____

---

6) Please use the slider to indicate the extent to which the people or organisations below influence your participation in improvement activity in your workplace.

	No influence **Strong influence** 0 1 2 3 4 5 6 7 8 9 10
Peers external to your workplace ()	
Peers internal to your work place ()	
Representatives from your PHO ()	

7) On the slider below please indicate how strongly you associate quality improvement goals or targets with your PHO.

	Weak association **Strong association** 0 1 2 3 4 5 6 7 8 9 10
1 ()	

8) On the slider below please indicate the extent to which you believe target or goal based activity is an effective way to improve population outcomes.

	Not effective **Very effective** 0 1 2 3 4 5 6 7 8 9 10
1 ()	

9) Please select the target you believe is the **most effective** (or one of the most effective) from the list of examples below.

10) Please select the target you believe is **least effective** (or one of the least effective) from the list of examples below.

- **Childhood immunisations**: 95% of children who are aged two years are fully immunised. (1)
- **Diabetes**: 70% percent of enrolled coded diabetic patients aged 15 years and over have Hba1c<=64mmol/mol. (2)
- **Tobacco:** 90% of enrolled smokers aged 15-75 have been given brief advice to stop smoking. (3)
- **Cervical screening:** 75% of enrolled woman aged 25 - 69 years have a current cervical screening result. (4)
- **Cardiovascular risk:** 90% of eligible CVRA patients have had a CVRA in the last 5 years. (5)
- **Influenza:** 70% of enrolled patients 65 and over are vaccinated against seasonal influenza. (6)
- **Breast screening:** 70% of eligible women aged 50–69 are screened every two years. (7)

End of Block: TARGET__COMPLEXITY_GEN

Start of Block: REL_PHO

Page Break

Section 3 of 5: Most Effective Target/Goal

This section contains sixteen questions about the target you selected as the most effective.

You selected the target ${Q10/ChoiceGroup/SelectedChoices} Please note definitions below before answering the questions.

Factors: Factors are a circumstance, fact or influence which may contribute to an outcome for the patient or population. *For this survey factors do not include finding or inviting patients, or their guardians to attend appointments. Please assume the patient is attending appointments.*

Interrelatedness: Interrelatedness is the degree in which factors are mutually related and can be affected by each other.

Enabling: Enabling means that the goal allows clinical autonomy in deciding the best approach for the situation.

Constraining: Constraining means that the goal decreases clinical autonomy in deciding the best approach for the situation.

Equity: Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically.

11) On the slider below, please indicate how many factors are involved for the intervention to be clinically successful.

	Few Factors **Many factors**
	0 1 2 3 4 5 6 7 8 9 10
1 ()	

12) On the slider below, please indicate the degree of interrelatedness between these factors.

	Low interrelateness **High interrelatedness** 0 1 2 3 4 5 6 7 8 9 10
1 ()	

13) Which statement do you believe best describes the nature of the problem (clinically) which is being targeted through the goal.

- **It is a obvious problem:** Their is a clear relationship cause and effect and a best practice approach will work. (1)
- **It is a complicated problem:** There is a relationship between cause and effect, but there is more than one approach which is known to be effective. It might require some analysis or expert knowledge to find the best solution. (2)
- **It is a complex problem:** Its not always possible to immediately identify cause and effect. Following guidelines does not always ensure the best outcome. There is a need to trial different approaches and evaluate the outcome in order to find an approach that works for the patient. (3)
- **It is a chaotic problem:** There is no easily visible relationship between cause and effect. The presentation may be too confusing to apply a specific known approach. I need to act immediately to stabilise the situation before deciding the way forward. (4)

14) Please use the slider below to indicate how enabling or constraining you find the target.

Enabling **Constraining**

0 1 2 3 4 5 6 7 8 9 10

1 ()	

Please consider the following statements in relation to the target and indicate the extent to which you agree with the statement.

15) The use of this target to drive improvement activity for this problem is a good approach.

- Strongly agree (1)
- Agree (2)
- Somewhat agree (3)
- Neither agree nor disagree (4)
- Somewhat disagree (5)
- Disagree (6)
- Strongly disagree (7)

16) The target aligns with my personal beliefs about the best approaches to improve outcomes for my patients.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

17) Pressures or incentives from **within my** work place are the main motivation to undertake activity in relation to this target.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

18) Pressures or incentives from **outside** of my workplace are the main motivation to undertake activity in relation to this target.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

19) I would undertake activity associated with meeting this target to the same degree, even if it were not being formally monitored outside of my workplace.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

20) Activity undertaken toward this target has or will improve outcomes for our patients.

- Strongly agree (1)
- Agree (2)
- Somewhat agree (3)
- Neither agree nor disagree (4)
- Somewhat disagree (5)
- Disagree (6)
- Strongly disagree (7)

---

21) This target has been effective at improving equity.

- Strongly agree (1)
- Agree (2)
- Somewhat agree (3)
- Neither agree nor disagree (4)
- Somewhat disagree (5)
- Disagree (6)
- Strongly disagree (7)

---

22) When we improve our target results we see a corresponding improvement in outcomes for our population.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

23) I consider that the cost of the resources used to meet the target is justified due to the improved health outcomes the activity towards this target achieves.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

24) Has the approach your workplace uses to meet this target changed over time?

- ○ Yes (1)
- ○ No (2)

Skip To: Q27 If 24) Has the approach your workplace uses to meet this target changed over time? = No

25) What are the changes your workplace has made to meet the target?

_____

_____

_____

_____

_____

26) Have there been unexpected outcomes or consequences, be those positive or negative, directly or indirectly related to activity undertaken toward meeting this target? Please note this could be within your workplace and/or in the wider health sector.)

_____

_____

_____

_____

_____

Page Break

Section 4 of 5: Least Effective Target/Goal

This section asks sixteen questions about the target you selected as the least effective. These are the same questions that were asked in the previous section, but your response should be in relation to the target below.

You selected the target ${Q11/ChoiceGroup/SelectedChoices} Please note definitions below before answering the questions.

Factors: Factors are a circumstance, fact or influence which may contribute to an outcome for the patient or population. *For this survey factors do not include finding or inviting patients, or their guardians to attend appointments. Please assume the patient is attending appointments.* **Interrelatedness:** Interrelatedness is the degree in which factors are mutually related and can be affected by each other.

Enabling: Enabling means that the goal allows clinical autonomy in deciding the best approach for the situation.

Constraining: Constraining means that the goal decreases clinical autonomy in deciding the best approach for the situation.

Equity: Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically.

27) On the slider below, please indicate how many factors are involved for the intervention to be clinically successful.

	Few Factors **Many factors**
	0 1 2 3 4 5 6 7 8 9 10
1 ()	

28) On the slider below, please indicate the degree of interrelatedness between these factors.

Low interrelateness **High interrelatedness**

0 1 2 3 4 5 6 7 8 9 10

1 ()	

29) Which statement do you believe best describes the nature of the problem (clinically) which is being targeted through the goal.

- **It is an obvious problem:** There is a clear relationship cause and effect and a best practice approach will work. (1)
- **It is a complicated problem:** There is a relationship between cause and effect, but there is more than one approach which is known to be effective. It might require some analysis or expert knowledge to find the best solution. (2)
- **It is a complex problem:** Its not always possible to immediately identify cause and effect. Following the guidelines we have does not always ensure the best outcome. There is a need to trial different approaches and evaluate the outcome in order to find an approach that works for the patient. (3)
- **It is a chaotic problem:** There is no easily visible relationship between cause and effect. The presentation may be too confusing to apply a specific known approach. I need to act immediately to stabilise the situation before deciding the way forward. (4)

30) Please use the slider below to indicate how enabling or constraining you find the target.

Enabling **Constraining**

0 1 2 3 4 5 6 7 8 9 10

1 ()	

Please consider the following statements in relation to the target, and indicate the extent to which you agree with the statement.

31) The use of this target to drive improvement activity for this problem is a good approach.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

32) The target aligns with my personal beliefs on what improves outcomes for my patients.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

33) Pressures or incentives from **within my** work place are the main motivation to undertake activity in relation to this target.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

34) Pressures or incentives from **outside** of my workplace are the main motivation to undertake activity in relation to this target.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

35) I would undertake activity associated with meeting this target to the same degree, even if it were not being formally monitored outside of my work place.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

36) Activity undertaken toward this target has or will improve outcomes for our patients.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

37) This target has been effective at improving equity.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

38) When we improve our target results we see a corresponding improvement in outcomes for our population.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

39) I consider that the cost of the resources used to meet the target is justified due to the improved health outcomes the activity towards this target achieves.

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Somewhat agree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat disagree (5)
- ○ Disagree (6)
- ○ Strongly disagree (7)

---

40) Has the approach your practice uses to meet this target changed over time?

- ○ Yes (22)
- ○ No (23)

Skip To: Q44 If 40) Has the approach your practice uses to meet this target changed over time? = No

41) What changes have been made to meet the target?

_____

_____

_____

_____

_____

42) Have there been unexpected outcomes or consequences, be those positive or negative, directly or indirectly related to activity undertaken toward meeting this target? Please note this could be within your work place and/or in the wider health sector.)

_____

_____

_____

_____

_____

End of Block: REL_PHO

Start of Block: Block 4

Section 5: Final questions

You are almost there. Thank you for persevering. These final three questions relate to quality improvement and targets in general.

43) On the sliders below, please indicate the extent to which the listed system features could or do positively influence your participation in target or improvement activity.

	Low influence **Strong influence** 0 1 2 3 4 5 6 7 8 9 10
Electronic prompts and guidelines. ()	
Access to data about how you are performing. ()	
Support from PHOs. ()	
Incentives or payments associated with achievement. ()	
Funding to reduce costs for patients. ()	

44) Are there any issues or emerging issues which you which you believe should be a focus for improvement activity in primary care?

_____

_____

_____

_____

_____

45) Do you have any final comments on improving approaches to quality improvement in primary care, particularly for areas you consider complex?

_____

_____

_____

_____

_____

Page Break

You have reached the end of the survey. Thank you again for your time and response. Your participation in this research is greatly appreciated.

If you have any questions or if you would like a copy of the (anonymised and aggregated) responses, please email me.

Please also consider sharing the link to this survey to other GP colleagues in your networks. Chloe Mercer. chloe.mercer@outlook.com

End of Block: Block 4

Appendix 5
Email accompanying survey

Dear General Practitioner,

Re: Request for General Practitioners (GPs) to participate in a one-off survey.

GP engagement in Quality Improvement (QI) is essential for it to be effective. Engagement may be increased through ensuring that QI approaches used reflect both the complexity of health at an individual and population level, and the dynamics of the environment that GPs work in.

This research uses a survey method and aims to use a complexity theory lens to;

· Understand GP perspectives on target or-goal based QI approaches being used in primary care settings.
· Understand if there are unintended consequences of target or goal-based QI approaches in primary care settings.
· Understand if current approaches to QI in primary care may be augmented by using a complexity theory framework.

This research project is being undertaken to fulfil the requirements of the qualification 'Master of Quality Systems', through the School of Food and Advanced Technology, Massey University, New Zealand. This research is for academic purposed and is independent of any health organisation.

Please consider participating in this research by completing the survey linked in this correspondence below.
I also ask and encourage you to forward this request to GP colleagues who are working in Primary Care in New Zealand.

The Survey

The survey should take around 12 to 20 minutes to complete. It can be completed on any device, but you will get a better experience on a larger screen. There are five sections, and a total of 45 questions.

Please click on this link to complete the survey. Or go to this URL https://massey.au1.qualtrics.com/jfe/form/SV_6yDAGxeeHefQjSl

Ethics Statement

Massey University Ethics Notification Number 4000020464: This project has been evaluated by peer review and judged to be low risk. Consequently it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director (Research Ethics), email humanethics@massey.ac.nz.

Anonymity of data

The anonymity of individual respondents, and related organisations will be preserved, and results will be presented in an aggregated form only. If you have any questions or if you would like a copy of the (anonymised and aggregated) responses, please email me.

This survey will close on 31 May 2019.

Chloe Mercer
Chloe.mercer@outlook.com

Appendix 6
Ethics approval

Date: 11 January 2019

Dear Chloe Newton

Re: Ethics Notification - **4000020464** - **Accepting complexity, creating order: Using complexity theory to understand current quality improvement approaches in primary care, and to design interventions for the future.**

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our system which is reported in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:
"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director - Ethics, telephone 06 3569099 ext 85271, email humanethics@massey.ac.nz."

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand **T** 06 350 5573; 06 350 5575 **F** 06 355 7973
E humanethics@massey.ac.nz **W** http://humanethics.massey.ac.nz

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)