

Whole of System Approach to the Design, Implementation and Evaluation of CVD Interventions in Counties Manukau

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Background

Funding for this project came from the District Health Board Research fund administered by the Health Research Council of New Zealand.

Cardiovascular disease (CVD) is the most common cause of death for people in New Zealand. It is a major cause of loss of quality of life and an important contributor to ethnic inequities. Addressing cardiovascular disease requires decisions to be made across a wide spectrum of health and social services. Much is known about the relationship of individual risk factors and CVD, but many causes, and especially inter-relationships between causes, are poorly understood. Even less well understood is the effect on the system of single or multiple interventions. Systems dynamics modelling is an established tool to aid decision making in just this type of 'complex system'.

A national model of CVD was developed during 2008 and 2009 by Synergia consultant David Rees with support from Dr Jack Homer who has led the dynamic modelling of CVD undertaken by the US Center for Disease Control and Prevention over the last 6 years. An overview of the national model is shown in **Appendix 1**. The size of the impact associated with each of the causal links is informed by data that has been obtained from a range of sources. These include;

- NZ Ministry of Health
- NZ Department of Statistics
- New Zealand research literature
- International literature
- Centers for Disease Control and Prevention

The same model structure was replicated then separate data was entered for Maori, Pacific and European/Other ethnicities to create three parallel models.

The model includes 12 interventions within five policy areas:

- Healthy lifestyles (physical activity and diet)
- Smoking
- Pollution and second hand smoke
- Quality and use of primary care
- Mental health and stress

Aims

The aims of this project were to identify local CMDHB data to use within the existing national model, then assess the usefulness, to CMDHB people, of either the national or the local model. We considered 'useful' to include any or all of:

- making a difference to decisions
- confirming current decisions
- improving confidence with decisions made
- advocating a case

- facilitating the process of decision making within and across different disciplines or interest groups

Methods

The study was conducted in three phases.

Phase 1

An initial round of presentations to individuals and groups in CMDHB, to seek:

- initial opinions and reactions to the models
- find people / roles who considered the models useful
- find what these people considered would make the models more useful
- identify sources of CMDHB data that could be used in the model instead of national data

Individuals and groups consulted are listed in **Appendix 2**.

Phase 2

Seeking and exploring CMDHB data to establish local population sizes and data on prevalence and incidence rates, especially where these might differed from those in the national model. In some cases this required detailed examination or re-analysis of existing data to render it appropriate for the models. This process was iterative, going back to the key informants to explore plausibility of data and its implications in the models. Individuals and groups consulted are also listed in **Appendix 2**. A list of model variables, with national data and local data where available, is provided in a **separate spreadsheet**.

In addition, the model was shown to leading clinicians within Counties Manukau to test the validity of the data assumptions and model outputs.

Phase 3

We conducted a series of presentations back to key informant individuals and groups, assessing the plausibility and usefulness of the local models in relation to their work at CMDHB.

Field notes were taken in all individual and groups sessions. The final sessions were also audio recorded when consent was given. Both were subjected to thematic analysis to prepare the final analyses. In the final sessions, individuals also provided quantitative data on a brief questionnaire.

Results

All participants, following explanation, were able to understand the models sufficiently to engage with them and test the implications of a range of interventions. Examples of model outputs, showing the effect of anti-smoking interventions, are shown in **Appendix 3**.

An early pattern was that participants typically wanted extensions to the model to include finer detail on interventions that related to their specific area of policy or clinical work.

Interest was expressed in extensions relating to:

- long term condition self-management
- secondary care options
- gestational diabetes
- a range of interventions to improve quality of primary care
- a range of interventions to improve physical activity and diet

Given the known workload to develop and validate existing components of the model, an early decision was made to not extend the model structure. Instead, the introductory explanation of the model was adjusted to emphasise the role of the models to predict the effect of, say, a 10% improvement in primary care quality, but not to help choose between interventions that might achieve such an improvement. With this explanation, participants accepted that if one had evidence of the effectiveness of interventions, generated external to the model, one can use the model to project the impact of such an intervention in CMDHB.

Who is it useful to?

- More for bigger DHBs, smaller DHBs don't have equivalent expertise in population analysis and planning
- CM DHB has more need for local model than do others – population different
- Many considered it primarily useful at a national level, where high level resource allocation decisions are made, and directions of investment are decided.
- Many expressed reservations about specific numerical values being put into the model
- Even while expressing doubts about the absolute numerical values in the model, all participants seemed to accept that the main value of the numerical outputs of the model was the relative magnitude of changes that could be brought about by interventions over which they had some control.
- Little discussion or dissension about the structure of the model as developed so far.
- But many / most wanted something added that related to their own roles and interests in choosing between local strategies that might be alternative ways of achieving change in one input to the model. For example, the model puts a numeric value on quality of primary care, and individuals wanted help making decisions on how much resource to put into supporting patient self management, and which self management programme to choose.
- Concern expressed that 'primary care quality' was a mis-leading label for two domains measured as a proxy of quality. The first domain is the proportion of patients attending primary care who are screened for high blood pressure, high cholesterol, diabetes and perhaps smoking. (The US data probably includes cervical smears, mammograms and other activities). The second domain is the proportion of patients, diagnosed with these conditions, who have these conditions 'controlled'. The concern was expressed most strongly by one secondary care specialist. The concern was that the large impact of primary care quality and access, in this model, would be simplistically interpreted to support 'any' activities in primary care, including those not logically related to what the model really represents.
- There are related concerns about 'access' to primary care, which is the other primary care intervention in the model. Access, in the original model, uses US data for 'annual check', but the NZ data we have used is 'attend a GP'. Medical practice in the US encourages annual checks in a manner that NZ does not. The proportion of those who 'attend' a GP in NZ who receive an annual check is not known. Nor is it clear that such an annual check is genuinely linked to better health outcomes.

What use would these models have in your work?

- Several people reflected on their experiences with related models, which gave them some confidence in the potential usefulness of the current model. The impacts they cited varied between projects.
 - A model projecting future numbers and requirements of rest home residents. The model served to develop acceptance and trust of the DHB

decision making process by the rest home sector. They could see some objectivity and plausibility in the projections, and could work with the DHB to refine the model and develop their own plans based around a shared understanding of expected future bed requirements.

- A model projecting the future numbers of people with diabetes was useful to persuade the DHB managers to invest in the Lets Beat Diabetes campaign while accepting that the programme outcomes would not be measured by short term improvements, that gains might have a lag time of 10 years or more.
- A model showing numbers of patients in each part of the Emergency Department, and the flow on effects to the medical wards was useful in reassuring staff that proposed policy and workflow changes would be achievable and could improve patient throughput.
- Participants recognised that the models suggested benefits, but not costs, of interventions. They recognised that decisions about resource allocation required data on both benefits and costs.

What would make it more useful?

- As noted above, most participants wanted further detail in the model to assist them choosing between interventions that might affect any one model variable, whereas the model is primarily designed to show the outcome of any (unspecified) interventions that achieve a given effect.
- As also noted, some participants wanted costs factored into the model.
- An early request was made for a table with numbers to be included with the output graphs. This was provided but participants made little use of the numerical data.
- Most participants felt there was little use in the model for variables ‘future air pollution’, ‘future workplace smoking’ and ‘stress sources’.

Table 1. Responses to question: ‘If you had \$10 million to spend currently to reduce CVD in Counties how would you spend it?’ N=14

	Before explanation and discussion Average million \$ (range)	After explanation and discussion Average million \$ (range)
Diet	1.3 (0, 5)	1.1 (0, 2)
Physical activity	1.1 (0, 2)	0.8 (0, 2)
Obesity – weight loss services	1.3 (0, 5)	1.1 (0, 3)
Primary care - use / access	1.9 (0, 5)	1.9 (0, 5)
Primary care – quality	1.4 (0, 3)	1.9 (0, 5)
Tobacco – social marketing	0.3 (0, 2)	0.5 (0, 2)
Tobacco – tax & sales restriction	1.3 (0, 5)	1.1 (0, 5)
Tobacco – quit services	0.9 (0, 2)	0.9 (0, 2)
Stress – decreasing sources	0.2 (0, 1)	0.3 (0, 2)
Stress – mental health services	0.4 (0, 2)	0.3 (0, 2)
Air pollution – general	0.1 (0, 1)	0.1 (0, 1)
Air pollution – workplace smoking	0.0 (0, 0.5)	0.1 (0, 1)
Total	\$10 million	\$10 million

Table 2. Numbers of people assigning each score (1 ‘Not at all’ to 5 ‘Absolutely’) to questions before and after explanation and discussion. N=14

	Not at all Absolutely				
	1	2	3	4	5
Before explanation and discussion					
How familiar are you already with the models?	1	3	2	2	1
Do you believe the models?		4	4	4	
After explanation and discussion					
Do you believe the model results?		3	5	6	
Would it help you make decisions / confirm decisions?		1	8	4	1
Would it help you to argue / advocate a decision?			9	4	1
We need Counties models, national won't do	1	1	4	5	3
How likely are you to use these models?		4	5	5	
How likely are to you use a model modified as you want it?		3	4	7	

Table 3. Responses to statement, at end of discussion: 'This modelling is most valuable for:' N=13

Process of building	1	2	3	4	5	6	7	8	9	10	Results from the final model
People for each score			1	1	4	2		2	1		

In retrospect, it would have been better to split this question into separate scales for the perceived value of the shared process building and the value of the results.

Conclusions

The models generated lively interest and discussion with a wide range of policy-makers and clinicians at CM DHB. All expected such models to be part of their future work, and expected them to become more valuable over time.

At this point it is premature to make recommendations of funding implications for this model given further work is required to refine the model. The addition of cost data would be the single biggest component to assist in funding decisions given the relative impacts of the intervention was demonstrated. Although cost data is essential to making 'real life' decisions represented in the models, this data could be provided either fully within the models or combined externally to the models. Most people over estimated the magnitude of the size of the impact and different interventions particularly exercise and nutrition. Many people underestimated the impact that smoking cessation would have. This in itself was a useful finding knowing that there are cost effective interventions for smoking cessation the model clearly demonstrates the relative advantages of investing in such interventions over others.

While people recognised a role for the model in prioritisation of interventions most felt sceptical to use the model in its current form at a DHB level.

We do not envisage or plan to develop a web interface, in part due to the cost, but, more importantly, because it has become clear that the value of the model can only be achieved when it is used within conversations and debates over health service decisions. With greater familiarity of the model it is likely that the trust in its predictions will increase.

Since this work was undertaken, new software has become available to present the models in a much more 'user friendly' manner to the CM DHB personnel. This serves to emphasise the fact that the model use and production are both ongoing processes, and, we emphasise again, the gain is from participation in the process rather than 'merely' using an end-product.

Dissemination

The participatory research methods we used ensured that most or all relevant parties within CM DHB are already informed of the process and outcomes. We are preparing an academic journal article for a public health journal. We intend to submit a presentation to the next meeting of the Australian Disease Management Association, and we anticipate that the models will inform part of the business case implementation plans for the 'Better, Sooner, More Convenient' initiatives in the Auckland region. The model and this research will be presented to the Northern Region, Regional Funding Forum. We will approach the School of Population Health at University of Auckland regarding presenting the model at the lunchtime seminar series but this may be better after the model is further refined. These results will also be communicated to the Ministry of Health Primary Care Team, given the finding that the model may be more useful at a national level.

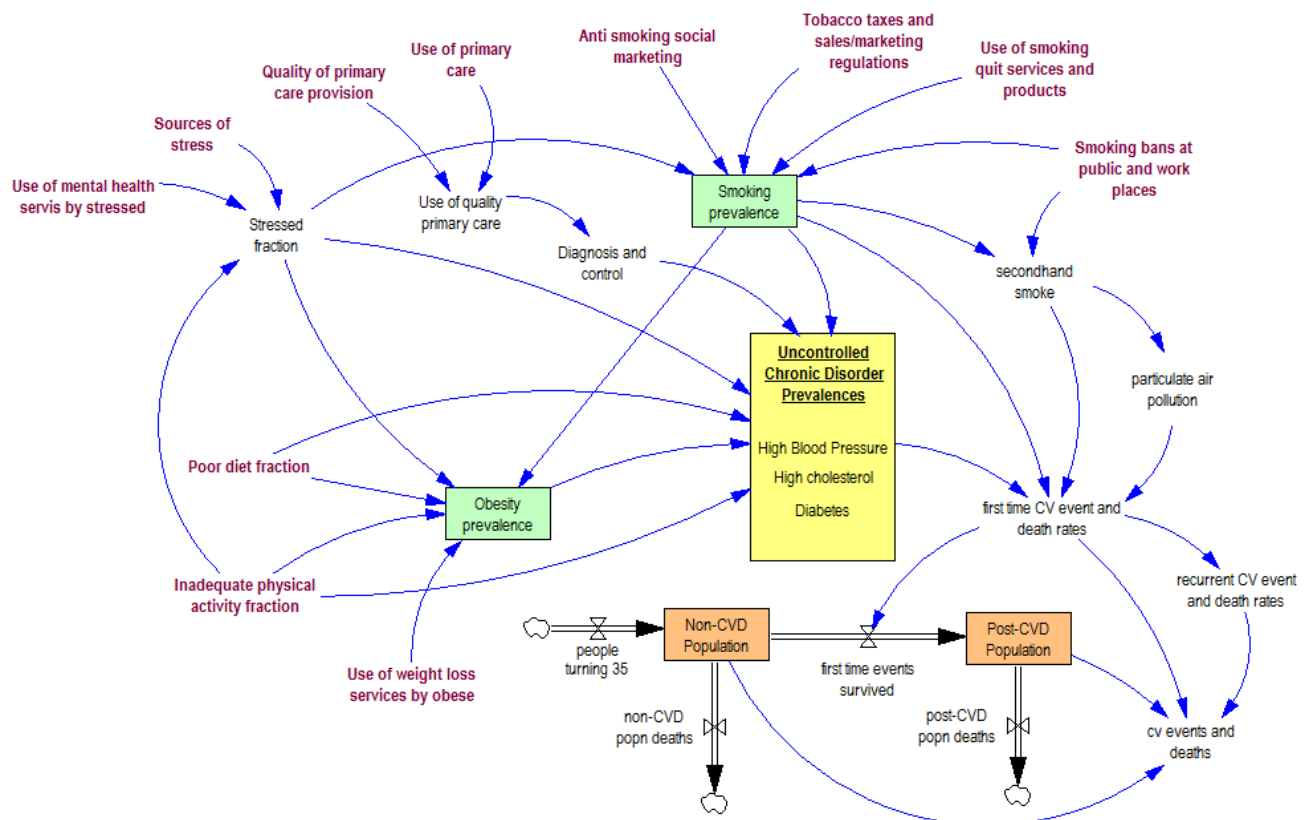
Appendix 1. Overview of the Model.

The figure below presents an overview of the model's cause and effect structure. The model focuses on the 'prevention factors' that influence the first time cardiovascular (CV) events and deaths, especially uncontrolled prevalences of diabetes, blood pressure and cholesterol, and the influence of smoking and obesity on those.

The 'stocks' represent the population, separated into those who have not had a CV event, 'non-CVD population' and those who have, 'post-CVD population'. People enter the 'non-CVD population' by 'turning 35'. People can leave that 'stock' by either dying, 'non-CVD popn deaths' or having a CVD event, 'first time events survived'. The model focuses on the adult population over 35, split into the 35 to 64 age groups and those who are 65 plus. Furthermore, the model looks at male and female and three ethnic categories; Māori, Pacific and 'other'. Thus the model does allow one to explore the impact of a range of interventions on, for example, Māori females between the ages of 35 and 64, or Pacific males over the age of 65.

The arrows represent in the model represent causal links. For example, the arrow between 'smoking' and 'uncontrolled chronic disorder prevalences', indicates that smoking has a causal effect upon those prevalences.

The purple variables around the outside of the diagram are the policy levers that can be used to test a range of interventions and change the model outputs. So, for example, one could choose to change the fraction of the population with 'inadequate physical activity'. Following the causal arrows the model indicates that such a change would have an impact upon 'obesity prevalence'. That would in turn affect 'Uncontrolled Chronic Disorder Prevalences' which would bring about a change in the number of 'first time CV event and death rates'.



Appendix 2. Individuals and groups consulted at phases 1, 2 and 3 of this study

Consultant Coronary Care Unit
Clinical Head of Diabetes & Endocrinology
Nurse Practitioner Coronary Care
Primary Health Care Nurse Specialist
Maaori Health representative
Pacific Health representative
Mana Whenua Forum
Public Health Physicians x 3
Self Management Facilitator
Group Manager Health Lifestyles
PHO Programme Managers
Programme Manager Long Term Conditions
Planning & Funding Managers
Health Equity Forum
Programme Manager Pharmacy

Workshops were held on the following dates:

- 17th September – Secondary Care Specialists
- 22nd September – Public Health and Planning and Funding
- 12th October – Health Equity Forum
- 29th January – Public Health
- 10th March – Project Team
- 10th May – Consultant Coronary Care
- 11th May – Planning and Funding
- 20th May – Clinical Head Diabetes and Endocrinology
- 24th May – Primary Care Team meeting

Appendix 3. Examples of output from the models

These graphs show the projected number of cardiovascular events each year, per 1000 people, from 2000 to 2040 in CMDHB, with separate graphs for Maori, Pacific and European/Other.

In each case the green line shows the numbers if all risk factors - other than age, gender and ethnicity - are set to ideal. The blue line up to 2010 shows historical trends. After 2010 the red line is a projection of numbers if no changes are introduced. The blue line shows project numbers if changes are introduced into the system

For example, one scenario of anti-smoking interventions has been modelled, with the results shown below. The interventions were a 50% increase in social marketing, a 25% increase in the use of smoking cessation services and a 20% increase in the tax on cigarettes to reflect current national policy changes.

In each case the model projects a decrease in cardiovascular events, but the magnitude of decrease is most for Maori, intermediary for Pacific and least for European/Other. This difference is primarily due to a baseline smoking rates being highest in Maori, intermediary in Pacific and least in European/Other. The model therefore suggests one mechanism to reduce health inequities.

