Using cognitive mapping and qualitative system dynamics to explore expert views on the requirements for successful implementation of chronic care management programmes

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Abstract

While chronic disease is viewed by some as the 'healthcare challenge of this century' and academics and practitioners around the world extol the virtues of chronic care management programmes, we are still a long way from fully specifying the causal connections that are needed to design and implement them successfully. Whilst the components needed in such systems of care are well articulated in the literature, it is less clear what the relationships between them are and it is unclear how those components can be implemented in a way that retains the integrity of the system they are a part of. The result is that despite strong clinical and management support, progress in implementing such programmes is slow. Where they do, they are only partially implemented and despite some success fall short of their original aspirations.

This study uses in-depth interviews with seven clinical, management and policy leaders within the New Zealand health system to develop a 'theory of change' which is then described using system dynamics. The study uses the cognitive mapping method 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. The cognitive maps are then used to inform the development of a causal loop diagram that depicts the key causal connections that are seen to be important in the implementation of such programmes and provides the basis for a simulation model. This paper describes in detail one core component of that model, engagement.

Over the last 15 years there has been a lot of research undertaken to understand the important components required to improve care for people with chronic conditions. The use of cognitive mapping and systems dynamics enables research to move from conceptual understanding of individual components to an operational understanding of the causal connections that influence whether or not they are implemented successfully.
It is hoped that this will enhance our current understanding of what constitutes effective chronic care management with an increased understanding of what is required to deliver it.

This study 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.
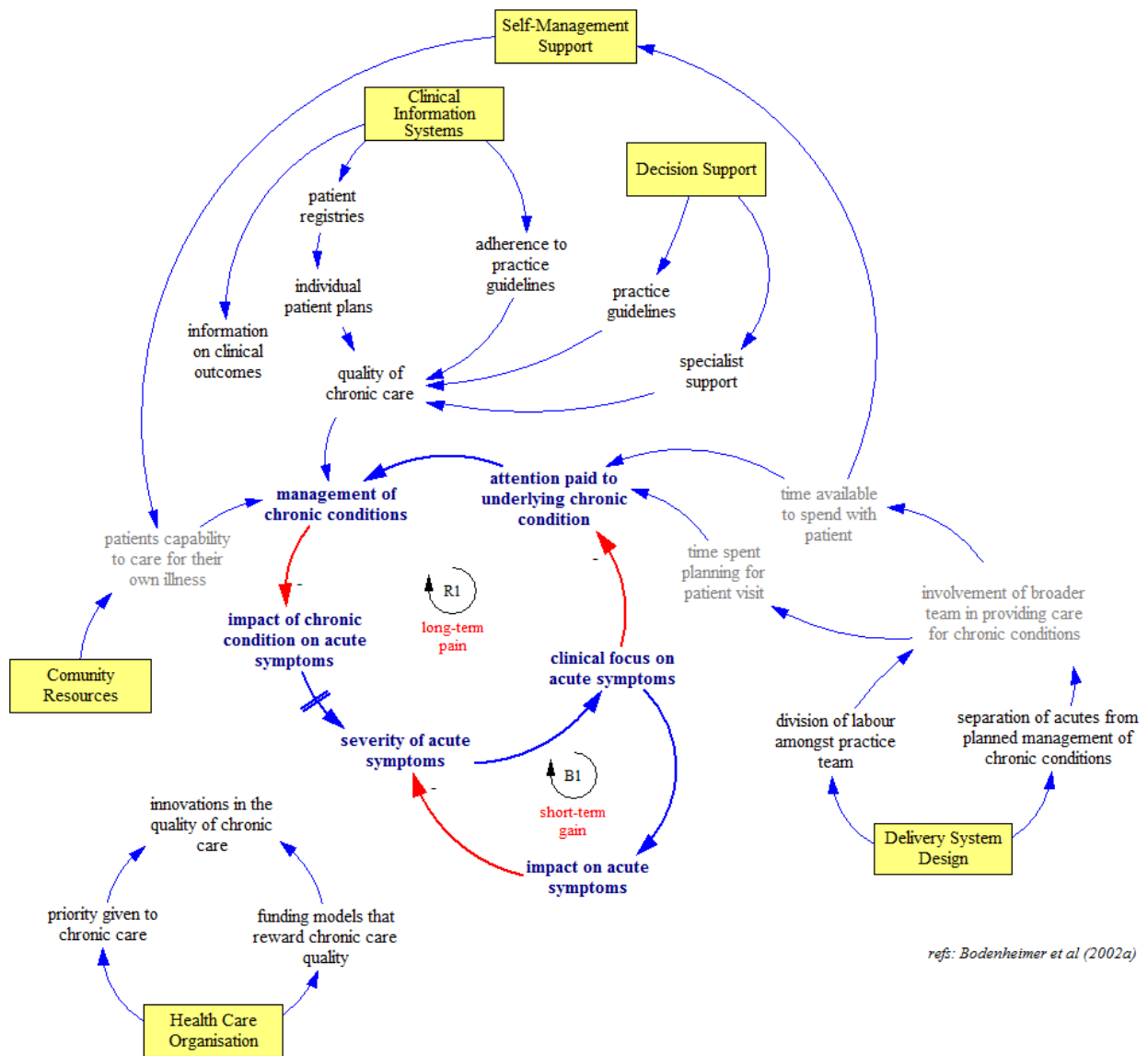
1. INTRODUCTION

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 et al, 2002a), the causal structures of the theories are not fully specified and it is unclear how those components can be implemented in a way that retains the integrity of the system they are a part of.

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, are such programmes even needed and if so what things need to be considered when designing and implementing them? The aim is to develop an understanding of some of the key components that such a theory would need to encompass. It is important therefore that this study elicits causal theories from the interviewees; their argument for why things are the way they are and what needs to happen if it is to change.

1.1 Moving Beyond Lists and Critical Success Factors: the Argument for a Systems Approach

To do this the study has to go beyond describing a list of factors. The reason for this is that such lists, while claiming to describe the universe they purport to represent are unable to do so in a way that makes the list useable; because the nature of lists aims at a description of discrete factors that, in reality are not discrete. For example, a recent comprehensive study of chronic conditions within New Zealand, (Connolly et al, 2010) has a list of 10 action areas. These action areas are described as "dimensions critical to effective chronic conditions management" (ibid, p 3). Action area 8 'delivery system design', for example, focuses on effective design of such programmes. This, the authors state, is based on Wagner's model of chronic care management (CCM), which provides a coherent framework for the design of programmes for the care of people with chronic conditions and is the most commonly used framework in New Zealand (Rea, ibid). Wagner's model however goes beyond action area 8 and encompasses a number of the other action areas described in the report; action areas 3, 5, 6 and 9. The ABCC study ignores these linkages, discussing each action area as a discrete area of focus. A causal map of Wagner's model, which highlights these linkages, is shown below. It was developed from a paper that described the reasons why care for chronic conditions is poor and the details of the key model components (Bodenheimer et al, 2002).

Self-Management Support

Clinical Information Systems

Decision Support

patient registries

adherence to practice guidelines

practice guidelines

individual patient plans

information on clinical outcomes

quality of chronic care

specialist support

time available to spend with patient

management of chronic conditions

attention paid to underlying chronic condition

patients capability to care for their own illness

time spent planning for patient visit

involvement of broader team in providing care for chronic conditions

Comunity Resources

impact of chronic condition on acute symptoms

R1

long-term pain

clinical focus on acute symptoms

severity of acute symptoms

B1

short-term gain

division of labour amongst practice team

separation of acutes from planned management of chronic conditions

innovations in the quality of chronic care

priority given to chronic care

funding models that reward chronic care quality

impact on acute symptoms

Delivery System Design

Health Care Organisation

refs: Bodenheimer et al (2002a)

Figure 1 Causal Map of the Wagner CCM Model

As the map shows, within Wagner's model, Self Management is dependent upon Delivery System Design and it makes no sense to talk of improving self management in the absence of delivery systems that can support it. Ignoring the links between key constructs undermines the integrity of Wagner's original thinking and ignores the research, upon which the model was built. What the map also shows is that the causal theory is far from complete and there is nothing that describes the link between 'Health Care Organisation' which supports 'innovations in the quality of chronic care' and the other 5 'pillars' of the CCM model. Furthermore, while each of the 6 'pillars' within the model is described, there is nothing, with the exception of the link between 'delivery system design and 'self management support', that describes the casual links that will ensure its implementation.

So, while the research by Connolly et al highlights many important factors known to be important in the care of people with chronic conditions, by placing little attention to the links

between those factors it undermines the ability, of anyone who wishes to, to successfully implement any of the factors on the list itself. By ignoring these interdependencies, lists are unable to move beyond description to explanation, which is a requirement of any information that is meant to inform practice (Argryris, 1996). It is unclear, in a list, how one is to bring about the consequences one is striving for. For information to be actionable in practice it;

"...should inform the users not only what is likely to happen under the specified conditions but how to create the conditions and actions in the first place. Otherwise the generalization is not actionable. For example, there is much research in the empirical literature on the relevance of trust in managing. However, there is little attention paid to informing the reader on how to create trust" (ibid, p. 392).

Lists therefore, do not possess any information about design causality; "...the specifications of actions to be taken (often in a specified sequence) to achieve the intended consequence." (ibid, p. 396). They also ignore context. In a manner consistent with much in the sciences lists assume a "...scheme of isolable units acting in one-way causality" (Bertalanffy, 1969, p45). They assume that somehow there is a direct and isolatable causal link between, for example, 'adherence to clinical guidelines' (action area 3) and improved care for people with chronic conditions. While it could be argued that clinical guidelines are necessary, they are not sufficient and they will only deliver improved care if they are combined with other necessary conditions that enable them to be taken up and integrated into the way care is delivered. As shown in figure 1, clinical guidelines affect the quality of chronic care. However, they will only improve the management of chronic conditions if there is a redesign of the clinical practice so that it supports the reallocation of resources needed to pay attention to the underlying chronic conditions, rather than simply focusing on the more immediate acute symptoms presented by the patient. Clinical guidelines are, along with every other action area on the ABCC study's list, what American philosopher E. A. Singer refers to as 'producers'. As described by Ackoff (Ackoff, 1981 pp 20-21), Singer differentiated between a 'producer-product' relationship and a 'cause-effect' relationship and;

"...the view of the universe revealed by viewing it in terms of producer-product is quite different from the view yielded by viewing in terms of cause-effect. Because a producer is only necessary and not sufficient for its product, it cannot provide a complete explanation of it. There are always other necessary conditions, co-producers of its product....These other necessary conditions taken collectively constitute the...environment." (ibid, p21).

It should be noted at this point, that this distinction can create some issues with language and shifting from discussing cause and effect relationships to producer and product relationships can overly complicate the writing and possibly confuse the reader. Therefore, although the terminology of cause and effect will be used throughout this paper, it is within the frame developed by Singer. There are very few 'effects' that result from single 'causes'. Context nearly always has a part to play and for a 'cause' to bring about a given 'effect' there will be additional necessary conditions that will determine whether or not it occurs. So, for example, if 'self management' is a 'producer', what are the additional conditions and co-producers required to bring about the desired outcome of clinical improvement for the person with the condition, that need managing? As Ackoff points out;

"...the use of the producer-product relationship requires the environment to explain everything whereas use of cause-effect requires the environment to explain nothing." (ibid, p21).

So, lists suffer a number of problems if the concern is to take action. Firstly, they create confusion in that items on a list that is concerned with action are rarely discrete; often overlapping and sometimes encompassing others. Secondly, by ignoring the links between them lists assume a single one-way model of causality that does not exist in the real world. Finally, any item in such a list is a 'producer', a necessary but not sufficient factor in bringing about the desired 'product' and therefore it is unlikely that any list item could be implemented in the absence of the necessary contextual or environmental factors.

1.2 Eliciting Causal Theories

To respond to this criticism of action lists this study aims to develop an initial 'theory of design' that as well as describing key factors affecting the implementation of chronic care programmes also provides insight into the causal relationships between the factors.

As chronic disease has become increasingly prevalent and initiatives to tackle it have increased there have been numerous efforts to evaluate their effectiveness both internationally (Singh 2005) and in New Zealand (Connolly et al 2010). Some evaluations have involved a comprehensive review of the literature (Singh, 2005), others have focused on descriptions of specific initiatives (Wagner, et al 1999), while others have focused on surveys of current practices (Connolly et al, 2010) to develop an understanding of what is happening in such programmes and how effective they are.

Because the concern here is to develop a deeper understanding of causality, this work focuses 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 such initiatives. The seven people interviewed are all involved at a national and regional level and four are also practicing clinicians, who combine 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 implementation of chronic care programmes?" The seven people interviewed were:

01	Primary care clinician and clinical advisor within the Ministry of Health
02	Primary care clinician, regional planner and manager of primary health services within a DHB
03	Senior planner within the Ministry of Health
04	Secondary clinician, senior academic and advisor on integrated care within a DHB
05	Senior planner within a DHB
06	Senior planner within a DHB
07	Primary care clinician and clinical advisor within the Ministry of Health

Table 1 Interviewee List

2. APPROACH

To overcome the limitations inherent in lists this study attempts to develop a more holistic view, by trying to gain a picture of the whole and its emergent properties, rather than focusing on discrete parts. That is, it tries to elicit the 'necessary conditions' needed for any given factor to have the effect it purports to have. The key steps in the approach are:

i.   Developing cognitive maps that reflect the thinking of key experts in the field
ii. Analysing individual maps to elicit key themes
iii. Combining the cognitive maps into one composite map to cluster the constructs within each theme
iv. Using the cognitive maps of each theme to develop initial causal maps
v.   Developing casual map further, converting them into stock/flow diagrams and simulation models.

This paper describes the initial outputs of steps i) and ii) and explore steps iii) to v) focusing on the theme of 'engagement'

2.1 Cognitive Mapping

Cognitive mapping, as developed by Eden, 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, using cognitive mapping, teases out the key ideas – termed constructs[1] – 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". (Eden, 1994, p 264). Cognitive maps, therefore, make explicit the additional conditions needed for the 'producer' to deliver the 'product'. 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.

2.2 Causal Loop Diagramming

Causal loops were developed from the analysis of the cognitive maps. Causal loop diagrams (CLDs) are an important tool as they help tease out the feedback loops that are present and feedback is an important concept within systems thinking, as it is a central mechanism in determining the dynamics of a system (Sterman, 2000 p 12). Feedback underpins some of the most puzzling behaviour we see in social and organisational systems and help us unravel why, despite strong support for the benefits of good chronic care management the system seems to 'push back' whenever major attempts are made to implement it:

"Mutual influence lies behind some of the most puzzling and problematic aspects of behaviour in organisational systems, such as their tendency to exhibit policy resistance (or to "bite back" when change is attempted).…" (Sastry, 2001, p 378)

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[1] The term 'construct' is synonymous with the term 'concept'. Cognitive mapping is based on 'Personal Construct Theory' developed by George Kelly in the 1950's and is the term most used by Eden himself. The software, developed by Eden to map and analyse the cognitive maps uses the term 'concept' In this thesis I will stick to the original term 'construc't when referring to the items within a cognitive map. This will enable me to differentiate them from 'concepts', which I will use when referring to items outside of the context of cognitive mapping.

The aim in developing the CLDs was to gain some insight into the key feedback loops at play and thereby potential points of intervention.

2.3 System Dynamics Simulation Modelling

While feedback has an important part to play in determining the behaviour of social and organisation systems it does not tell the full story

"…feedback alone cannot explain all counter-intuitive behaviour in social systems. Instead, the notion of dynamic complexity has been proposed to account for the pairing of feedback with temporal features that delay responses, add nonlinearities, and other wise complicate prediction, action and policy design." (Sastry, 2001 p 378).

System Dynamics modelling is an approach that specifically focuses on the temporal domain, helping elicit the dynamics that evolve over time in response to initial conditions and current feedback loops. In developing dynamic simulation models it is hoped to provide more insight into the factors that generate the 'push-back' we see in the response to policy initiatives designed to change health care delivery, and to identify more effective interventions strategies.

3. DEVELOPMENT OF INDIVIDUAL COGNITIVE MAPS

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 I developed and that enabled my understanding of what was said 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.

For example, figure 1 shows the cognitive map that emerged from the first interview with one of the participants. Figure 2 shows the cognitive map that emerged after the second interview; the most significant change being the development of a line of argument around the engagement of patients.

In all there were 7 cognitive maps developed and each one refined in a second meeting with the interviewee.
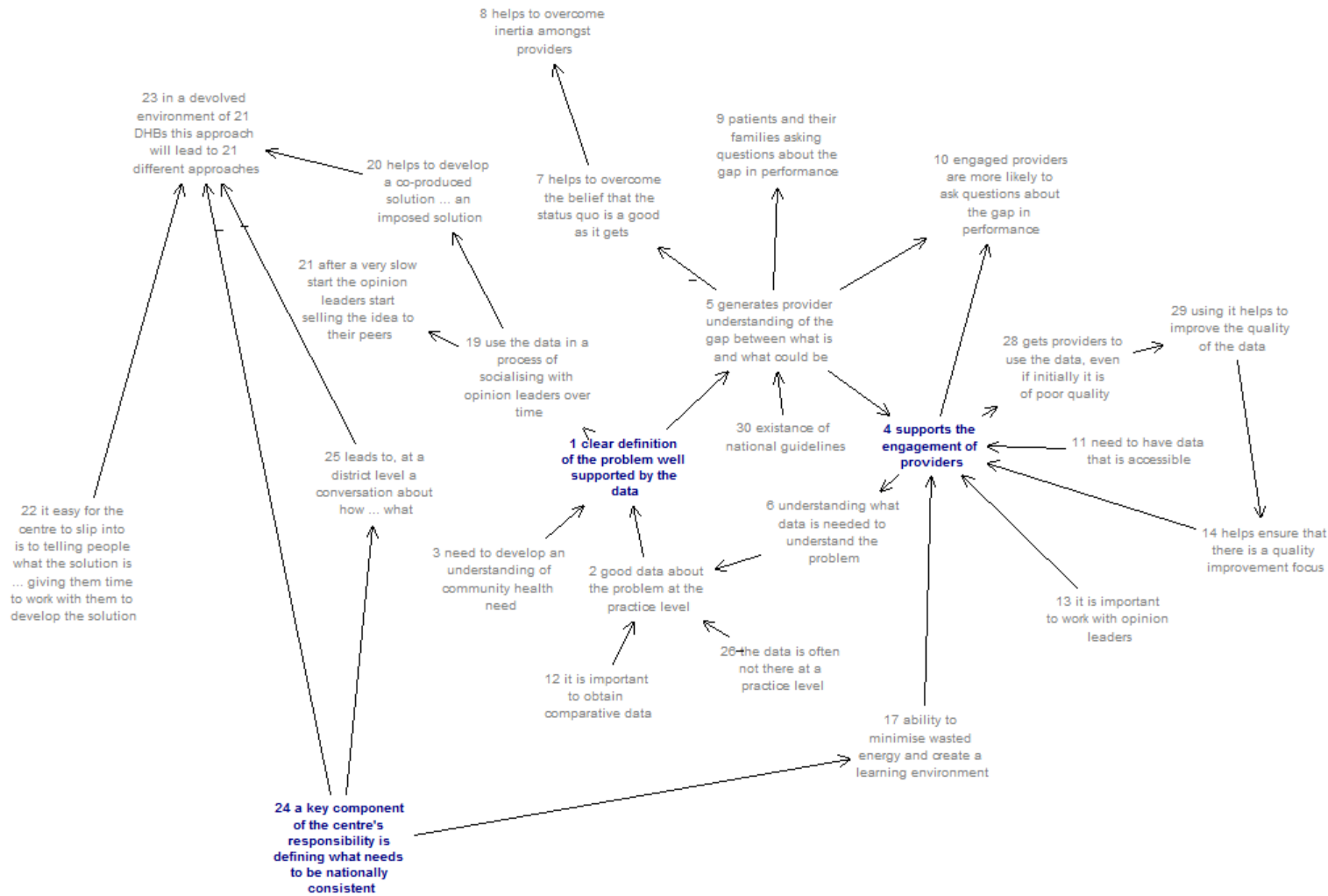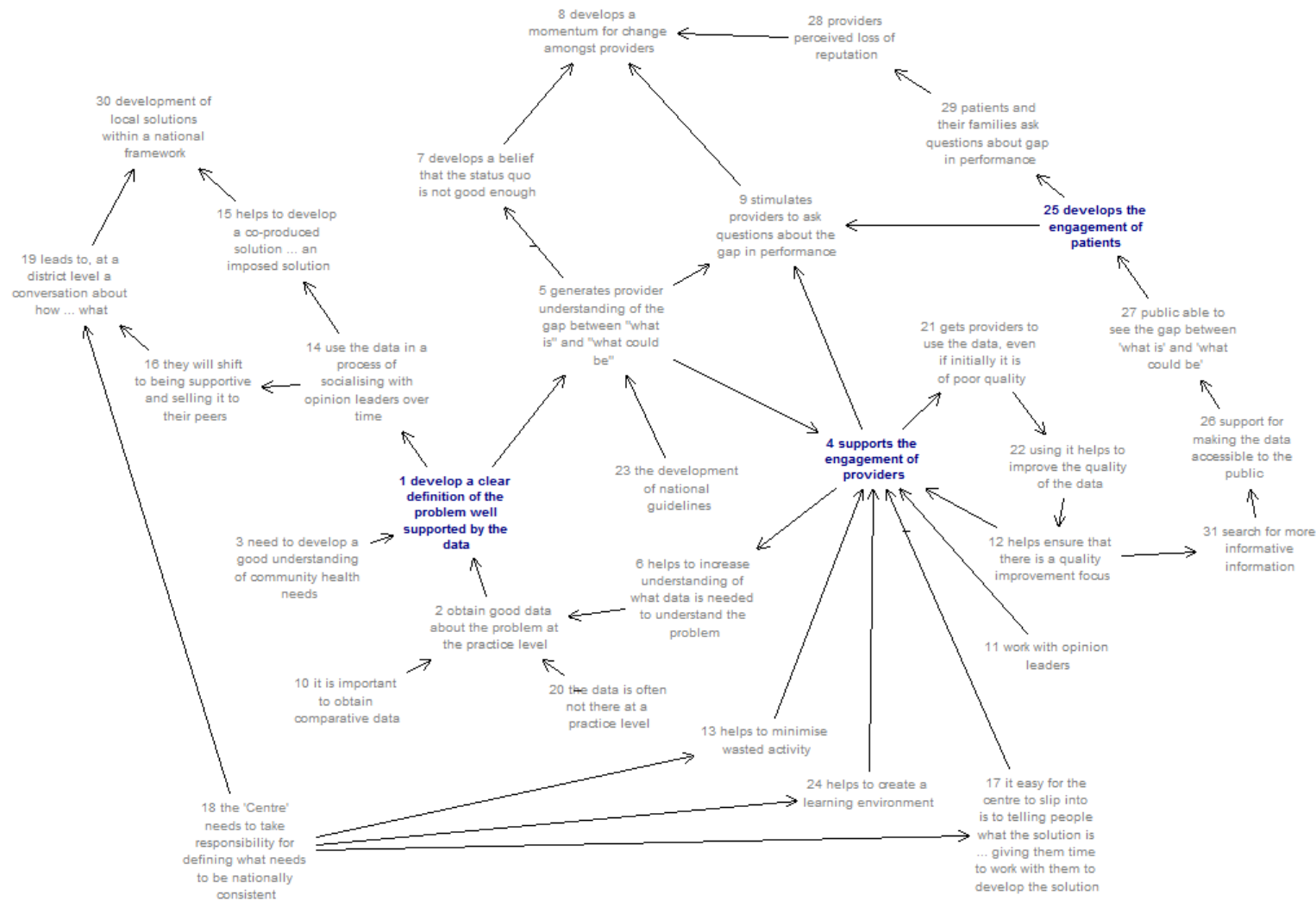
Figure 2: Cognitive Map from Interview #1

8 helps to overcome inertia amongst providers

23 in a devolved environment of 21 DHBs this approach will lead to 21 different approaches

20 helps to develop a co-produced solution ... an imposed solution

7 helps to overcome the belief that the status quo is a good as it gets

9 patients and their families asking questions about the gap in performance

10 engaged providers are more likely to ask questions about the gap in performance

21 after a very slow start the opinion leaders start selling the idea to their peers

29 using it helps to improve the quality of the data

19 use the data in a process of socialising with opinion leaders over time

5 generates provider understanding of the gap between what is and what could be

28 gets providers to use the data, even if initially it is of poor quality

25 leads to, at a district level a conversation about how ... what

1 clear definition of the problem well supported by the data

30 existance of national guidelines

4 supports the engagement of providers

11 need to have data that is accessible

22 it easy for the centre to slip into is to telling people what the solution is ... giving them time to work with them to develop the solution

6 understanding what data is needed to understand the problem

14 helps ensure that there is a quality improvement focus

3 need to develop an understanding of community health need

2 good data about the problem at the practice level

13 it is important to work with opinion leaders

12 it is important to obtain comparative data

26 the data is often not there at a practice level

17 ability to minimise wasted energy and create a learning environment

24 a key component of the centre's responsibility is defining what needs to be nationally consistent

Figure 3: Cognitive Map from Interview #2

4. ANALYSIS OF INDIVIDUAL INTERVIEWS

4.1 Centrality Analysis

The cognitive maps shown in figures 1 and 2, as well as those developed in the other 6 interviews were all inputted into 'Decision Explorer', a software tool developed by Colin Eden to display and analyse cognitive maps. Individual maps ranged in size from 25 to 53 constructs and are all shown in appendix 2. However, the number of constructs in any map reflects more the length of the interview and the scope of the discussion that it does of any complexity of ideas expressed by the person being interviewed (Colin Eden and Fran Ackerman et al, 1992, p312). So little, if anything, can be inferred from the difference in number of constructs in each interview. Of more importance are the links between them.

The analysis of those links was undertaken using a centrality analysis (ibid, 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. This is illustrated in figure 3 with an extract from one of the cognitive maps.
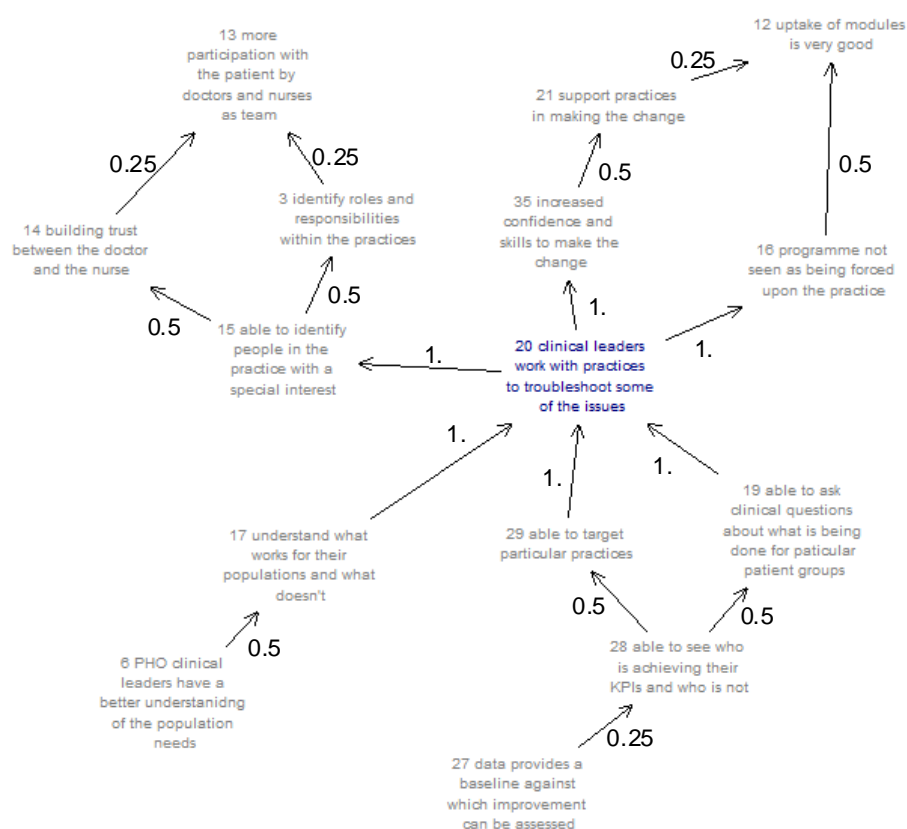

Figure 4: Structure of Centrality Analysis

In this example, the central construct is linked to 14 other constructs. Using the scores noted on the map the score given to this construct is 10.5. It is described has having a score of 10.5 from 14 constructs[2].

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. For example, in the domain analysis conducted on the map shown in figure 2 the following construct had the highest centrality score and thus was seen to be the most central construct; 'supports the engagement of providers' (construct 4).

When shown within the context of the map, figure 4, a much richer picture is revealed, in which other 'necessary conditions' are highlighted as well as the consequences of developing that engagement are shown.
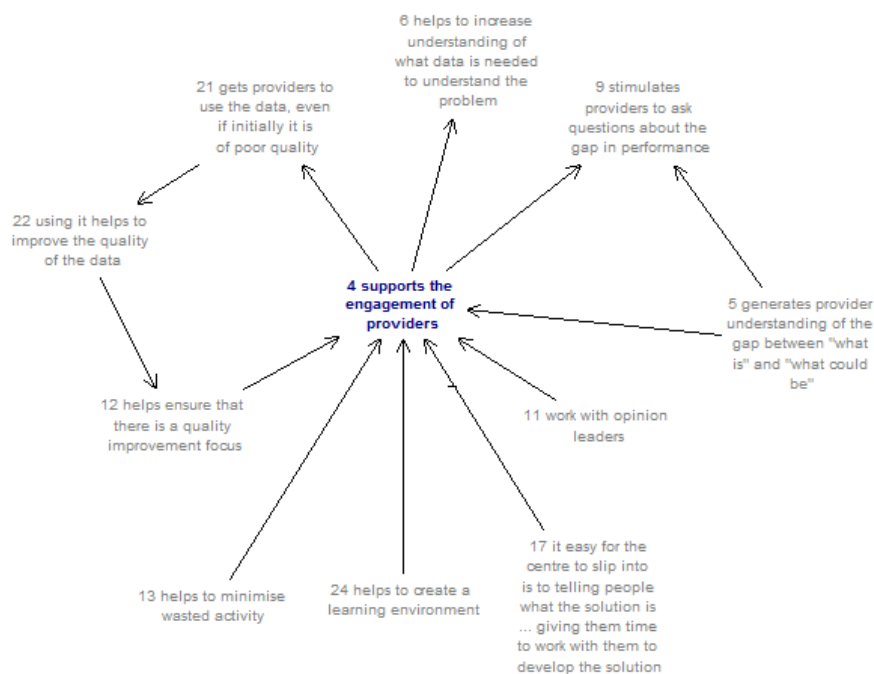
Figure 5: Causes and Consequences of Engaged Providers

Shown in the context of the map it becomes clear why this construct is considered important by the interviewee, and what is required if the meaning associated with it is to occur. As the map shows it is considered important by the person interviewed because it is a causal factor in increasing understanding of what data is needed to understand the problem (construct 6), supports the use of data, even when it is of poor quality (construct 21) and stimulates providers to question performance gaps (construct 9). To develop that engagement the interviewee considers it important to have a quality improvement focus (construct 21), minimise wasted activity (construct 13), develop a learning environment (construct 24), giving people time to work closely with you in developing the solution (construct 17), working with opinion leaders (construct 11) and developing provider understanding of what is and what could be (construct 5). In addition there is also an important feedback loop at play in which the engagement of providers, promotes the use of data (construct 21) which enhances

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[2] This is a simplified extract, to illustrate how the scores are calculated. To avoid making the diagram too complicated the example does not show all the links present.

the quality of data available (connect 22) which in turn helps ensure a quality improvement focus (construct 12) that supports the further engagement of providers.

The meaning associated with each of these constructs can be explored by unravelling the model further. For example, unravelling the model further can reveal the existence of any feedback loops that may be present and thereby impact the engagement of providers.
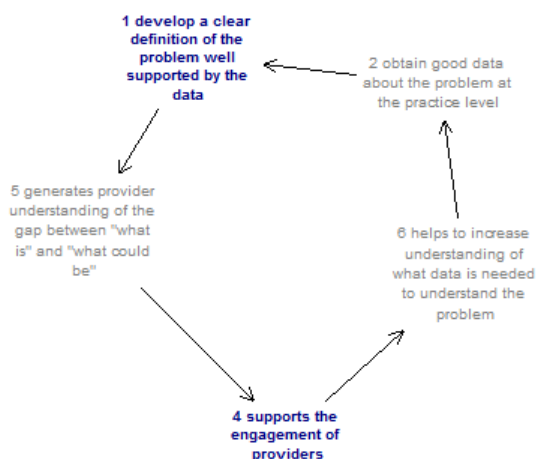

Figure 6: Feedback Loop Affecting Engagement of Providers

Exploring a map in this way reveals what the interviewee considers important and what their line of argument is. It does provide a 'list' of key items but also uncovers the context within which they sit, how they 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.

In this case the list item, 'provider engagement', is seen as a key factor in moving from the 'as is' situation to a situation in which programmes for the care of people with long term conditions are being designed and implemented effectively. It is also linked very closely to data and changed behaviour amongst front-line service providers. In moving from a simple item on a list to a construct embedded in a rich web of context, the analysis provides an initial sense of what an effective theory of implementation will need to contain.

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 is 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.

	Central Concepts	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 community and consumers	7 from 13 constructs
	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 2: Results of Centrality Analysis

4.2 Thematic Analysis

The centrality analysis enabled the authors to distil the key ideas from each of the 7 interviewees. Focusing on the top 5 constructs for each person provided a list of 35 key constructs that were considered by those interviewed to be central to the implementation of programmes for the care of people with chronic conditions. Each of these constructs were then coded, using the steps outlined in Cavana et al, 2001, resulting in the emergence of 7 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 3: Key Themes Arising out of the Centrality Analysis

The analysis from this point forward uses the results arising out of a focus on the top 5 constructs.

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.

5. ANALYSIS OF COMPOSITE MODEL

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 264 distinct constructs. These constructs are listed in appendix 2.

The second step was to go through each of the 264 constructs and code them into one or more of the seven themes that emerged out of the analysis of the individual interviews. Maps were then created for each of the themes and each map was reviewed to merge constructs, where their meaning was the same.

These individual maps then become the elements from which a system dynamic model can be built to explore how engagement, for example, 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.

This work is still underway and the following section limits its focus to the theme of engagement. It's purpose is to illustrate how individual interviews, using cognitive mapping, can be used to assist in the development of a model that captures some key dynamics in the implementation of programmes for the care of people with chronic conditions.

5.1 Theme 1 Engagement

In coding the constructs within the combined model there were 51 distinct variables within the 'engagement map'. These are shown in appendix 3.

In drawing this 'engagement map' a number of clusters, i.e. constructs linked together, emerged containing 43 of the 51 constructs coded as 'engagement'. These clusters are shown on the following page – figure 7. The cluster at the bottom of the page contains factors that refer to the relationships between planners and providers. The next cluster up contains factors that relate to providers, while to the right of that is a cluster relating to funding models. At the centre of the map is a cluster that contains factors relating to patients and finally. At the top left-hand side of the map are factors that relate to the relationship between provider and patients and at the top right-hand side are factors that relate to the community.

What this map does therefore, is highlight the clusters that the experts consider important within the theme of engagement. Furthermore, the nature of the cognitive map highlights the casual links between those factors and how together they affect engagement in a number of different areas. The clusters in the engagement model I have referred to as:

- Engagement of providers.
- Engagement of patients.
- Collaborative planning and programme design.
- Funding model.
- Provider-patient relationship.
- Community Involvement.

Figure 7: Engagement

It is important to note here that the links between the key themes are already emerging, in that 'collaborative planning and programme design' and 'funding model' while being a part of the engagement theme also came through as key themes on their own (see table 3). At this stage these themes have not been explored in depth, so it will be described here as a sub-set of the theme of 'engagement'.

6. DEVELOPING A CAUSAL THEORY OF ENGAGEMENT

6.1 High-Level Causal Theory

As stated at the beginning of this paper the aim is to develop an understanding of some of the key components of a 'theory of change' in regards to the implementation of programmes for the care of people with chronic conditions. One of the key themes is that of engagement and the cognitive map shown in figure 7 begins to unravel what the interviewees understand by the term engagement and what are the factors that contribute to its development.

Using the labels from each of the clusters shown in figure 7, a simplified casual map is developed and shown below:
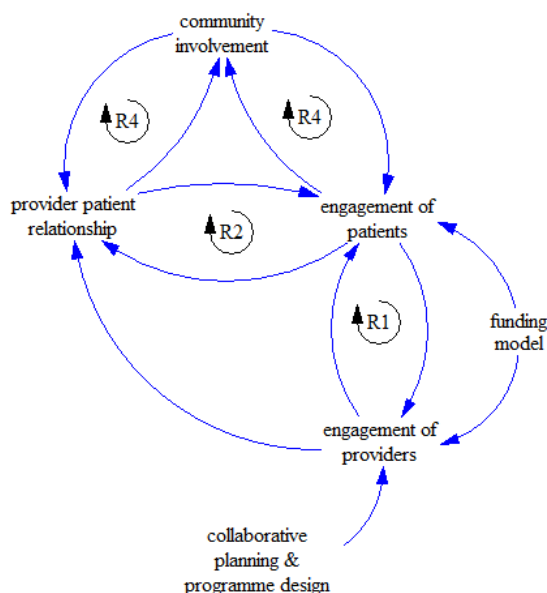
Figure 8: Simplified Causal Diagram of the Interviewees Engagement Theory

This causal diagram takes the clusters from the engagement map and highlights the key causal links. Some of the key points that emerge from this include;

- Engagement is a complex idea that involves the engagement of planners, funders, providers, patients and the community in a pattern of feedback relationships.
- Collaborative planning and programme design, along with the funding model are two key factors that help to initiate a series of feedback loops supporting the engagement of provides and planners and their community.
- Each of the three key 'partners' exists in mutually supportive relationships, so that engagement of one supports the engagement of the others. However, it is also true that the disengagement of one can facilitte the disengagement of the others.

Engagement is then a complex construct, and it is not surprising that, despite overall agreement with the concepts underpinning chronic care management it has been difficult to

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develop widespread and consistent engagement of providers. To do so would require their involvement in the initial stages of the programme design and ensure that the funding model took cognisance of their needs. In New Zealand, this is a significant issue in that those involved in planning such programmes are usually employed by Government funded bodies, whereas those who provide such services are, in the case of General Practitioners, owners or employees of private organisations. So, while the simplified causal map begins to unravel the complexity, it still falls short of a model that can guide the design of an implementation pathway. To do this the analysis has to unravel the concepts further and explore the strength of the causal links and how they combine over time to develop a level of dynamic complexity. System Dynamics (SD) modelling is the method chosen to do this.

6.2 Developing an Operational Description of the Causal Theory

To develop a more formal model I have used an approach developed by Anjali Sastry from the University of Michigan in developing models of organisational change theory (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 models are based on the cognitive maps, which contain assertions about causal relationships, 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 one variable influences another and how that variable is likely to evolve over time depending on the causal relationships they have described.

Table 1 shows examples of the statements which will be used in formulating the dynamic model.

Summary of Coding Categories			
Name	**Definition**	**Structure/Relationship**	**Dynamic Behaviour**
Name of the variable	Definition of the variable	Description of how the variable affects other variables and/or how it is affected by others	Pattern of the variables evolution over time
Engagement of providers	Refers to the engagement of providers in the delivery of effective chronic care programmes	"I think it is quite important to have a structured programme. And with that of course, goes the ability to be able to measure and respond	"Seeing the gap in their own performance provides a momentum to change"

		to the outcomes"	
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"
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"
Provider patient relationship	Refers to the relationships between the patient and those who provide the health services	"…so I think it is fundamental that if you are going to enter into this then there is a … contract between the patient and the care team"	"If you get engaged providers and an engaged patient, then actually what happens should be dramatically improved outcomes."
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 4: Coding Categories

The following section uses the interview transcripts, the cognitive map of engagement and the high-level causal loop diagram to develop an operational definition of the causal link between 'collaborative planning and programme design' and 'provider engagement'.

6.3 Understanding the Links between Collaboration and Engagement

The high-level causal map posits a link between 'collaborative planning and programme design' and 'provider engagement'. To develop a model that can support the design and implementation of chronic care programmes this link needs to be unravelled further. This is done using the interview data to explore the casual links in more detail. To develop the SD model, the interview material that describes the structure and the dynamics of behaviour that

result from that structure is used. An extract from table 4 that provides information on the concept of provider engagement is shown below:

Name	Definition	Structure/Relationship	Dynamic Behaviour
Engagement of providers	Refers to the engagement of providers in the delivery of effective chronic care programmes	"I think it is quite important to have a structured programme. And with that of course, goes the ability to be able to measure and respond to the outcomes"	"Seeing the gap in their own performance provides a momentum to change"

Table 5: Statements describing constructs related to the engagement of providers

In this example, the engagement of providers is facilitated by the development of a structured programme that provides, "…the ability to be able to measure and respond to the outcomes". Furthermore, when providers perceive a gap between their performance and the performance standards, 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.
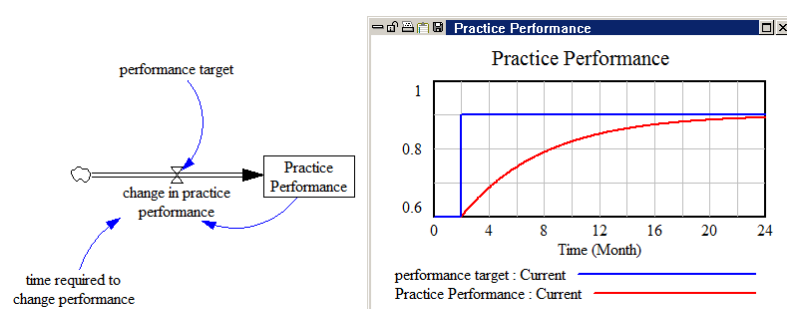

Figure 9: Simple model of performance improvement in GP practice

In this simple model, 1 on the y axis equates to the best possible performance, and 0.6 equates to current practice, based on the percentage of GP practices that provide optimal care. In a major study of the quality of primary care it was found that only around 60% or practices deliver optimal care as defined by agreed clinical guidelines and protocols (Asch et al 2006). Performance is driven by the gap that the provider sees between themselves and the performance target. This is a very simple model but does capture the idea that performance will increase if people see a gap between their own performance and what is considered to be an important performance target. Furthermore, 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 but an involvement in trying to improve practice in line with the aspirations of the programme.

Furthermore, data from the interviews indicates that the performance targets are more likely to be seen as important if those who are required to achieve them have been involved in developing them. This is illustrated in the following extract from table 4 which describes key statements related to 'collaborative planning and programme design':

Name	Definition	Structure/Relationship	Dynamic Behaviour
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"

Table 6: Statements describing constructs related to collaborative planning and programme design.

In this example the importance of involving people in the design of the performance standards is seen to be important; "I think there is a lot of value in working together with groups to actually come up with agreed elements to a program". Furthermore, there is a view that this has not happened; "I don't think there has been as much grass-roots input into the process of how we would change" The behaviour that results from this is that as the programme develops those who were involved in the initial design become the minority and new 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 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". 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 clinicians' involvement in the design of them. This is shown below.
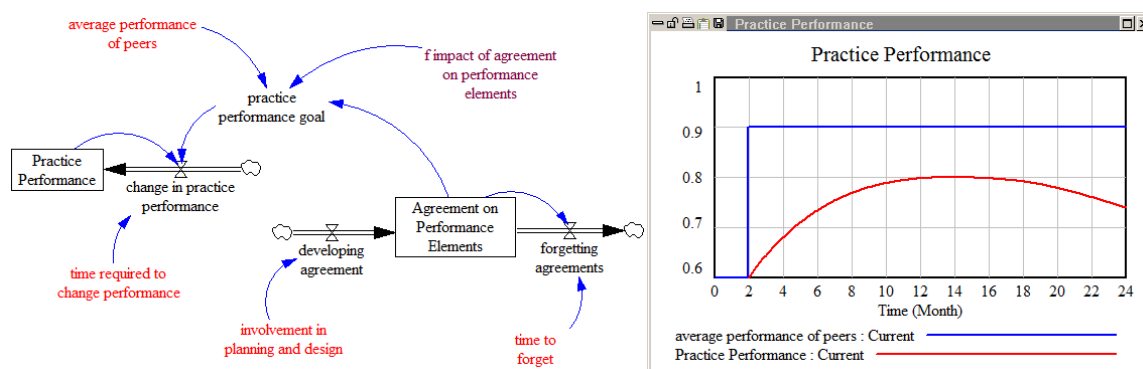

Figure 10: Simple model of performance improvement in GP practice incorporating impact of collaborative design

In this case the initial improvement effort, driven by the gap between practice performance and agreed performance standards, starts to decline as new GPs become involved while those who were initially involved move on. This is simulated by incorporating a 'forgetting function', 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 and highlights a number of the key factors that have to be attended to if one is trying to develop, and maintain, the engagement of providers.

7. 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, and only develops some aspects of this into a simulation model, 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 understand 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 is not developed enough yet to really test out thinking but it does highlight some of the key components involved in engagement and provides a plausible hypothesis of how these variables might interact and perform over time.

Current work involves developing the model structure further to take account of the other factors central to the concept of engagement 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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