Developing Model-Based Theories: Improving the Quality of Conversations About How To Implement New Health Innovations

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Abstract

While there are many models of what would constitute effective health practice, the 'theories' that people use to implement them are less well articulated. However, those charged with designing the implementation programmes for these models of health practice have internal mental models that comprise their 'theories of change' and which guide their actions. System Dynamics is a powerful tool to develop explicit representations of these theories.

This study uses in-depth interviews with seven clinical, management and policy leaders within the New Zealand health sector to develop a 'theory of change' which is then described using system dynamics. The study uses cognitive mapping to elicit the key components of the 'expert' theories by analysing both the individual maps and a composite map developed by combining data from all seven interviews. A thematic analysis is conducted of this composite map and the resulting themes are used to inform the development of a system dynamics model. The system dynamics model highlights the key causal connections within the map, projections of how they evolve over time and the key modifiable variables that affect the future pathway.

This paper describes in detail the development of one core component of that model, engagement and is part of a larger research effort which aims to develop a fully quantified system dynamics model that explores the dynamics of change in the implementation of chronic care management programmes.

INTRODUCTION

While chronic disease is viewed by some as the 'healthcare challenge of this century' (WHO, 2005) and academics and practitioners around the world extol the virtues of chronic care management (Rea et al. 2007), we are still a long way from understanding how to design and implement the system that will deliver the care that so many say is necessary, if the worst fears about the 'burden of chronic conditions' are to be avoided. Whilst the components needed in such systems are well articulated (Wagner et al. 2001, Bodenheimer, Lorig, Holman and Grumbach, 2002), the theories that inform how these components are implemented are largely absent in any formal sense. They are there however, in the mental models held by those who develop the policies, supply the funding and manage the implementation of such programmes. These people generally have very strong views about what is needed to successfully implement such programmes.

The prime purpose of this study is to stand back from the theories about chronic care management and elicit the 'theories of change' as espoused by seven experts who are active at a senior level within the New Zealand Health sector. What do they say about the design and implementation of chronic care programmes, and what things need to be considered when designing and implementing them? The aim is to develop a model-based theory of implementation; specifically, a theory that can provide insight into the dynamics involved in implementing new innovations within the New Zealand Health sector.

Creswell defines a theory as, "…an interrelated set of constructs (or variables) formed into propositions, or hypotheses, that specify the relationship among variables… [which]...helps explain (or predict) phenomena that occur in the world (Creswell, 2009, p 51). This description of a theory is not too different from that of model, "…a representation of relationships between and among variables" (Cavana, Delahaye and Sekaran, 2001, p 91). The description is in fact so close that Cavana et al. note that they use the terms 'theoretical framework' and 'model' interchangeably. It is surprising therefore, that models have not been used more widely, at least not in the social sciences, in the development and discussion of theory. As Sastry (1997) points out, this reliance on purely qualitative descriptions means that, "…too often, the causal structures of the theories are not fully specified and that theoretical frameworks and empirical results are not well integrated" (Sastry, 1997, p237). To address this Sastry uses System Dynamics (SD) to explore, "…an existing theory in detail, formalizing it to investigate how well the theory accounts for the phenomena its authors set out to explain." More recently Schwaninger and Grosser (2008) argue that theories developed using formal models "…have the potential to be stronger – in terms of both robustness and reach – than theories without this property, which are largely based on implicit mental models" (Schwaninger and Grosser, p449). In both cases the arguments for the use of models in theory development is that models provide an explicit and testable tool for describing the variables in the theory and the relationships between them.

Building upon this idea this paper elicits the 'implicit mental models' about the requirements for successful implementation of programmes for chronic care management held by senior managers and policy makers working in the New Zealand health sector. In doing so it aims to develop a formal model of change that can help describe the key variables and their relationships involved in successful implementation of innovations.

MODEL-BASED THEORY DEVELOPMENT

Sastry (1997) provides a detailed description of the use of SD to examine an existing theory, Tushman and Romanelli's theory of punctuated change (Tushman and Romanelli, 1985). In doing so she found out, early in the process, that the theory was incomplete; some aspects being irrelevant to a causal theory and others involving multidimensional constructs e.g. 'strategic orientation', with components that included such things as values, beliefs and markets yet not providing any information about how these components interacted and evolved over time, thus making it difficult for anyone who wished to use the theory to develop their organisations 'strategic orientation. Even if one was convinced of its importance in change, the theory provides little help in bringing it about. In formalising the theory using SD Sastry finds that there were discrepancies between model behaviour and what the theory proposes; discrepant behaviour which she argues results from gaps in the theory. By adding elements to the theory, which took account of the fit between the organisation and the environment, Sastry was able to eliminate the discrepancies and in doing so was able to enrich the original theory and test its ability to bring about successful 'strategic orientation, under a range of environmental shifts.

What Sastry's paper shows was that the use of SD to examine an existing theory can help to assess, "…how well the theory accounts for the phenomena its authors set out to explain" (Sastry, 1997, p237). Furthermore, the model provided the insights needed to develop the theory further, adding components that were not in the existing theory but which were shown to be needed if the behaviour the authors sought to explain were to be brought about.

Within health the 'theories of change' tend to be 'end-state' theories i.e. theories about effective practice that if implemented would bring about improvements in health outcomes. The Chronic Care Management (CCM) model developed by Edward Wagner, (Wagner, Austin and Korff, 1996) is one such model. Wagner's CCM model provides a comprehensive description of what is required if care is to be effective for people with chronic conditions. The model describes a number of key elements, such as effective self management, placed within a complex interacting system comprising the patients and their family, the practice providing the care, the broader health system and the community within which the practice and the patient lives. It is well researched, grounded in good clinical practice, and is being increasingly adopted around the world.

Despite the overwhelming evidence for the value of the CCM model and its elements, implementation is highly variable. In some practices some elements are implemented while others are not. In others nothing has been adopted from the model, while in a few number of cases there has been a comprehensive attempt to implement the model fully. Improving care for people with chronic conditions is a major challenge for health systems around the world and in New Zealand it has been given high priority for a number of years. The challenge is how to get health providers to adopt a model that requires major changes to current practices and roles, and provides benefits that often can only be measured in years rather than weeks and months.

While Wagner's CCM model is well documented and well researched, theories about how to implement the model and make it a reality are largely non-existent, except in the implicit mental models of those charged with developing the polices to implement such programmes. This paper describes work undertaken to make these mental models

explicit and then formalise them into a SD model to test whether or not they are capable of bringing about the changes desired. The purpose is to build an understanding of implementation requirements, based on the expert judgements of senior clinicians and planners currently working within the New Zealand health system.

CHRONIC DISEASE AND ITS MANAGEMENT

While modern medicine has developed more and more sophisticated therapies, the living conditions of those the profession treats has changed remarkably. The result of these changing conditions is a host of new chronic conditions that are not so amenable to the wonders of medical science. The World Health Organisation (WHO) refers to chronic conditions as the 'healthcare challenge of this century' highlighting the enormous personal and social costs of chronic conditions.

"The great epidemics of tomorrow are unlikely to resemble those that have previously swept the world, thanks to progress in infectious disease control. While the risk of outbreaks, such as a new influenza pandemic, will require constant vigilance, it is the "invisible" epidemics of heart disease, stroke, diabetes, cancer and other chronic conditions that for the foreseeable future will take the greatest toll in deaths and disability" (World Health Organisation 2005 p. vii).

Even though 'advanced' countries have made progress in some areas, reducing the death rates from heart disease, for example, by around 50% over the last fifty years, other chronic conditions, such as diabetes, have risen dramatically so that chronic conditions now account for approximately 60% of the world's disease burden (World Health Organisation 2005 p. 39). Cardiovascular disease (CVD) alone accounts for 10% of the global disease burden. The social costs of this burden are horrific. Not only do chronic conditions contribute to an early death, with over 45% of chronic conditions deaths occurring prematurely, but also to disabilities, often lasting for decades of a person's life. As the health of the world improves and fewer people are dying from infectious disease, the awful, and ironic consequence is that many are now living long enough to develop chronic conditions. People may be living longer, but for many it is a life of suffering.

New Zealand is not immune from this situation. While there is a need to develop better data on the overall costs of chronic conditions, data on specific chronic conditions are alarming (National Health Committee, 2007). The direct costs of strokes are estimated to be around $150 million a year; the total financial costs of arthritis are estimated to be $2.35 million; asthma costs the country over $800 million per year and patients with diabetes generate hospital costs that are around 2.5 times greater than someone without diabetes. In terms of overall financial impact we do know that chronic conditions in New Zealand are the leading cause of hospitalisations, use 70% of health funds, and account for 80% of all deaths (National Health Committee, 2007, p112).

In designing responses to these challenges one of the most influential writers has been Edward Wagner, from the McColl Institute for Health Care Innovation (Wagner 2000, Wagner et al. 1996, Bodenheimer et al 2002a & 2002b). His CCM model has provided the inspiration for a number of programmes providing care for people with chronic conditions in New Zealand (Wellingham, Tracey, Rea and Gribben, 2003). Along with the Flinders Model (Flinders Model of Chronic Condition Self-Management 2006), which focuses on tools to assist in self management, the work of Edward Wagner is central to both the research and practice of providing care for people with long term

conditions. The CCM model has also been adopted by the World Health Organisation (Epping-Jordan, Pruitt, Bengoa and Wagner, 2004).

[insert figure 1]

The model developed by Edward Wagner views the health system, not as an isolated system with all it needs to tackle health problems, but as part of a larger community. Within this model the effective provision of services for people with chronic conditions requires that the health system is closely linked with the necessary resources available within the local community. With the development of this model the boundaries between health and social policy become blurred (Milstein, 2008). The effective management of chronic conditions is no longer simply a matter of the provision of health services. It requires a close link between health services and the broader community within which these services sit (Wagner, Davis, Schaefer, Korff and Austin, 1999). The role of the health system is to provide the leadership, incentives and resources to help health service providers' change. Together these two foundations support the, "…development of both informed, activated patients and prepared, proactive professional practice teams" (Wagner, et al 1999). It is this interaction that assures the service delivery mechanisms that deliver improved outcomes.

Implementing Models of Chronic Disease Management

Since the development of this model there have been a number of reviews exploring how the model has been implemented. None have been able to point to practices or broader health systems that have successfully implemented the whole model. In many ways this is not surprising, in that the model calls for a major redesign of the health delivery system, internally through process change and externally through a critique of what constitutes the boundary of concern. To be successful each system not only has to reconsider what they do, but also reconsider who they do it with.

While there are many initiatives undertaken to implement such programmes, without an overarching model of implementation to compliment the formal model of practice, these initiatives are informed by the internal and implicit mental models of the policy makers and managers charged with getting them up and running. But what are these mental models and how do they influence the programmes that are finally implemented?

The next section describes the mental models of seven senior health professionals, all of whom are familiar with contemporary thinking about effective chronic disease management and are actively involved in developing policy to support the implementation of such programmes or actively involved in the design and management of such programmes.

DEVELOPING MODEL-BASED THEORIES

Overview of Approach

This work focused on developing an in-depth understanding of the views of seven people who are actively involved, at a senior level, in the design and implementation of initiatives to improve that care for people with chronic conditions. The seven people

interviewed were all involved at a national and regional level and four were also practicing clinicians, who combined their clinical practice with involvement in policy at both national and regional levels. The question that formed the basis of the interview was; "What are the key issues that you consider to be important in the effective implementation of chronic care programmes?" When completed and tested the cognitive maps developed from the interviews were analysed using a cluster analysis to tease out what each person considered to be important factors involved in successful implementation. A thematic analysis was then conducted on these clusters to capture the main themes across all seven interviews. Using a consolidated map containing all the constructs, and their linkages, from each interview maps were developed for each theme. It was these thematic maps incorporating the thinking of all seven interviewees' that were then used to develop the SD model. Figure 2 provides a schematic representation of this process.

[insert figure 2]

Initial Interviews

The interviews were structured using the cognitive mapping method, developed by Eden (1988). Cognitive mapping is a visual mapping technique used to elicit peoples' description of a situation and/or issue; why it is the way they see it and why it is important to them. The interview process teases out the key ideas – termed constructs – related to the interview focus and through the use of unidirectional arrows depicts the line of argument. Thus meaning "…is not deduced from a semantic analysis but rather from the context of the construct – what it explains (consequences) and what explains it (causes)". (Eden, 1994, p 264). Cognitive maps also have an additional advantage in that by laying out the interviewees responses in the form of a visual map the interpretation of meaning is made explicit, can be tested and therefore changed. To ensure that my interpretation of what was said in the initial interviews reflected what the interviewee was in fact trying to say, all people were interviewed twice. In the second interview we discussed the cognitive map that was developed in the first interview, allowing it to be tested and refined. In all cases, the second interview led to further additions to the map, elements they thought were not covered, or not covered in enough detail. It was rare to have any of the constructs in the first version deleted. In most cases the second interview provided the opportunity for a richer, more detailed discussion of key ideas. In all there were seven cognitive maps developed. An example of a cognitive map developed in these initial interviews is shown in figure 3.

[insert figure 3]

Thematic Analysis

The cognitive maps were all inputted into 'Decision Explorer', a software tool developed by Eden to display and analyse cognitive maps. Individual maps ranged in size from 25 to 53 constructs and the analysis of the links between the constructs was undertaken using a centrality analysis (Eden, 1994, p313). Centrality analysis highlights how central a construct is and, "…indicates the richness of meaning of each particular construct" (ibid, p 313), by calculating the number of in-arrows (causes) and out-arrows (consequences) from each construct. To ensure that the wider context of the construct is

taken into account successive layers, or domains, are considered, that is, not just the constructs to which it is immediately linked, but also those that are further removed. Those that are further removed are given a diminishing weight i.e. those that are directly connected to the construct are given a weight of 1. Those that link into them, i.e. level two, are given a score of 0.5. Those that link into them, i.e. level three, are given a score of 0.25.

Centrality analysis isolates core constructs and provides a method for developing a summary, or overview, of the total map which highlights the constructs that have a significant importance to the interviewee. Exploring a map in this way reveals what the interviewee considers important and what their line of argument is. It also uncovers the context within which the central idea sits, how it link to other items and the meaning it has for the interviewee. The use of cognitive maps begins to describe the causal theories of the interviewee, not just the factors considered important.

Each of the interviewees had a centrality analysis conducted on their individual maps to ascertain those constructs that had a central position in their thinking. The top 5 constructs for each person are shown below. The scoring on the right hand side shows the number of constructs the central one was connected to and the score itself reflects the distance of each of those constructs from the central construct as described at the beginning of this section. So, a centrality score of '15 from 26 constructs' means that the central construct is linked to 26 other constructs, down to level three, and adding up the scores, using the method described above, provides a score of 15. The results of this analysis are shown in table 1.

Interviewee	Central Constructs	Centrality Score
01	Develops the engagement of providers	15 from 26 constructs
	Generates provider understanding of the gap between what is and what should be	14 from 17 constructs
	Stimulates providers to ask questions about the gap in performance	12 from 24 constructs
	Develops a clear definition of the problem well supported by the data	11 from 23 constructs
	Helps to increase understanding of what is needed to understand the problem	10 from 22 constructs
02	Support practices to do the right things around the evidence	15 from 26 constructs
	Have data on key process measures where we know those processes lead to clinical outcomes	12 from 24 constructs
	Collect data to let us know whether or not we are doing better	11 from 23 constructs
	Pay more attention to getting the patient engaged and activated	11 from 21 constructs
	Practices able to use data to see how they compare	10 from 21 constructs
03	There are now a wider range of stakeholders, including	7 from 13 constructs

	community and consumers	
	The problem definition often shifts over time	7 from 13 constructs
	Engage people in the conversation	7 from 11 constructs
	Develop team-based care in a primary setting	6 from 13 constructs
	Develop a consensus that we would want to work together	6 from 11 constructs
04	Define your units of community	13 from 22 constructs
	Budget holding	13 from 22 constructs
	The community would hold all the budget	12 from 26 constructs
	It is a community problem, therefore it has to be a community solution	10 from 17 constructs
	Establish clinical governance for health and provision	9 from 20 constructs
05	Improve the provider, patient relationship	18 from 31 constructs
	We need multiple things to happen…one lever	17 from 31 constructs
	Change driven by the provider	13 from 30 constructs
	Change driven by the patient	13 from 30 constructs
	Effective management of LTCs may buy time	13 from 26 constructs
06	Clinical leaders work with practices to troubleshoot some of the issues	15 from 29 constructs
	Increased confidence and skills to make the change	13 from 27 constructs
	Able to target particular practices	11 from 23 constructs
	Develop strong partnership between DHB and PHO clinical leaders	10 from 19 constructs
	Programme not seen as being forced upon the practice	10 from 23 constructs
07	Attention is diverted away from the important stuff	14 from 26 constructs
	Develop a coherent model of care	12 from 23 constructs
	The Ministry of Health needs to highlight priorities that are not implemented	11 from 21 constructs
	We need to focus less on services, such as wellness checks, that are not delivering much value	10 from 25 constructs
	Provide evidence that the process of change will deliver outcomes	10 from 21 constructs

Table 1: Results of Centrality Analysis

The centrality analysis enabled the authors to distil the key ideas from each of the seven interviewees. The 35 key constructs that emerged from this process were then coded, using the steps for conducting a content analysis outlined in Cavana et al, 2001, resulting in the emergence of seven key themes.

A check was done to see if any significant change in themes would occur if a greater number of constructs were included. To do this a further centrality analysis was done to include the top 7 constructs for each person, giving a total of 49 in all. When this analysis was done there were no new themes emerging. The only change was a slightly higher score for the theme of clinical leadership.

The themes and their scoring under the two options are show below:

Theme	Scoring of top 5	Scoring of top 7
Problem definition	6	8
Engagement	5	7
Provider Performance	5	7
System Change	5	6
Clinical Leadership	4	6
Collaborative planning and programme design	4	6
Models of Care	3	6

Table 2: Key Themes Arising out of the Centrality Analysis

Having now obtained the key themes from the initial interviews, the next step was to combine the data into an overall composite model that captured the constructs and their connections across all seven interviews.

Development of Composite Maps

A major benefit of utilising the decision explore software is that it makes it possible to manage large amounts of qualitative data in a structured way. The first step was to combine all the individual maps into one overall composite map. This produced a map with 258 distinct constructs. The second step was to go through each of the 258 constructs and code them into one or more of the seven themes. Maps were then created for each of the themes and each map was reviewed to merge constructs where their meaning was the same. This work is still underway and consolidated maps have been completed for the themes of ‘problem definition’ and ‘engagement’. The merging of constructs that has occurred during this process has reduced the number of distinct

constructs to 222. This will decrease further as consolidated maps are developed for the other five themes.

These consolidated maps provided the elements from which a system dynamic model was built to explore how, for example, engagement could be developed over time and how changes in the levels of engagement could affect the other six themes and how together they could improve the care for people with chronic conditions. The themes become the equivalent of sectors within the System Dynamics Model. The rest of this paper focuses on the theme of 'engagement'

Coding the constructs within the combined model and merging duplicate constructs resulted in 30 distinct variables within the 'engagement map'. In drawing this 'engagement map' a number of clusters, i.e. constructs linked together, emerged. The map is shown in figure 4. The cluster on the left side of the map contains factors that refer to the contracting model. The next cluster along contains factors that relate to collaborative planning and programme design, while to the right of that is a cluster relating to community involvement. The boundaries between the clusters are drawn with a dotted line to acknowledge that fact that there is overlap, with some constructs able to be included in more than one cluster. While the boundaries are permeable they do highlight the four sub-themes that the experts interviewed consider important within the theme of engagement. Furthermore, the nature of the cognitive map highlights the causal links between those elements and how together they affect engagement in a number of different areas.

[insert Figure 4]

As stated at the beginning of this paper the aim is to develop an understanding of the key components in a 'theory of change' about the implementation of programmes for the care of people with chronic conditions. Thematic analysis of the individual maps revealed seven key themes and the cognitive map shown in figure 4 begins to unravel what the interviewees understand by one of those themes - engagement - and what the factors are that contribute to its development. The cognitive map in figure 4 highlights that engagement is a complex construct, and it is not surprising that, despite overall support for the CCM model amongst funders and providers it has been difficult to develop widespread and consistent engagement. The 'theory' being proposed by the seven 'experts' and documented in the engagement map (figure 4) argues that to develop the engagement needed by the CCM model requires that service providers are involved in the initial stages of the programme design, that the contracting model is supportive of the structures and behaviours required by the CCM model, that there is a focus on engaging the patients in the programme and finally that there is close contact with the community. It is clear that in the minds of these 'experts' engagement is a complex system problem that will not be solved by simply selling the benefits of the CCM programme, or even by presenting the evidence base in support of it. It will require something more comprehensive and systemic. To gain a more operational picture of what this 'something' is, the next step was to develop a SD model, based on the 'engagement map' to explore whether or not it could be used to articulate a plausible theory of engagement.

DEVELOPING THE SD MODEL

What the cognitive mapping has shown is that engagement is a complex construct and, in the minds of the seven health experts interviewed has at least four key dimensions; contracting model, collaborative involvement in planning and programme design, the engagement of patients and the involvement of the community. To

The advantage of beginning the modelling process with the development of cognitive maps is that it forces a conversation about meaning. In the literature 'engagement' is often mentioned as a key factor in the success of implementing new programmes in health. However, what actually constitutes engagement, or how it is developed is rarely discussed and one can easily end up developing a model of engagement that has little to do with the reality on the ground. As Eden (1994) mentions cognitive mapping is a tool that can be very useful in helping decide what to model.

It is about problem-structuring processes that give assurance we have not focused too early on one definition of the system rather than another. It is about understanding and managing the complexity of problem definition. In the end, it ***is*** *about reducing the risk of finding the right solution to the wrong problem.* (Eden, 1994, p257)

To develop a more formal model I have based my approach on the work of Anjali Sastry from the University of Michigan who used SD to develop a model of organisational change (Sastry, 1997). In that work Sastry undertakes a detailed analysis of an influential paper on organisation change, (Tuschman and Romanelli, 1985). She takes a modelling approach because:

"Despite the important theoretical and practical implications of understanding organisational change, the organisational processes involved in transformational change have not been fully explored. Critics of the existing research argue that, too often, the causal structures of the theories are not fully specified and theoretical frameworks and empirical results are not well integrated" (Sastry, 1997, p237)

Modelling provides a powerful tool to assist in exploring the causal structures and in integrating theory with empirical data. In this work the model is based not on a published theory of change but on the mental models of experts in the field. These mental models have been captured using cognitive mapping. The cognitive maps, which contain assertions about causal relationships, are often supported in the interview data with detailed descriptions of specific examples and predictions of what would result from their 'causal theory of change'. Thus, the interview data and the cognitive maps that have been developed from them help define constructs such as 'engagement', how the elements within that construct influence another and how they are likely to evolve over time depending on the causal relationships between them.

Using the same structure for analysing the qualitative data as Sastry, table 2 shows examples of the statements that have been used in formulating the dynamic model.

Summary of Coding Categories

Name	Definition	Structure/Relationship	Dynamic Behaviour
Name of the	Definition of the variable	Descriptions of how the	Pattern of the variables

variable		variable affects other variables and/or how it is affected by others	evolution over time
Contracting Model	Refers to the contracting and funding models used to pay providers for their involvement in CCM programmes.	"The lack of a shared budget means it disintegrates at the slightest change"	"building trust between the doctor and the nurse"
Collaborative planning and programme design	Refers to the collaboration between national and regional planners and those who provide the health services	"I think there is a lot of value in working together with groups to actually come up with agreed elements to a program" "I don't think there has been as much grass-roots input into the process of how we would change"	"…by the time you get the necessary DHB people involved and then you have one or two lead GPs that tends to be it. The impact of that in terms of the wider sector is nothing"
Engagement of patients	Refers to patients taking an active role in their own care	"That they have heaps of other priorities in their life, other than their own personal health; that actually, family commitments are more important than this particular thing; that when I hold down two jobs and work 16 hours a day, I don't actually have time for much else."	"Patient engagement is hard to maintain over time…after 6 months it tends to drop off drastically" "If a patient is engaged they are more likely to adhere to the treatment recommendations" "…they take their drugs"
Community involvement	Refers to the involvement of family, whanau and community organisations in supporting patients in caring for their own health	"Well I start with the perspective that this is a community problem and unless the solution is community driven, it is not going to work"	"If it's community driven we increase the chances that people take responsibility for their own care; self management improves"

Table 3: Summary of Coding Categories

Supporting Conversations – One Step at a Time

To develop the SD model, the interview material that describes the structure and the dynamics of behaviour that result from that structure is used. While the interviews do not provide any empirical data they do provide detailed qualitative descriptions that can be represented formally in a SD model. Wherever possible the qualitative descriptions have been supplemented with empirical data to provide parameter values for the constants and initial conditions for the state variables.

As the purpose of these models is to make explicit the internal 'theories' of experts in the field and to support conversations, the model is built up one step at a time, thus allowing the story of engagement to unfold in line with the key themes that emerged out

of the interviews. Experience in using models in a policy setting indicates that it is important that those using the model have a clear understanding of how the structure of the model drives the behaviour the model produces (Kenealy and Rees et al. 2011). Building up the engagement model by the sequential addition of 'micro-models' enables the user to develop an increasing complex understanding of engagement and what increased engagement will deliver. These micro models are described below.

Provider Performance: The starting point used for the model is the challenge of improving provider performance so that it better matches the behaviours needed to support people with chronic conditions; the focus of the interviews was on what would be required for this to occur. A central idea expressed by the experts was that when providers perceive a gap between their own performance and the performance standards specified by the programme, efforts are made to close that gap; "Seeing the gap in their own performance provides a momentum to change". Starting from this building block an initial model can be developed.

While this is a very simple structure starting the model in this way is important in that it focuses on the idea that 'engagement' has within it the concept of performance. Engagement, in the eyes of those interviewed does not equate to a verbal statement about the attitudes of providers to the programme but an active involvement in trying to improve their own practice in line with the aspirations of the programme. Engagement has a purpose and in this case it is improving the performance of providers.

[insert figure 5]

In this initial model key variables that influences performance are i) the gap between the goals set by the programme and the providers goals and ii) the 'time required to change performance'. The initial value for practice performance is 0.6. This has been taken from a major study of the quality of primary care that found that only around 60% or practices deliver optimal care as defined by agreed clinical guidelines and protocols (Asch et al 2006).

The modifiable variables of interest highlighted by this formulation of the model are:

i. The goals set by the practice
ii. The time it takes a practice to change

Collaborative Planning and Programme Design: If 'Model #1' provides the focus, the sub-themes become the key factors that can help bring about improved performance. Model #2 focuses on a key sub-theme within engagement i.e. that the performance targets set by the programme are more likely to be seen as important and worth striving for if those who are required to achieve them have been involved in developing them, This is the sub-theme described above as 'collaborative planning and programme design'; "I think there is a lot of value in working together with groups to actually come up with agreed elements to a programme". Furthermore, there is a view that this has not happened in many programmes; "I don't think there has been as much grass-roots input into the process of how we would change" The consequence of this is that as the programme develops, those who were involved in the initial design become the minority as they leave and new General Practitioners (GPs) within the practice become involved. As they have not been involved in that initial design and had no part in agreeing to the performance standards they, potentially, have less belief in the importance of them; "…

by the time you get the necessary DHB [District Health Board] people involved and then you have one or two lead GPs that tends to be it." This behaviour may then impact upon the simple model shown above and create another level of complexity in which the desire to achieve the performance targets is mediated by the providers involvement in the design of them. This is shown in figure 6.

[insert figure 6]

In this case the initial improvement effort, driven by the gap between practice performance and agreed performance targets, starts to decline as new GPs become involved while those who were initially involved move on. This is simulated by incorporating a 'avg time of GP in practice', which 'kicks in' as those involved initially lose touch with programme developments and new GPs, who were not involved, enter the programme with a lower level of understanding and agreement about the performance standards. As a result, the efforts to close the gap between practice performance and the performance of their peers on the programme performance standards decline. This dynamic corresponds to a common behaviour seen in programme establishment – initial enthusiasm and improvement followed by inertia and possible decline in performance. To replicate the pattern that was often expressed during the interviews a lookup function was used that incorporates high levels of involvement in the first year, dropping off drastically to zero in years two to five of the simulation. With this additional theme, the modifiable variables of importance now become the:

i. goals set by the practice
ii. time it takes a practice to change
iii. involvement of the practice in the development of the programme and the programme improvement targets
iv. turnover within the practice and the balance between those who were actively engaged in the initial planning and design and those whose involvement has come later

Patient Engagement: A major sub-theme was that of patient engagement; "we need to pay more attention to getting the patient engaged and activated" This was important because when patients were engaged they, "adhere better to the treatment recommendations, medication, diet…" Patient engagement, through its effect on adherence is a major factor limiting how far a practice could improve. Regardless of how enthused the providers are, unless that enthusiasm and commitment can be transferred to the patient, improvement is going to be limited. To simulate this, the model incorporates adherence into a function that affects 'change in practice performance.

Community Involvement: Closely linked to patient engagement is 'community involvement. What came through strongly in the interviews was a view that unless the patient lived within a supportive family and/or community their ability to sustain their commitment to an ongoing programme of medications and lifestyle changes was severely limited. So, alongside patient engagement is the importance of community involvement in helping develop and maintain adherence. The model focuses on adherence as the key factor affecting improved performance and both patient engagement and community involvement are important factors helping to develop and maintain it.

[insert figure 7]

With the addition of patient engagement and community involvement, the modifiable variables of importance now become the:

i. goals set by the practice
ii. time it takes a practice to change
iii. involvement of the practice in the development of the programme and the programme improvement targets
iv. turnover within the practice and the balance between those who were actively engaged in the initial planning and design and those whose involvement has come later.
v. Practices to improve patient engagement
vi. Community and family/whanau support

Contracting Model: The final sub-theme is that of the contracting model. The argument is that the model used to fund practices involved in the programme needs to support a team approach. In contrast a CCM programme, because it requires a number of different interventions has to, "pull together people who are all working under different employment contracts and different employers". In most cases there is no change to the contracting model with the result is that it is difficult to develop shared goals and aspirations, delaying the development of 'Agreement on performance Elements' and limiting how far that agreement can develop. In the model the quality of the contracting model modifies the effect of involvement in 'planning and programme design', by limiting the development of agreement.

[insert figure 8]

With the addition of the contracting model, the modifiable variables of importance now become the:

i. goals set by the practice
ii. time it takes a practice to change
iii. involvement of the practice in the development of the programme and the programme improvement targets
iv. turnover within the practice and the balance between those who were actively engaged in the initial planning and design and those whose involvement has come later.
v. practices to improve patient engagement
vi. community and family/whanau support
vii. contracting model

SIMULATION RUNS

The purpose of the initial simulation runs has been to test the impact of each of the factors within the engagement theme on provider performance. In what way and by how much do they affect performance and is the behaviour plausible. Finally, does the model structure and the model outputs contribute to a richer conversation about implementation. The following examples illustrate the outputs and the implementation issues they are raising. GP turnover, while having an impact upon the level of agreement that can be reached has a bigger impact upon the time that the agreement will remain in force. As 'GP turnover' increases, the quicker the agreement erodes.

[insert figure 9]

In contrast the impact of the 'contracting model' is largely to make it more difficult to develop that agreement; the less supportive the contracting model the longer it takes to start developing agreement on the performance elements.

[insert figure 10]

Ongoing collaborative involvement has a significant impact, allowing agreement to develop over time while negating the impact of GP turnover, ensuring that as new people arrive they are involved in the ongoing development of the programme.

[insert figure 11]

DISCUSSION

What this work has tried to do is illustrate how the thinking of experts in the field of planning and implementing chronic care models can be used to develop a theory of change. While the CCM model of Edward Wager describes, in detail, the components of what constitutes good chronic care, little is known about how to implement this programme successfully.

In this paper we have described the process by which individual interviews were analysed using cognitive mapping and how key themes were identified. By creating a composite map these themes were explored in more detail, providing the information needed to develop a more operational description that provides the basis for the change theory. While this paper focuses only one theme, engagement, it does highlight how the views of experts can be used to inform the development of a more comprehensive plan of implementation that takes account of the key causal dynamics.

Engagement, in the minds of these experts is a complex construct in which a number of variables interact in self-supporting ways. Exploring engagement in more detail, using SD modelling, begins to show not just that the variables do interact but how and what the consequences of that interaction are. As such the simulation model begins to provide a mechanism to test thinking and to explore the consequence of different interventions strategies. The aim is not to develop predictive models but to develop models that help increase understanding of the dynamics involved in implementing chronic care programmes and provide a mechanism to test thinking about implementation. As one writer puts it:

"…computer models faithfully demonstrate the implications of our assumptions and information. They force us to see the implications, true or false, wise or foolish, of the assumptions we have made. It is not so much that we want to believe everything that the computer tells us, but that we want a tool to confront us with the implications of what we think we know" (Botkin, 1977).

At this stage the SD model has not been validated nor has it been tested against empirical evidence. It makes no claims to providing a valid depiction of how the theory of engagement, proposed by the experts would in fact play out. It does however highlight some of the key components involved in engagement and provides a plausible

picture of how these variables might interact and perform over time. The model provides a tool to structure and extend the conversation about engagement, the factors that impact it and strategies that could be used to develop it. At this stage the model is just 'one voice in the conversation' no more or less valid than any other.

The work described in this paper describes the foundation for developing a comprehensive and valid mode of implementation within the New Zealand health sector. Current work involves developing the model structure further to take account of the other themes and secondly to refine and validate the size of impact of the casual connections being developed in the simulation model. The aim is to develop a model that reflects the rich understanding of practitioners involved in the design and implementation of chronic care programmes. Its purpose is to provide insight into what will be required if 'best practice care', as embodied in the work of Wagner and others is to become more widespread.

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Figure 1: Wagner's CCM Model

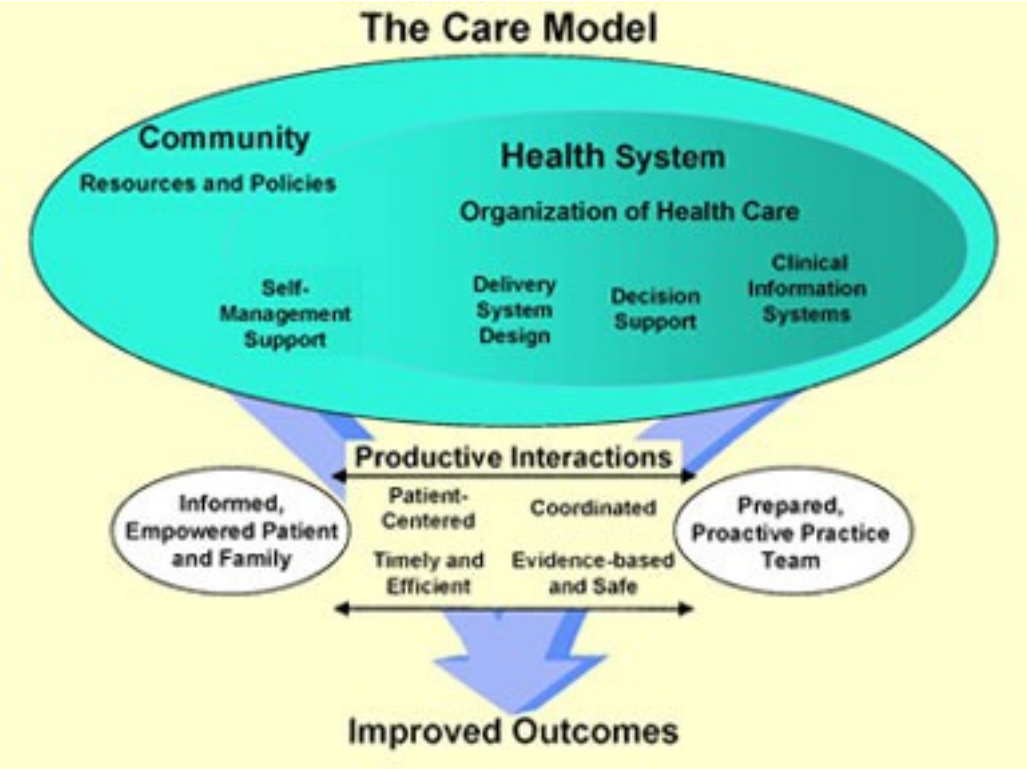


Figure 2: Translating Qualitative Data into SD Models – Overview

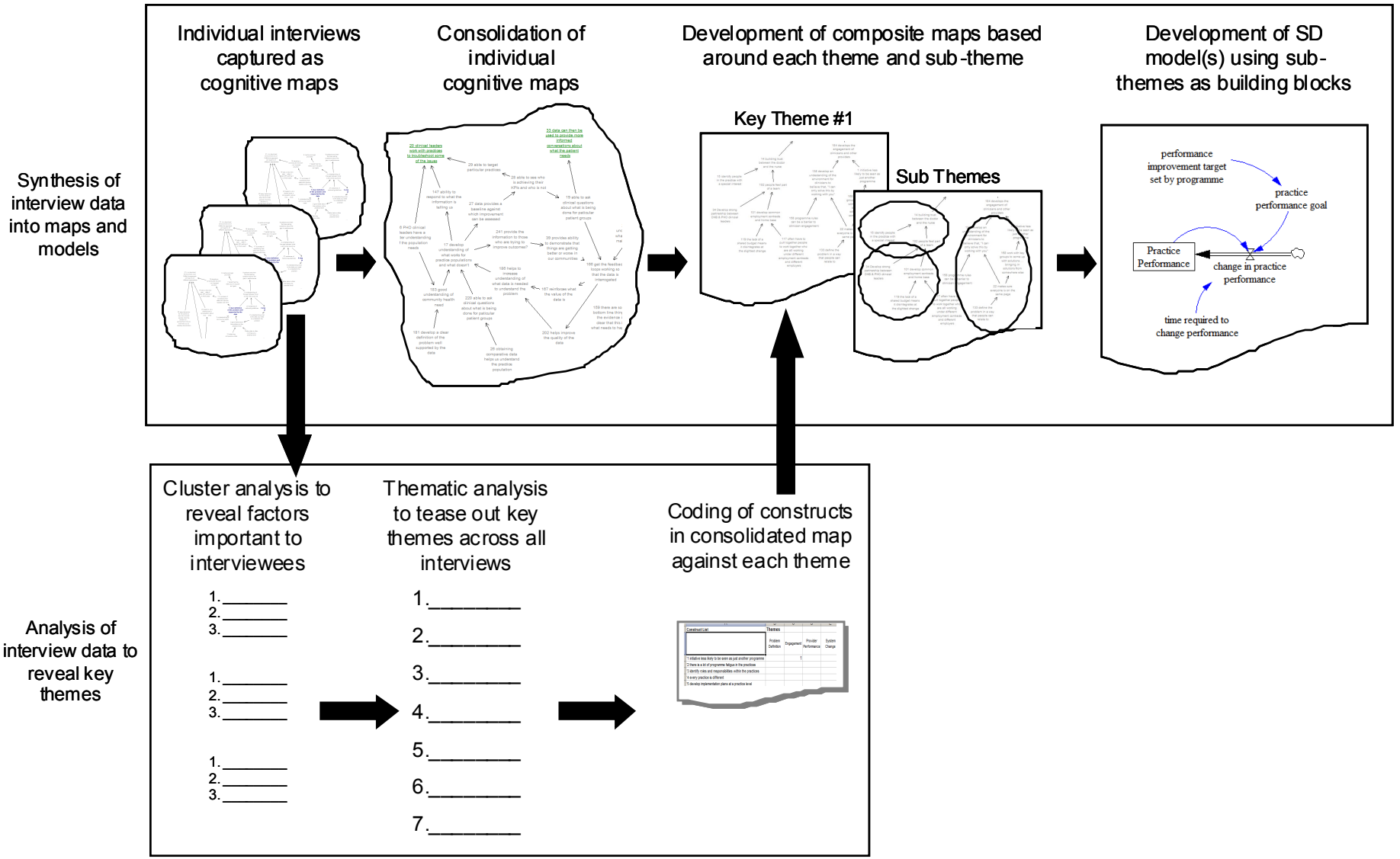


Figure 3: Example of a Causal Map Developed in the Initial Interviews

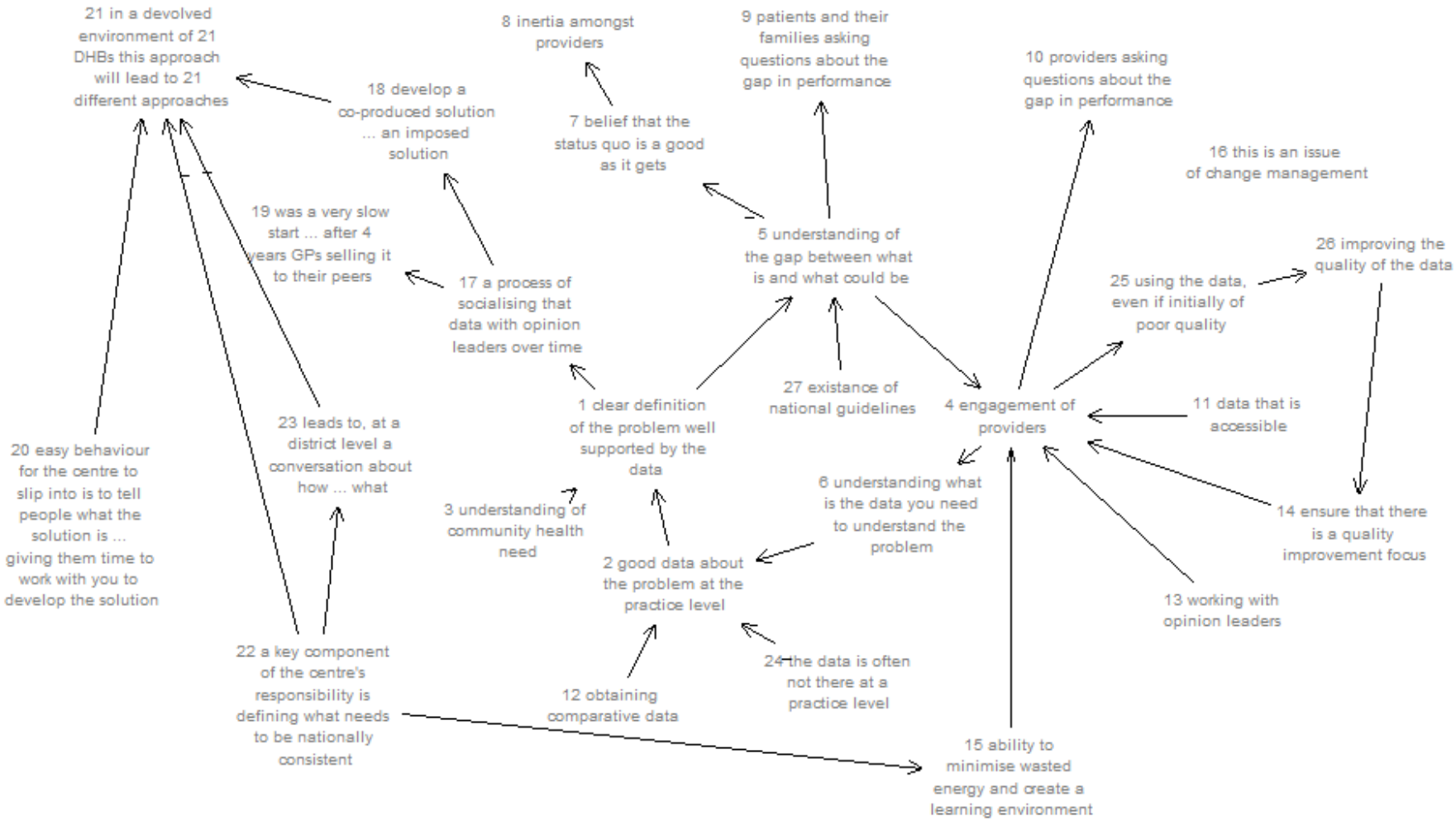


Figure 4: Composite Map – Engagement

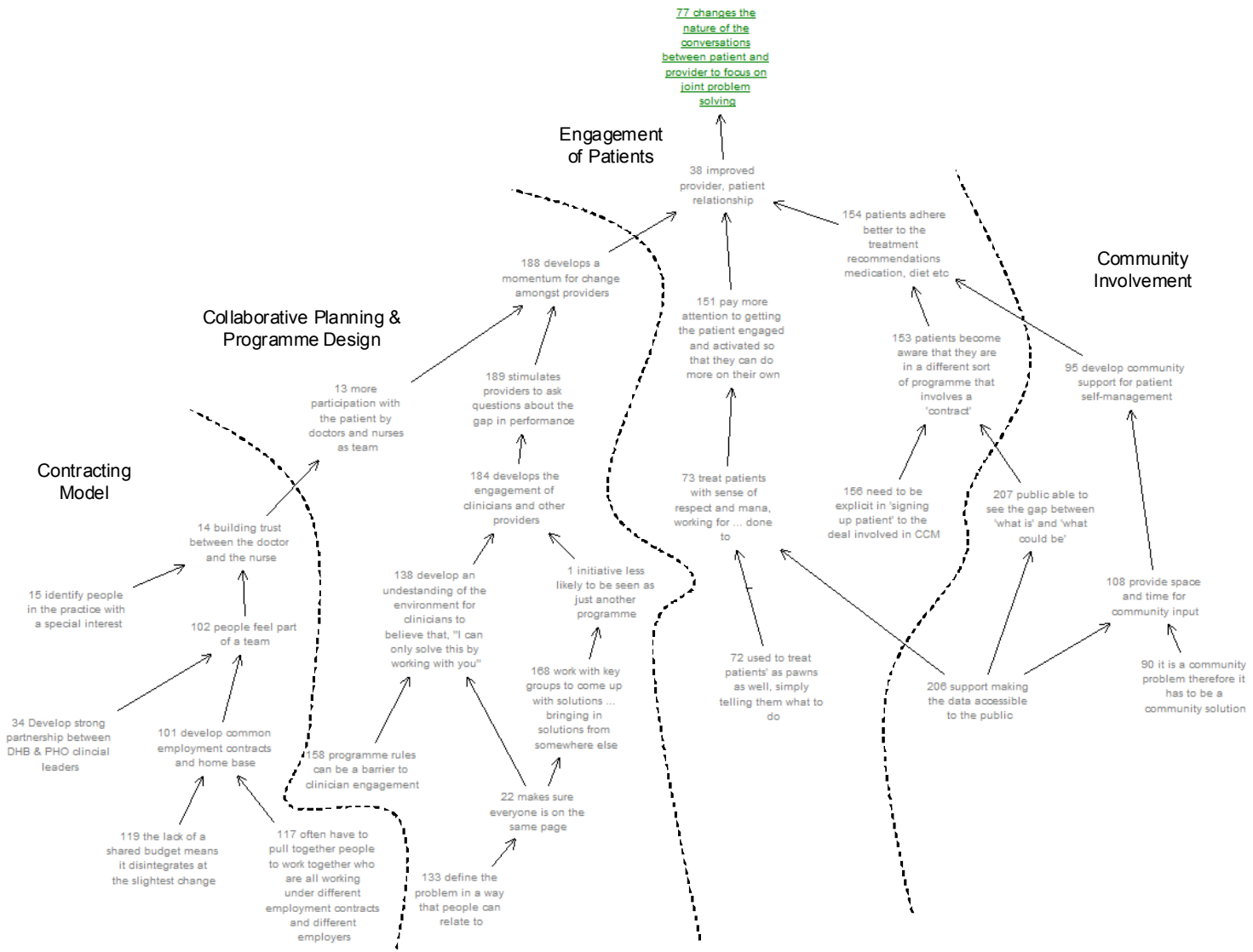


Figure 5: Model 1 - Practice Performance

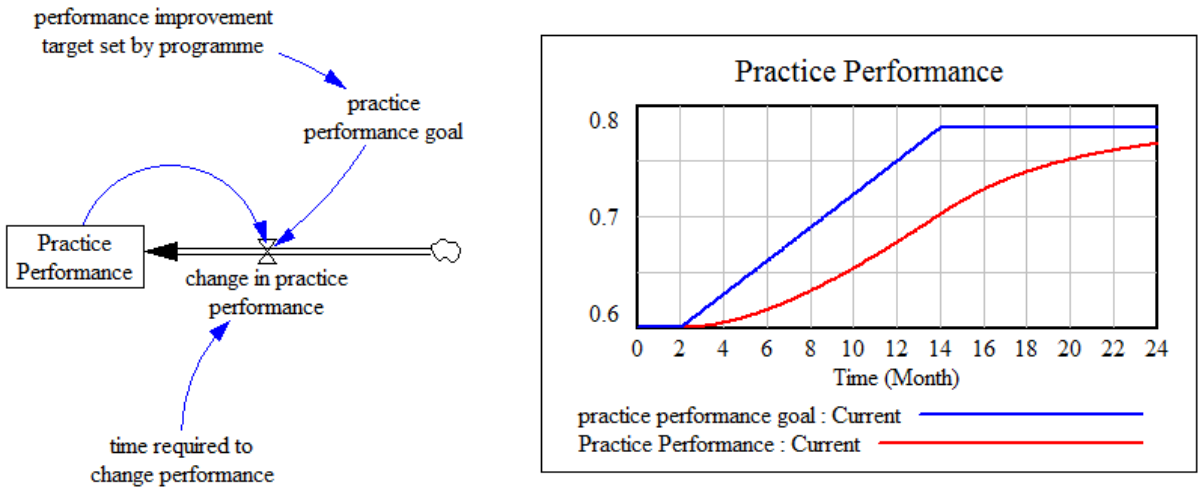
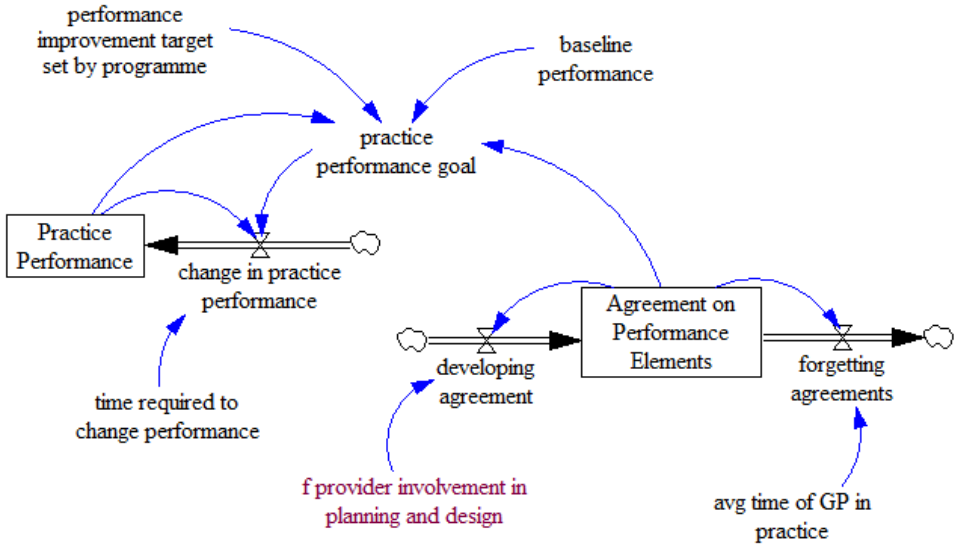


Figure 6: Collaborative Planning & Programme Design



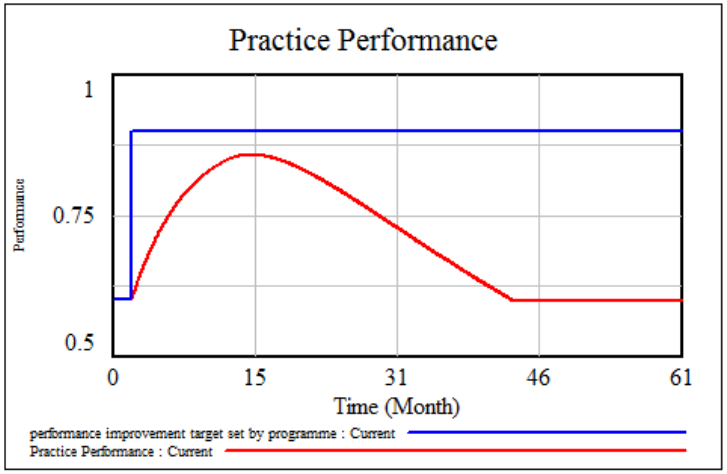
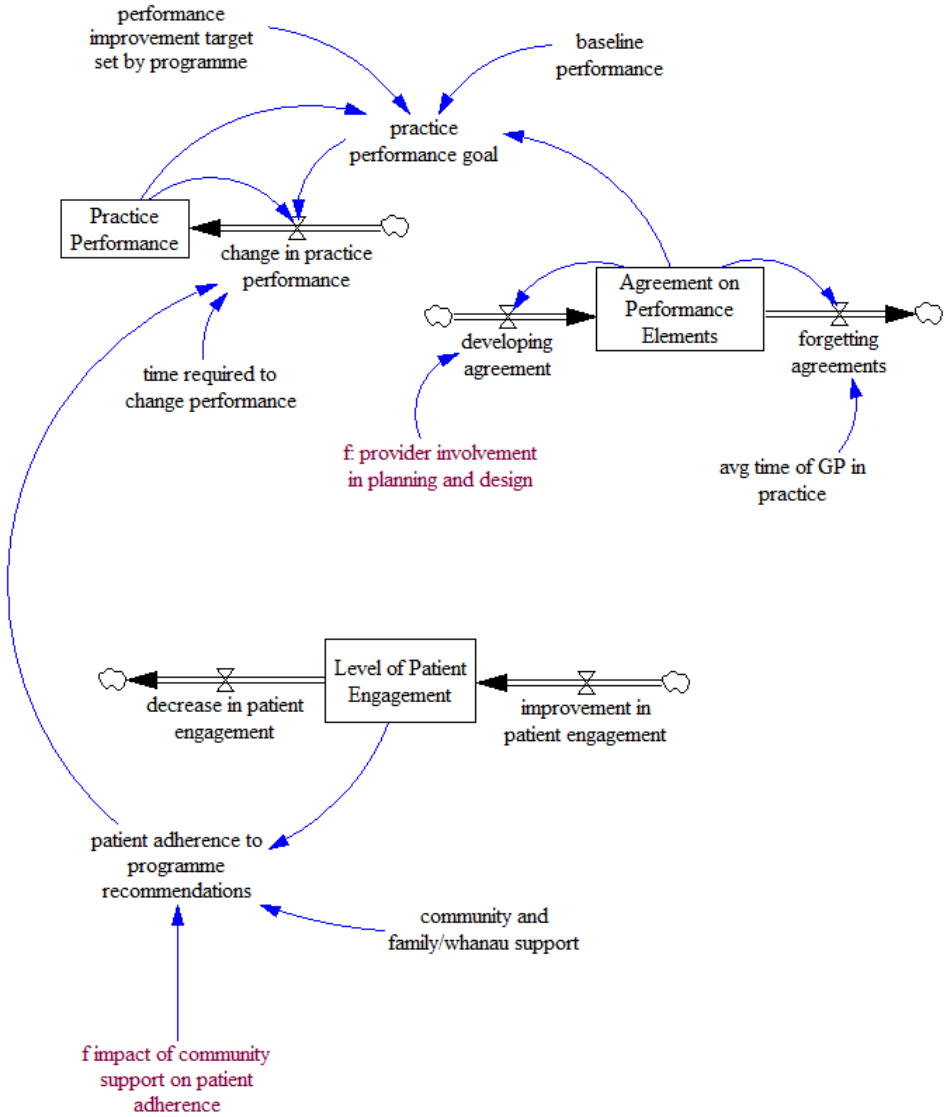


Figure 7: Patient Engagement and Community Involvement



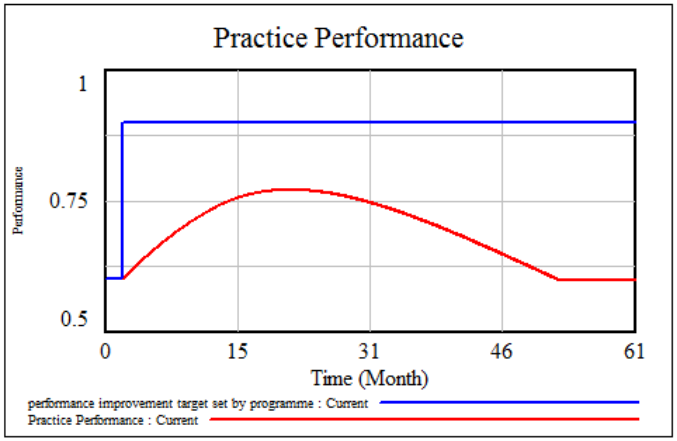
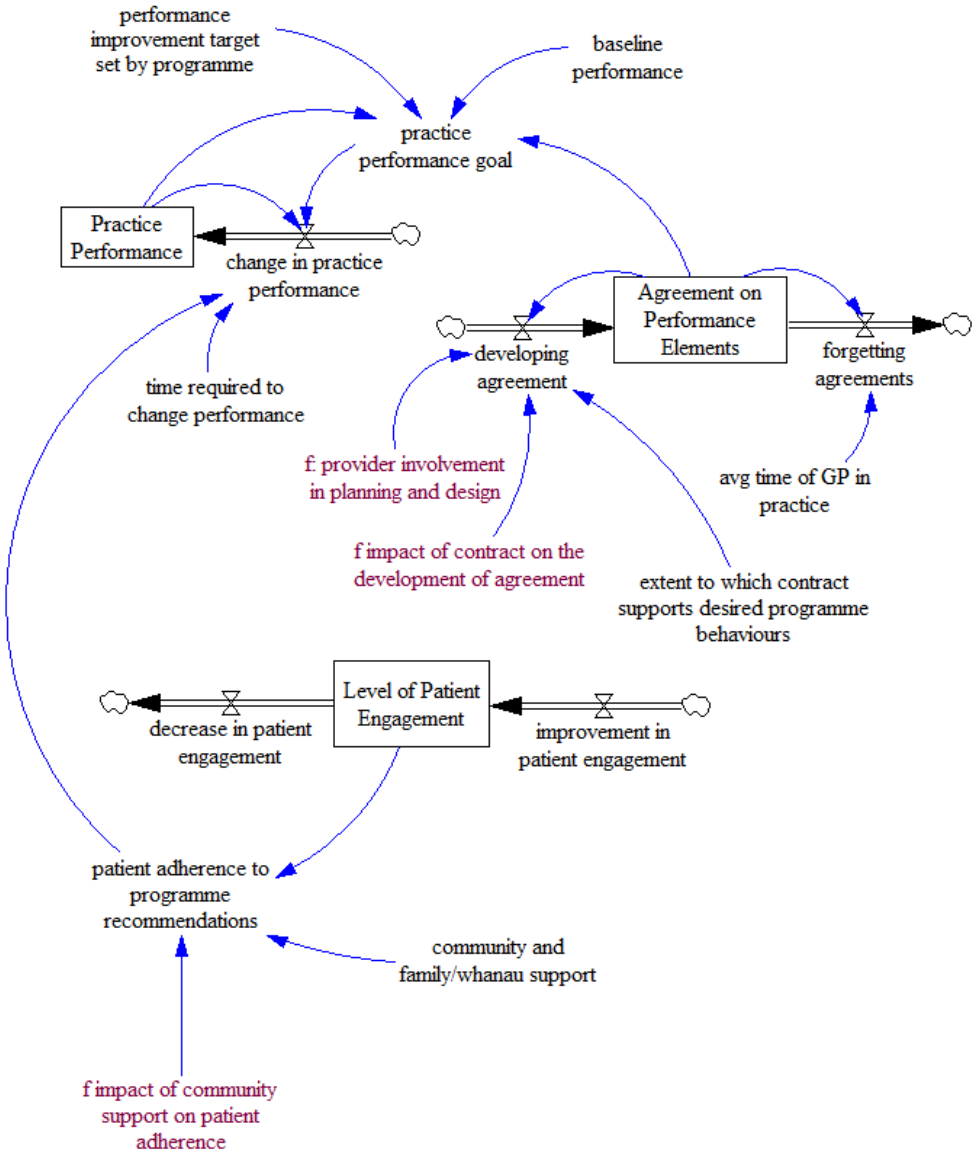


Figure 8: Contracting Model



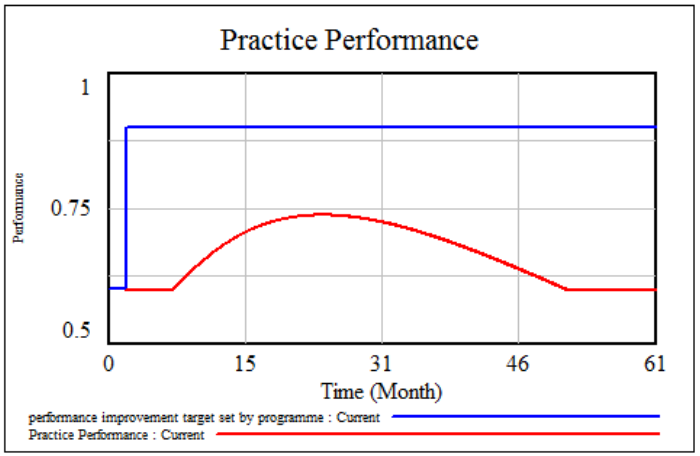


Figure 9: GP Turnover

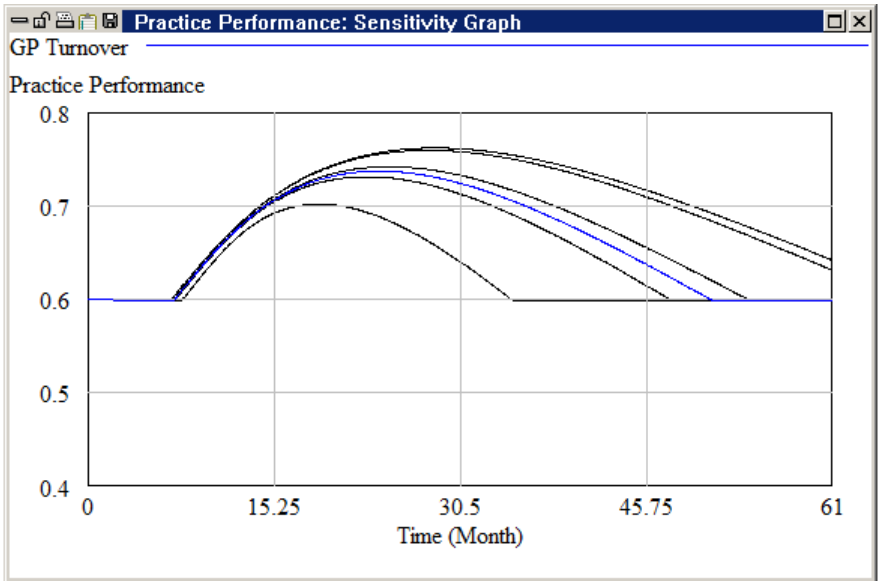


Figure 10: Contracting Model

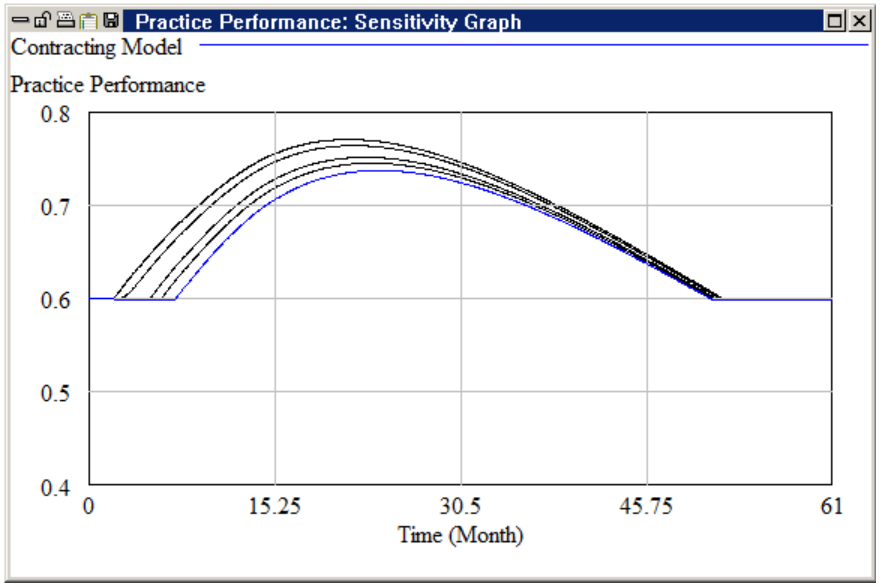


Figure 11: Ongoing Collaborative Involvement