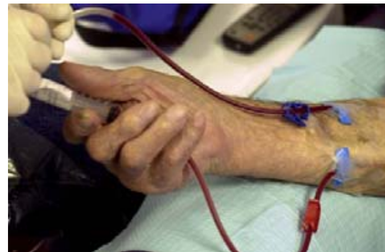
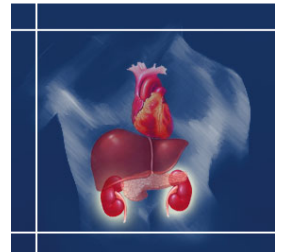
MIDCENTRAL DISTRICT HEALTH BOARD
Te Pae Hauora o Ruahine o Tararua

Renal Services Plan

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1. Introduction

This report has been put together to provide MidCentral with the information required to make investment decisions about the future of the region's renal service. The report looks at the service from a 'whole system' perspective, incorporating into the analysis both primary and secondary care, and the issues surrounding the development of chronic kidney disease (CKD), which is the precursor to end-stage renal failure (ESRF); the primary focus of MidCentral's renal service.

Given that that the Board of MidCentral is concerned to manage rising demand and their associated costs, this report uses dynamic modelling techniques to explore a number of scenarios highlighting the impact upon patient numbers, patient types and overall costs. The model, developed in close consultation with clinical and managerial staff, provides a tool that MidCentral can use to explore the consequences of a range of decisions that they may wish to make.

The report includes a number of scenarios that the authors believe are important for MidCentral to consider and provide the basis for the recommendations described in section 3.

1.1 Renal Service Provision in New Zealand

Renal services comprise a relatively small but steadily growing and expensive area of the health sector. Over the decade from 1995 to 2004, the number of renal dialysis patients (per million population) in New Zealand grew by 7.2 percent per annum on average, while the number of people with functioning transplants grew by only 3.9 percent. The number of transplants performed in New Zealand remained constant at approximately 28 per million per year from 1998 to 2003, declining to 26 in 2004 (3, 4).

The key drivers of the growth in dialysis patient numbers are an increasing incidence of CKD either presenting or being referred for dialysis, as a result of:

- improved survival (especially cardiovascular) of the general population,
- type II diabetes epidemic,
- greater acceptance of and demand for dialysis services from Maori and Pacific Island peoples,
- greater acceptance of and demand for dialysis services from elderly patients,
- greater expectation for dialysis services from the medically frail, who previously would either not have been offered, or would not have taken up an offer of dialysis.

CKD is divided into five stages, which are defined by the level of kidney function or glomerular filtration rate (GFR) (5, 6). These are:

Stage 1: Kidney damage (pathological abnormalities or markers of damage including abnormalities in blood or urine tests or in imaging studies) with normal or raised glomerular filtration rate (≥90 mL per min per 1·73 m^2).

Stage 2: Glomerular filtration rate 60–89 mL per min per 1·73 m^2 with evidence of kidney damage.

Stage 3: Glomerular filtration rate 30–59 mL per min per 1·73 m^2.

Stage 4: Glomerular filtration rate 15–29 mL per min per 1·73 m^2.

Stage 5: End-stage renal failure; glomerular filtration rate <15 mL per min per 1·73 m^2.

The GFR scale represents steadily decreasing levels of kidney function. CKD 4 represents advanced kidney disease not requiring dialysis, and CKD 5 represents ESRF, most of whom require dialysis or transplantation.

At present, there are no reliable prevalence estimates of the number of people in New Zealand with chronic kidney disease. US data from K/DOQI indicate CKD affects 11 percent of the national population. Applying these data to the New Zealand population (recognising the problems with such an extrapolation, given their different population profiles) would suggest the following levels of CKD prevalence at stages 3 to 5:
CKD 3 with GFR 30-59mls/min - 178,000

CKD 4 with GFR 15-29mls/min - 8300

CKD5 with <15 mls/min or RRT – 4200 (Collins J, pers comm)

In New Zealand, there were 3,093 (755 per million) receiving renal replacement therapy (RRT) as at 31 December 2005.[1] Of these, 1,239 (302 per million) had a functioning kidney transplant[2], and 1,770 (452 per million) received dialysis treatment. Within New Zealand, 436 patients (106 per million) commenced RRT in 2005. Among those receiving dialysis treatments in 2005, 34 percent were Maori and 19 percent were Pacific peoples (7).

1.2 Renal Service Provision in MidCentral

In Palmerston North, there has been a strong growth in demand for in-centre haemodialysis services in recent years, rising from 27 patients in 2004 to 55 in 2006. This compares to growth in home haemodialysis and peritoneal dialysis of only 4 patients each over the same period.

Like many DHB's throughout the country MidCentral is facing an increasing burden of chronic disease. Amongst these, ESRF is significant in that, while the numbers are relatively low the cost per patient is very high; ranging from around $30,000 to $70,000 per patient per year, depending on the modality choice. A significant proportion of this cost is generated by the inpatient and outpatient events experienced by ESRF patients, who are relatively high users of hospital services. In addition, ESRF patients tend to suffer from a number of co-morbidities. The most recent ANZDATA report for Palmerston North, published in May 2006, shows that patients being provided with dialysis also had a number of other conditions[3]:

[1] RRT includes haemodialysis, peritoneal dialysis and transplantation.

[2] Note that those with functioning transplants move from CKD 5 category to CKD 2 or 3, as a direct result of their improved kidney function.

[3] The percentages are for those patients who had or who were suspected of having the condition.

Condition	Percentage
Hypertension requiring treatment	84%
Type II Diabetes	39%
Coronary Artery Disease	36%
Peripheral Vascular Disease	20%
Chronic Lung Disease	14%
Cerebro Vascular Disease	12%

NOTE: Many patients had more than one of these chronic conditions.

Table 1: Co-Morbid Conditions of Dialysis Patients

The concern therefore is not just that the numbers of patients requiring renal replacement therapy (RRT) is rising but also that ESRF patients are high users of other health services. Whilst there was a drop nationally in the rate of growth during the 2005-2006 year this was not reflected in MidCentral. The latest ANZDATA report also shows a drop in the incidence rate; however it is considered that much of this is due to significant under serving, especially of the elderly population. If services are developed to match need it is unlikely that, over the next 10 to 15 years, the rate of growth will drop significantly below the 7% growth of the last few years. If this assumption is correct, unless initiatives are undertaken to influence demand, the total number of ESRF patients requiring RRT will double over the next 10 years.

In response to these rising numbers the Board, during 2006, approved the opening of a new 'self-management' facility which could take the more independent patients from the current in-hospital facility. This will not only help the service cope with the current volumes but also provide an environment more suitable for the more independent patient. This is a positive move in that it provides an additional treatment option for patients and more flexibility in the way the renal unit configures its service. As a result the service is now in a better position to offer a wider range of treatment options for the more independent patient, who may not want, or need, the intensive support available within the in-hospital facility.

Despite the opening of this service however the renal unit is still faced with increasing numbers. Its resources are stretched and further investment in staff and facilities will be required. This report endeavours to provide some insight into the rising numbers and the options open to MidCentral in responding to them.

Renal disease is a chronic condition which cannot be addressed by specialists alone, let alone specialists operating within the renal unit. If MidCentral is to have any impact upon the volume of patients developing ESRF and requiring renal replacement therapy (RRT) in the coming years it must develop strategies that move up the chain, involving primary care and community agencies, who are more active and better placed to work with people in the early stages of chronic kidney disease (CKD) and with those at risk of developing it.

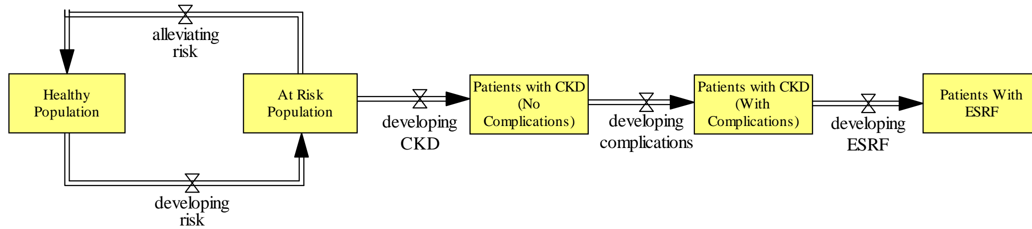

Figure 1: Population Structure of Chronic Kidney Disease (CKD)[4]

Figure 1 describes the population structure of people flowing into ESRF. It portrays people moving in and out of the following stages:

- the healthy population, having no associated risk factors for renal disease,
- the at risk population, having associated risk factors for renal disease - GFR[5] generally <90,
- patients with CKD but no complications, suffering a decline in kidney functioning but with no evidence of any associated complications - generally having a GFR between 60-90,
- patients with CKD and associated complications, suffering increased decline in kidney function which contribute to a range of complications - usually with a GFR between 15-60, and
- patients with ESRF, who are requiring RRT and/or palliative care - generally with a GFR of <15.

Extending the previous diagram figure 2 highlights the fact that by the time a patient develops ESRF he/she has already had many contacts with health professionals and probably community groups and individuals working in the area of community development and public health.

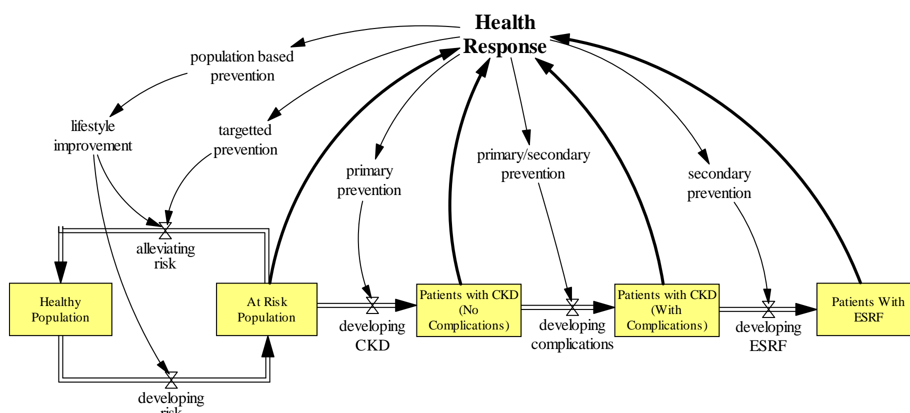

Figure 2: Range of Health Responses to Patients with CKD

[4] This structure is based on the work of the US Centres for Disease Control (CDC) who commissioned a dynamic model of diabetes prevalence. This work was presented at the International System Dynamics Conference in 2005. The paper was titled, "The CDC's Diabetes Systems Modelling Project: Developing a New Tool for Chronic Disease Prevention and Control".

[5] GFR is the glomerular filtration rate and is a measure of the health of the kidney. It refers to the ability of the kidney to filter out toxins and CKD is considered to be present when this rate drops below 90 millilitres per minute.

As figure 2 shows there are a number of places where the health system intervenes with people with, or at risk of developing CKD. Furthermore many of these people and agencies are not health professionals and are not employed and/or contracted by MidCentral Health. The further the patient moves along the chain of disease progression the more health professionals become involved and the more involved they become with health service provision. The renal unit is at the far right-hand end of this chain, dealing with patients who have flowed through all previous stages to arrive at the unit with severe kidney failure. There is little the renal unit can do to affect the rate of disease progression unless it becomes involved with other health professionals and community groups who interact with renal patients much further up the chain. What the renal service is concerned with is providing the most appropriate form of care for the patient with ESRF and requiring RRT.

This report is based on the premise that a sustainable renal service is one that has close links right through to primary care and community care, seeing itself as part of an integrated service. It aims to provide MidCentral with the confidence that any investment made into the renal service will result in a better and more sustainable service not subjected to the shocks of unexpected volume demands. The report is built around a detailed model of the renal service that explores changes in demand over the next 20 years and the impact of a range of interventions. The model allows the Board to explore a number of scenarios as part of considering the future options for the renal service.

1.3 Current Situation

The current situation is that the renal service is stretched. As a result the work of the renal team is focused on day-to-day coping strategies, moving and shifting patients so as to free up machines for unexpected arrivals and/or acute emergencies. Little if any development work is being undertaken as staff have no free time to engage in such activities and they are acutely aware that there are risks of increasing morbidity and mortality rates as care is sub-optimal. It is a service that is on the 'back foot' coping with the demand but not able to take a more proactive stance towards it. The service currently has 283 patients with ESRF. Of these 53 have transplants, 100 are enrolled in the pre-dialysis programme and 130 are undergoing some form of dialysis. The implications of this are that the renal service will simply continue to be the 'end-of line' service and take all patients presented to it. As a result costs will continue to rise and unless MidCentral is prepared to publicly ration the service there is little that can be done to manage the demand with current resources and practices.

It is also clear from the numbers and domicile of those receiving RRT that the service is not being delivered equitably across the region. The following table shows the numbers, by region, currently either on the pre-dialysis programme, undergoing some form of dialysis or with a transplant.

	Pre-D	ICHD	CAPD	HHD	Transplant	Tot RRT	Total Pop	Prevalence %
Palmerston North	35	31	16	6	23	111	72,069	0.15%
Horowhenua	20	10	7	3	6	46	29,808	0.15%
Manawatu	27	10		2	6	45	27,468	0.16%
Tararua	5	3	1	4	7	20	17,811	0.11%
Kapiti (Otaki)	1	1	2			4	7,764	0.05%
Wanganui	12	16	11	7	11	57	43,269	0.13%
	100	**71**	**37**	**22**	**53**	**283**	**198,189**	**0.14%**

Table 2: Spread of Patients Across Regions and Modalities[6]

Despite the fact that Horowhenua and Otaki have the highest proportion of Maori, 20% and 31.2% respectively, have high percentages of people aged 65 and over, 18.6% and 19.8%, and have higher levels of deprivation than the rest of the MidCentral region, they are not proportionally represented in the patient numbers. We know that Maori, the elderly and those living in high deprivation areas have a higher incidence of CKD. The fact that these patients are not coming through to the renal service can only mean that there are levels of demand not yet met. As MidCentral strives to improve its service and meet the real demands in the region this will only put more pressure on the service and require more staff, more machines and more facilities.

1.4 The Nature of Renal Disease

1.4.1 What's So Special About Chronic Disease (an illustrative case)[7]

John Tuwhare is a 55 year old taxi driver from Horowhenua. He was diagnosed with Type II diabetes 12 years ago and began haemodialysis at Palmerston North Hospital last year. He was first seen by the renal clinic with a GFR of 12 and had to start dialysis with temporary access. Permanent access was put in three months ago. John is a smoker and has been overweight for most of his life. He weighs 120 kilos with a BMI of 32 (a BMI of 30 is the threshold for obesity). He also has high blood pressure and lower back pain which has got steadily worse over the last few years.

John has begun to suffer eyesight problems which are beginning to cause him problems driving. He recently had a close call going through a red light that he didn't see. Luckily he had no passengers in his cab at the time. He is afraid of losing his job and has not told his employer or his GP about these problems. Even though his wife also works he is struggling to make ends meet.
He has been going to the same GP for over 20 years and knows him well. In addition to his GP John has seen a number of other clinicians over the last year; a cardiologist, renal physician, renal nurse, diabetes nurse educator and a dietician. Each of these clinicians works independent of each other and their care is limited to the specific problem John presents with, showing very little interest in the other medical problems that lie outside their area of expertise. Even his GP does not often have the time during John's visits to review and/or co-ordinate John's multiple conditions and overall health. For example, he was unaware that last

[6] Kapiti figures are Otaki figures only - MDHB portion of Kapiti. Also note that people may refer to Wellington for treatment
[7] The following case is a fictional story, but based on the reality of many people in MidCentral with chronic disease.

week his cardiologist prescribed a new blood pressure medication that would interact with one of his diabetes drugs.

Everyone who sees John gives the best care they can. But, even though there are many people involved (possibly because so many people are involved) no-one has the time and/or desire to take overall responsibility for his care. As a result a number of routine checks are missed. John's feet were recently checked after he complained of open sores. It was nearly two years since his last check – despite that fact that annual foot examinations are recommend for all patients with type II diabetes.

John has been unhappy with some of his care, especially the inability of anyone to do anything about the increasing back pain he is suffering. As a result he has taken some advice from a friend and seen a chiropractor, acupuncturist and a naturopath over the last 18 months. Other than the chiropractor John has not told his GP about these visits nor about the herbal remedies he is now taking in addition to the drugs prescribed by his clinicians.
His clinicians tell him that he must lose weight and take more control of his condition. Although he tries John is not sticking to any programme long enough to get results. He feels that he is getting very little support to do this and does not have the information or tools to succeed.

John is worried about his future and often gets depressed. Full-time work is becoming more and more difficult and long hours behind the wheel exacerbates his back pain. He is concerned that he may lose his job and it will make it even harder to cope and pay for the many out-of-pocket expenses he is incurring because of his condition. He has talked to no-one, not even his wife, about these worries.

1.4.2 Acute and Chronic Conditions

Generally acute conditions have a sudden onset. They only last a short time and end with appropriate care. They include colds and flu, many communicable diseases such as chicken pox, injuries with short recovery times, and other conditions such as appendicitis or even heart attacks, that require prompt medical or surgical intervention, but not necessarily requiring ongoing care.

Chronic conditions last for a substantial period of time, wax and wane in terms of their severity and typically cannot be cured. A chronic condition is enduring and is not simply a series of unconnected complaints. Furthermore, unlike the sudden onset of most acute conditions, chronic conditions develop slowly over time. People often have the condition long before they are aware of it, or before it is actually diagnosed. Chronic conditions have multiple causes and can emerge long after interactions with the causal factor. As one writer puts it; "In chronic conditions the threat is ongoing, long lasting, and global – affecting the social, physical, psychological and economic aspects of the person's life".[8]

The travel requirements of dialysis, visiting Palmerston North Hospital three times a week for four hours of dialysis each session, are enormous, and have a major impact upon that person's

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[8] Kane, R. L. et al (2005) Managing the Challenge of Chronic Illness. John Hopkins University Press.

quality of life. The combined travel and dialysis time for many patients is, as one clinician described it, "Like flying to Sydney and back three times a week without getting off the plane." On top of this the patient also has to visit other clinicians and receive other treatments for their associated conditions.

Renal disease is a chronic condition. Hospitals have been designed to respond to acute events. They are staffed by clinicians, who work independently within specialist disciplines, separate from each other and from primary care. The patient with a chronic disease suffers from many conditions but confronts clinicians with little time or expertise to deal with more than the immediate problem. No-one has overall responsibility for co-ordinating the patients' care. Who, for example, has overall responsibility for a patient on haemodialysis who suffers from type II diabetes and hypertension? Furthermore, who has the ability to identify the cause of, or to resolve, the patients debilitating back pain? Is it the cardiologist; the renal physician; or maybe the nurse who helps with their dialysis three times a week? Maybe their General Practitioner should have overall responsibility. As the story of John Tuwhare tries to highlight the fact is that although patients with chronic conditions receive the same care from the same clinicians in the same facilities as people with acute conditions they need and use health services very differently.

The issues raised by this example are central to MidCentral providing high quality care for renal patients. Furthermore, the inability to resolve them not only impacts upon patient care but also on costs. Delivering a service in a manner designed to meet the needs of acute patients, to people with chronic conditions such as ESRF is both costly and sub-optimal.

1.4.3 Treatment Modalities

When a patient has reached the stage of ESRF there are a number of options open to them. The three major categories are kidney transplant, dialysis or palliative care. New Zealand in general and MidCentral in particular have low transplant rates compared with the rest of the Western world. MidCentral also has very low provision of supported care facilities outside of the hospital[9]. MidCentral does however have relatively high rates of home haemodialysis and good services for palliative care.

Modality of Treatment	Mid Central %	New Zealand %	England %	Wales %	Scotland %
Transplants	32	41	48	55	47
CAPD	21	25	20	18	15
ICHD	33	17	19	15	33
SSCHD	0	9	11	11	3
HHD	14	8	2	1	2

Table 3: Comparison of Modality Choices between MidCentral and the United Kingdom[10]

[9] We use the term 'supported self-care' to describe the nature of the care provided. In the UK they refer to satellite centres.

[10] The UK data is taken from Mowatt et al (2003). Systematic review of the effectiveness and cost-effectiveness, and economic evaluation, of home versus hospital or satellite unit haemodialysis for people with end-stage renal failure. The data for England and Wales was taken from the UK Renal Registry in 1998. The data for Scotland relates to 1999. The New Zealand Data is taken from the ANZDATA registry 2005 whilst the Palmerston North data is 2007.

This table highlights the low rate of transplants and the relatively high rates of in-centre hospital haemodialysis (ICHD) where MidCentral is significantly higher than the rest of New Zealand, England and Wales and on a par with Scotland. Of significance is the absence of the supported self-care option (SSCHD) within MidCentral. Whilst MidCentral has put a major emphasis on HHD it has made no progress until very recently on providing supported self care options outside of the hospital for haemodialysis. Combining the two supported self care options for haemodialysis (SSCHD and HHD) MidCentral has 14% of patients within this modality. New Zealand, as a total, has 17%. When CAPD is also added to this mix as a further option for supported self care New Zealand has 42% of patients taking a supported self care option whilst MidCentral has 35%.

These figures are significant for a number of reasons. The first is that research indicates that hospital haemodialysis patients have higher rates of hospitalisation, die earlier, are less likely to be in full-time work and experience more adverse events during haemodialysis. Although there is an element of selection bias i.e. those able and willing to have HHD are often younger and both physically and emotionally healthier, HHD, SSCHD and CAPD offer patients a better quality of life and are also less costly. Differences in cost and patient benefit for supported self care and home dialysis are marginal. Both are significantly more beneficial and significantly cheaper than the in-centre option. The variation in the cost of providing supported self care facilities are largely due to the amount of staffing provided. Recent work done by Auckland DHB, utilising 2003/04 data from Counties Manukau, puts the annual dialysis costs, including additional inpatient and outpatient costs, for each modality as:

ICHD	$64,318
SCCHD	$48,172
HHD	$33,585
CAPD	$36,614
Transplant – initial operation	$109,000
Transplant – per annum	$9,000

Table 4: Comparative costs of different modalities

Research also indicates that there is a great degree of individual variation in these costs. For example, one research finding was that a significant proportion of those costs could be attributed to diabetes[11]. That is, the costs for dialysis patients with diabetes are nearly twice as high as those without. Furthermore, these costs could be attributed largely to outpatient costs. They concluded at the end of their report that "…nearly one-half of the costs of ESRD are driven by the presence of diabetes. This serves to emphasise the importance of early intervention, which is one of the major recommendation in this report.

At this stage these costs cannot be calculated for MidCentral as it relies on a costing system which is currently being implemented. However, the important point about these numbers is that the relative costs are consistent with international comparisons so although the *exact and current* amounts might vary for MidCentral the *relative* costs are very likely to be the same.

11 Joyce, A. T. (2004). "End-Stage Renal Disease-Associated Managed Care Costs Among Patients With and Without Diabetes." Diabetes Care 27(12): 2829-2835.

One of the recommendations we will be putting forward in this report is that once the costing system is put in place, MidCentral use the Counties Manukau DHB methodology which they have made available to MidCentral to conduct its own more detailed costing of the different modalities to confirm the assumptions made in this report[12].

Given this range of modalities it seems therefore that, even if the demand for renal services continues to rise, MidCentral still has a number of options to consider in response; options that will have a significant impact both upon the quality of patient care and on costs.

1.5 The Importance of Collaboration

The complexity of managing people with CKD and ESRF requires a care model which deals with that complexity, for which the individual practitioner office paradigm is unlikely to be effective. Underpinning the design of renal services therefore needs to be an approach that draws on the collective efforts of professionals across the health sector, including primary care, secondary care, pharmacists, nurses, dieticians, social workers and occupational therapists.

Frankel et al (2005) observed that:
The use of calculated glomerular filtration rate is likely to identify patients with less severe degrees of chronic kidney disease, who may be missed if serum creatinine is used to assess kidney function. We do not have enough nephrologists or nephrology outpatient clinics to manage the workload that this would generate, and evidence shows that using nephrology outpatient clinics is not the most effective means of managing chronic diseases. Such patients would be best managed in a partnership arrangement between primary and secondary care. In this model, many professional groups including general practitioners with a specialist interest, specialist nurses, pharmacists, and dieticians all have a role in the management of the chronic condition[13].

Building on these observations, renal providers need to think creatively about the skills their staff will need in the future, and create roles and training to reflect those needs. Trends in similar services in NZ (such as diabetes), and renal services internationally, indicate that an effective way to respond to the growing demand for renal services lies in the development of new roles within the renal workforce, such as nurse practitioner. There may also be benefits in developing links to these new roles within the primary health sector, dealing with the early stages of CKD as part of a comprehensive package addressing chronic disease in general (incorporating cardiac and diabetes in particular). This could be an attractive field of work for renal nurse specialists, offering flexibility and a community base. Such working conditions are likely to promote workforce retention.

These themes are also echoed by a renal workforce plan developed by the British Renal Society, which states:
'A patient's 'journey' with renal disease can span many decades. High quality care and efficient use of resources throughout this journey require a seamless service. Patients require access to

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[12] CMDHB have provided the report and the costing methodology on the basis that if MidCentral does this work they will use the same methodology and make the results and any additional learning available to CMDHB.
[13] Frankel A, Brown E, Wingfield D. Management of chronic kidney disease. BMJ 2005;330:1039-1040.

and support from the whole range of renal healthcare professionals and primary care practitioners to differing degrees at differing times and stages of evolution of their renal disease.

Coordinated service delivery requires an integrated multiprofessional team with the range of skills, competencies and responsibilities to manage patients throughout their journey of care and to minimise the institutional, professional and geographical barriers to the timely provision of appropriate care.'[14]

Initiatives at MidCentral demonstrate support for a multi-disciplinary model, evidenced by the pending appointment of an anaemia coordinating nurse, and the use of a pre-dialysis nurse educator. However, noted shortages in the team, including nephrologists and clinical psychologist, undermine the ability to craft a multi-disciplinary group, and to move beyond responding to acute demand.

The potential of service re-design around a multi-disciplinary team is highlighted by a study of a pre-dialysis service in Melbourne[15]. A review of the service identified three critical points where blocks, waste, or risk occurred: notification of patients to service, predialysis education, and vascular access. The specific objectives of this pathway redesign were to:

- encourage earlier notification of each patient to the NWDS so that better planning for that patient could occur;
- facilitate earlier establishment of vascular access;
- increase the proportion of patients commencing haemodialysis with a permanent access.

In association with process redesign, the proportion of patients registered 'late' decreased from 29% in July– September 2000 (pre-implementation) to 6% in January–March 2004 with the corresponding median time from registration to commencement of dialysis increasing from <1 month to 14 months. Patients not registered with the service decreased from 57 to 0%. Eighty-three per cent of patients commenced dialysis with a permanent vascular access in January–March 2004, compared with 24% in July–September 2000.

[14] National Renal Workforce Planning Group. The Renal Team: A multi-professional renal workforce plan for adults and children with renal disease. Woking: British Renal Society; 2002.

[15] Owen JE, Walker RJ, Edgell L, Collie J, Lee Douglas, Hewitson TD, et al. Implementation of a pre-dialysis clinical pathway for patients with chronic kidney disease. International Journal for Quality in Health Care 2006;18(2):145-151.

2. Modelling Renal Demand and Service Provision

The issues discussed in section 1 highlight that the success of any attempt to manage the demand and cost of ESRF will depend, to a large extent, on understanding the connections that patients with CKD, and those at risk of developing it, make across the health system. The modelling used in this report maps many of these connections, providing an overview of the system that patients with CKD are involved in. In addition, the maps enable us to create simulations, exploring the consequences of different assumptions and decisions. What would happen if, for example, the progression of CKD could be slowed? What would happen if patients with CKD were referred to the renal service earlier? Using the best clinical and management evidence available the model provides a decision support tool for the Board and senior management of MidCentral Health.

2.1 The Continuing Rise in Renal Demand

In September 2006 the Technical Advisory Service (TAS) presented a forecast of renal demand for the Capital Coast and Mid-Central Regions. It was based on an extrapolation of current trends[16].

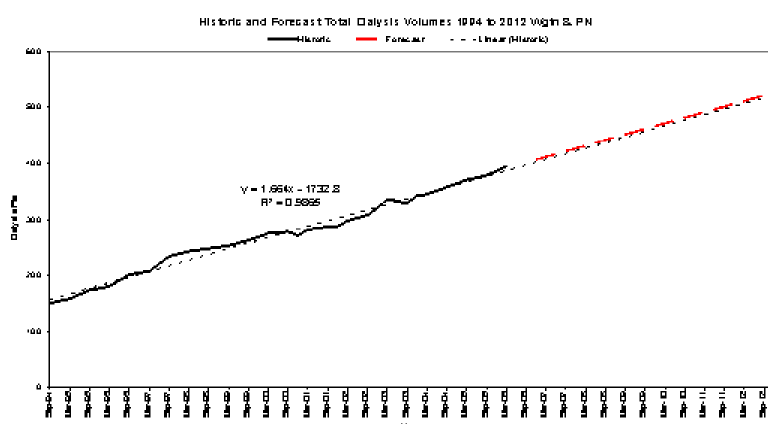

Figure 3: Renal demand within the Capital Coast and MidCentral Regions 2004-2012.

Figure 3 shows dialysis volumes continuing to rise in a linear fashion. In addition, TAS also put forward an argument that both Capital Coast and MidCentral should invest in further in-centre facilities as the need for them will increase due to the ageing population. This graph provided no options for MidCentral. The conclusion was: numbers are going up, the nature of the ageing population means that more and more in-centre facilities will be required and therefore Palmerston North hospital should plan for significantly larger on-site facilities for the provision of dialysis services.

While there is no argument with the figures presented, based on the assumption of continuing trends, this report questions the assumption that the only response is to increase in-centre facilities.

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[16] Renal Demand 1994-2012. Presented at the Central Region Renal Services Planning Workshop Wellington. 22nd September 2006

Acknowledging that numbers would rise, the question is whether or not there are any other plausible futures that could be designed in response to it, or is MidCentral simply faced with a future of ever expanding hospital dialysis facilities for patients with ESRF.

2.2 Dynamics of Renal Demand

One of the key issues that need to be understood in developing an effective response to the rise in demand for renal services is to understand the dynamics of that demand.

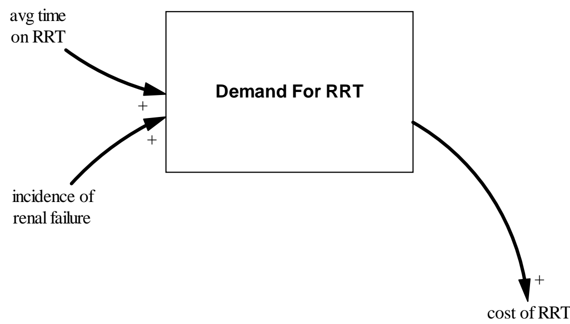

Figure 4: Key Elements in Renal Demand

Figure 4 shows the key elements in driving renal demand. The two most proximate variables are the incidence of ESRF and the average time receiving RRT. In addition the cost of RRT is directly related to the volume of demand. As demand rises so do costs. The nature of the population is one of the major drivers of 'average time on RRT' and 'incidence of renal failure'. As the Figure 5 shows it is especially the age profile of the populations and their deprivation level that are major factors underpinning the risk and therefore the incidence of ESRF as well as the existence of other forms of vascular disease, which is a major indicator of survival rates on dialysis.

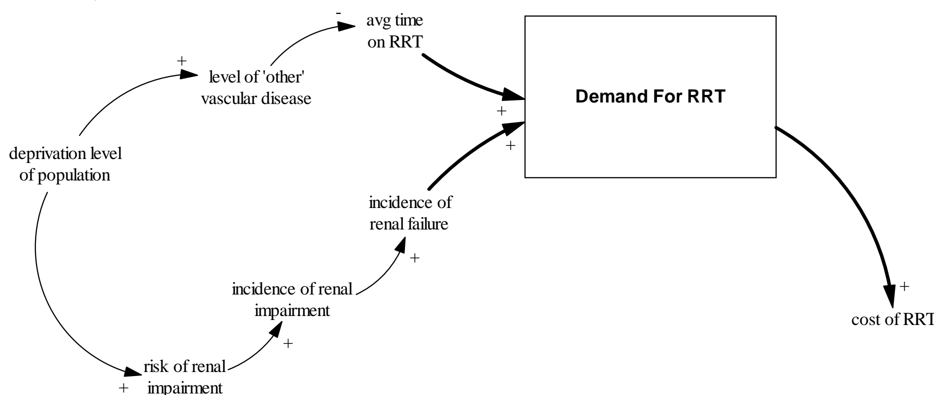

Figure 5: Population Characteristics and the Impact upon Renal Demand

If we look a bit further however w e can see that there are things beyond the nature of the population that affect demand. These are shown in Figure 6.

Figure 6: Impact of Effective Management of Renal Disease.

As noted above, many renal patients suffer from a number of co-morbidities and aggravating factors and if these are managed well – 'management of aggravating factors' - it can delay the onset of ESRF and reduce the level of renal impairment. Furthermore the effective 'management of renal disease' can slow down the progression of the disease and reduce the incidence of ESRF. What figure 6 shows is that alongside the nature of the population it is the nature of the services delivered to that population that can affect the overall demand for renal services. Renal demand is not outside the influence of MidCentral.

Figure 7: The Dynamics of Better Management of Renal Disease and Increased Investment in Primary Care.

Figure 7 shows that the impact of better management goes beyond just incidence rates. Better management means that patients arrive at the renal unit less sick and therefore less dependent. As a result they are able to choose amongst a wider range of treatment options – those who arrive sick and dependent often have to go straight onto in-centre dialysis as they

are physically and/or psychologically unable to take a more independent option. The result of people arriving at the renal clinic without good prior management of their disease is an increase in the relative prominence of in-centre dialysis. This leads to increased dialysis costs and, given limited resources, less investment in primary care. This last point is important as it is 'investment in primary care' that provides the feedback loop supporting, or undermining – depending on the level of investment – the effective management of CKD. Effective management of the early stages of CKD is crucial to enabling the renal unit to provide care that is the best for the patient and the most cost-effective.

Understanding this dynamic shows, that while there are no easy or short-term answers, there are options open to MidCentral. These options are based on changes to the three variables highlighted above i.e.
management of aggravating factors,

management of renal disease, and

investment in primary care.

2.3 Concept models

The concept models for the renal service focuses on four key areas of patient flow.

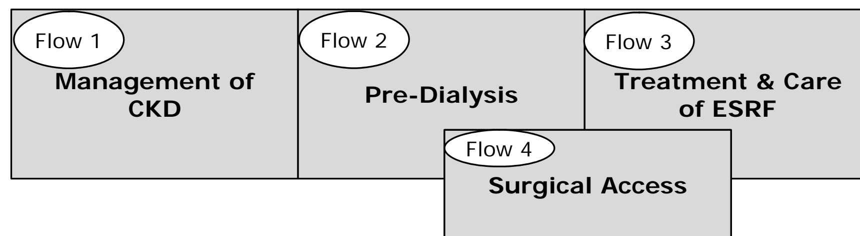

Figure 8: Key Flows Explored in the Simulation Model

The first of these is the flow of patients from primary care up to the pre-dialysis phase. This focuses on the stages the patient goes through and the key factors that affect that flow. The second flow looks at the pre-dialysis phase in which options for treatment and/or care are explored, and relevant education is provided. The third flow looks at the treatment options following the pre-dialysis programme, focusing on the different dialysis modalities, transplants and palliative care. The fourth flow focuses on surgical access. The model components that sit within each of these flows are shown below:

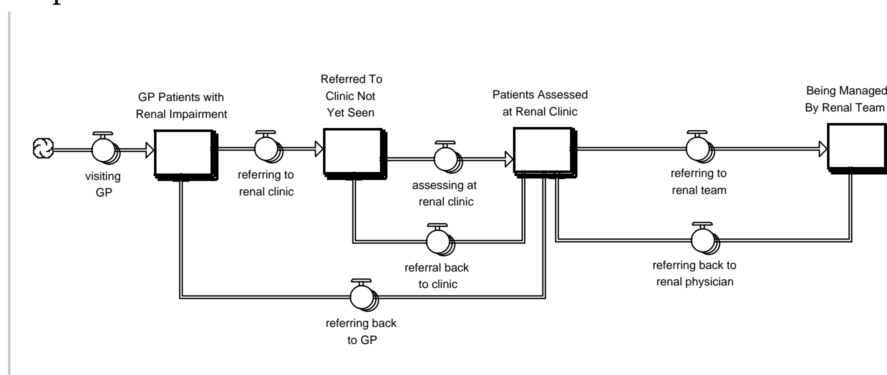

Figure 9: Flow 1 - From Primary Care up to Pre-Dialysis[17]

Figure 9shows the patient flow through from primary care up to pre-dialysis. Through this flow the patient meets different groups of clinicians. The first is the GP and any other members of the primary care team that may be involved in the early management of the patients CKD. This could be the nurse, dietician, social worker, or other members of the team.

Key factors that are important here are those that affect whether or not the patient contacts their GP and those that affect the referral rate to the renal physician. It is known that early involvement of the renal physician can have a major impact on the progression of the disease.

As the patient progresses they will eventually meet the renal physician, and key factors here are the criteria used to refer back to primary care, see the patient again or refer on to the renal team. Once the patient is referred onto the pre-dialysis programme the key factors are those that affect modality choice. This flow is shown in Figure 10.

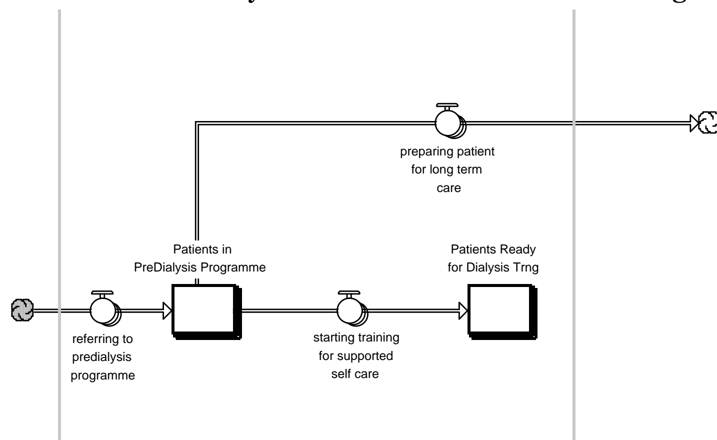

Figure 10: Flow 2 – Pre-Dialysis

Once the patient enters the pre-dialysis programme the key factors are those that affect modality choice. Once the patient has begun their treatment, be it dialysis, transplant or palliative care, the key factors are those that affect the success of the treatment and its duration. The flows relating to treatment options are shown in Figure 11.

[17] Larger versions of these flow models are shown in appendix 1

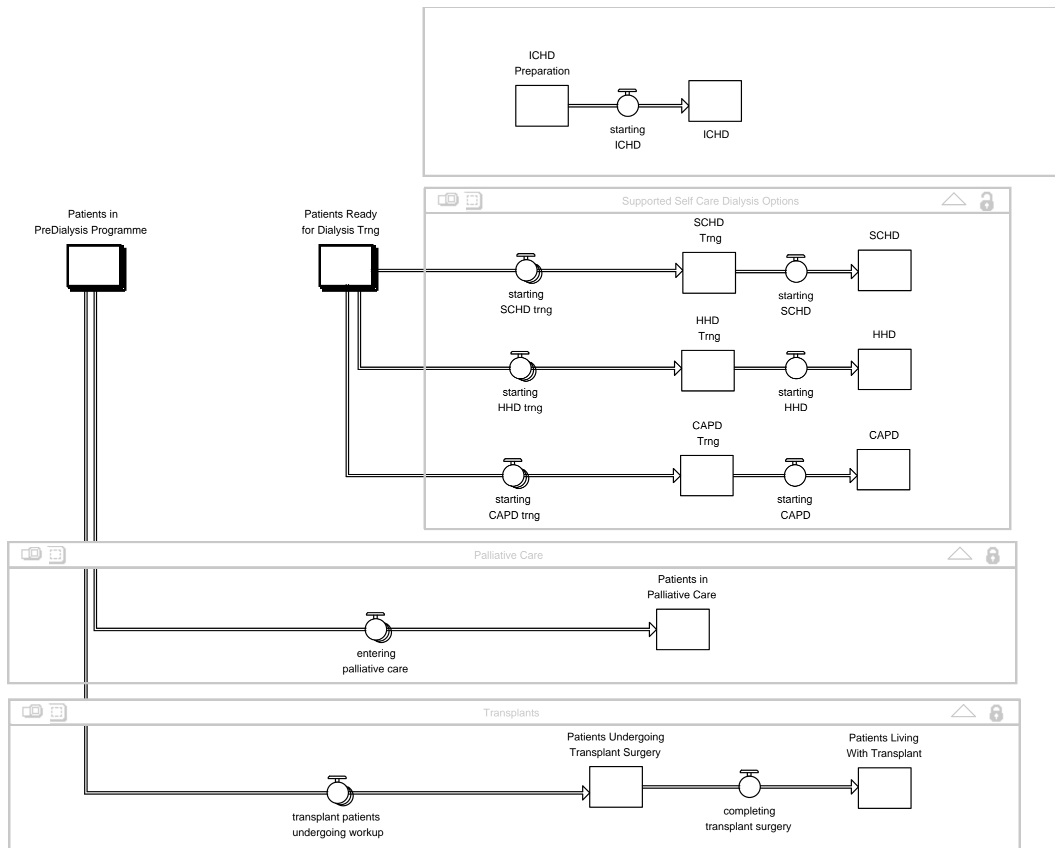

Figure 11: Flow 3 – Modality Options

For patients who are undergoing dialysis treatment, timely insertion of permanent access is important for them to be able to choose their most appropriate modality and for success on that modality. Having timely access is a crucial part of providing high quality care for renal patients. The key process flows for surgical access are shown in Figure 12.

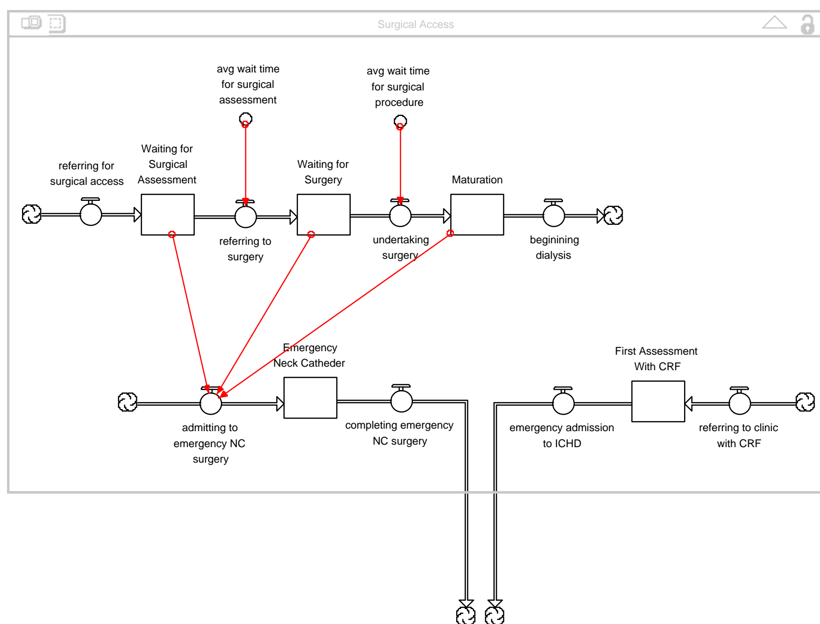

Figure 12: Surgical access

Key factors that affect surgical access are those that affect the wait time for surgical assessments and the wait time for surgical procedures. In addition, the factors that affect unplanned admissions, creating the need for emergency dialysis are also important.

2.4 Operational model

Building upon the original concept model, which was discussed and refined by the steering group, a more detailed operational model was developed so that the demand for renal services could be explored under a range of assumptions and scenarios. The key sectors covered by the detailed model are shown below:

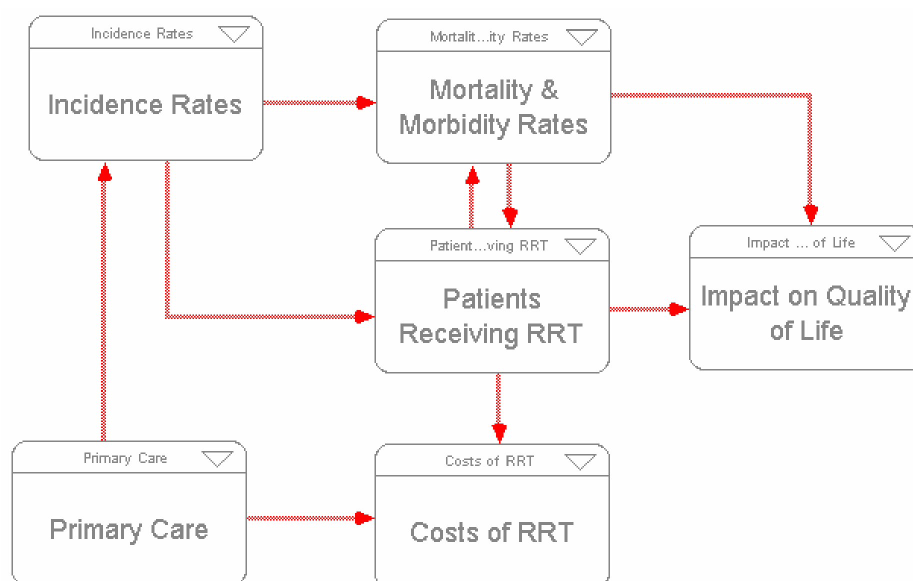

Figure 13: High level map of detailed model

This high level overview of the detailed operational model shows the key sectors and the key connections between them. The numbers of patients that are receiving RRT at any time is influenced by the incidence rates as well as the mortality and morbidity rates. Incidence rates, while affected by general population demographics are also affected by activities within primary care. As a result the costs of RRT are affected both by patients receiving RRT and activities within primary care. In addition the quality of life of patients is affected by the treatment they are receiving and the corresponding morbidity and mortality rates. At this stage the model differentiates between in-centre dialysis, home dialysis and transplants. The research evidence shows that in-centre dialysis delivers the least desirable outcomes from a patient perspective with transplants providing the best.

The model runs from the year 2000 through to 2020. Initial numbers are based on 2000 data. The model has also incorporated actual data from 2000 to 2006 so that the simulation outputs for that same period can be checked against known numbers. The model runs in increments of years so that data projections are available for each year between 2007 and 2020.
The next section describes some of the model outputs under a baseline scenario and three other scenarios to provide some guidance on the policy options available to MidCentral.

2.5 Model Scenarios - Overview

To develop scenarios that had both clinical and financial validity a number of steps were undertaken:

a detailed model was developed based on the concept model developed with the Steering Group,

the model was populated with data taken from a number of sources. These were the ANZDATA registry, MidCentral population data, data taken from a review of the literature[18] and the 'informed judgments' of clinical and management staff involved,

the model behaviour was checked to confirm that it reflected the actual data of the last five years, giving increased confidence that projections based on the model would be valid

Once this was completed a number of scenarios were developed based on our understanding of the issues being faced by MidCentral and what we knew about best practice in renal care. The four scenarios were:

continuation of current practices and trends,

improved modality choices,

improved management of CKD,

best practice combining the changes incorporated into scenarios 2 and 3,

best practice along with maintenance of the transplant rate.

2.6 Scenario 1 - Continuation of Current Practices and Trends

The following projections are based on a continuation of current trends. That is, this scenario assumes that there will be no change to the ratio of modalities and no change to the current growth rates. The figures represented in these graphs show what may happen if current policies and practices continue unchanged

[18] The literature review was also peer-reviewed by Dr. John Collins, Clinical Director, Department of Renal Medicine, Auckland District Health Board and Dr. Grant Pidgeon, Snr. Lecturer Renal Medicine, Wellington School of Medicine, Capital Coast District Health Board.

2.6.1 Total Dialysis Numbers:

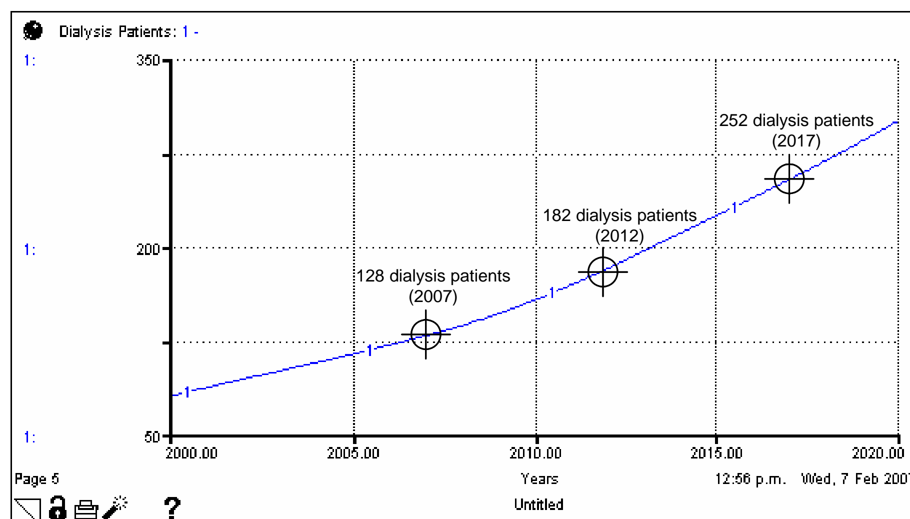

Figure 14: Total dialysis numbers under a 'no change' scenario

As this graph shows under a 'no change' scenario, in which the growth rate is 5% from 2001 to 2002, 7% from 2003 to 2012 and 5% from 2013 to 2020, the number of patients will nearly double over the next 10 years. The evidence is strongly indicative that this growth is likely to continue over the next five to ten years. The continuing rise in Type II diabetes, the ageing population and the continuing improvements in life expectancy of patients with cardiac problems will all contribute to keeping current rates of growth constant for the next decade or so.

This scenario is not an exaggerated one and is consistent with national and international data on the rise in ESRF. It is also consistent with actual number of patients currently in the renal unit. It is also possibly a conservative one. Rapid growth in the number of dialysis patients over the age of 65 is occurring coincidentally with the overall aging of the general population. In New Zealand the over 65 population is growing at around 3% per annum and the increasing demand for elderly patients to have access to dialysis[19]. This factor alone makes it likely that a growth rate of at least 5% will continue into the near future.

The latest data from the ANZDATA report does show a decline in the rate of growth. However, this is not consistent with what is going on in Australia, or in other Western countries, and the current view is that this is due to underservicing, especially of the elderly population.

2.6.2 In-Centre Numbers:

Under this 'no change' scenario the ratio of patients entering each modality remains unchanged. As a result the numbers entering ICHD continues to rise, with 119 patients requiring in-centre facilities within 10 years.

[19] Madhan, K. (2004). The epidemic of elderly patients with end-stage renal disease requiring dialysis in New Zealand. *The New Zealand Medical Journal*, vol. 117, No. 1195.

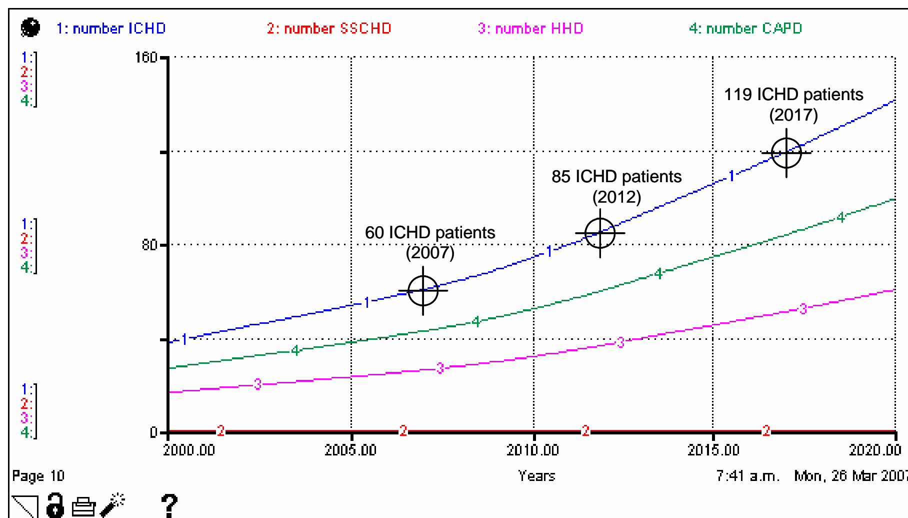

Figure 15: In-centre dialysis numbers under a 'no change' scenario

This continuing rise in ICHD will have a significant impact upon hospital facilities. Future scenarios explore what changes could be made to this figure under a number different policy options.

2.6.3 Costs

Under this 'no change' scenario costs will also continue to rise in line with patient numbers.

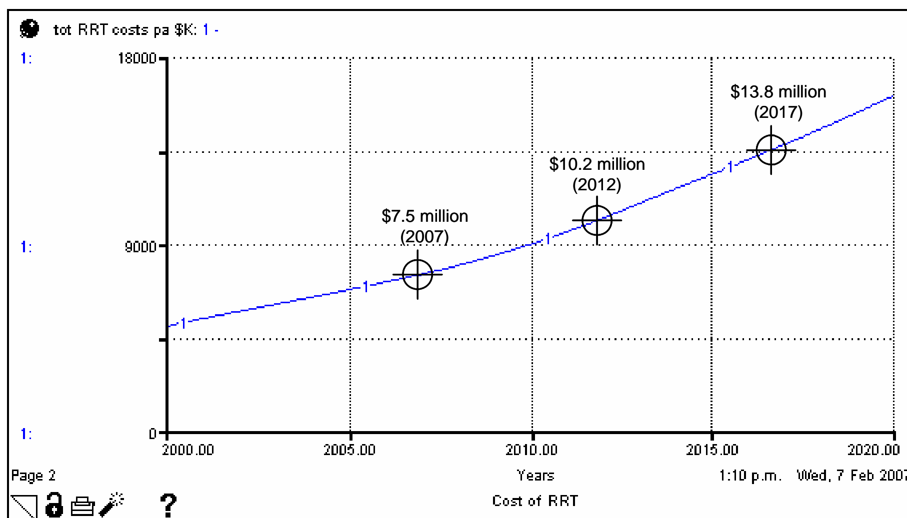

Figure 16: RRT costs under a 'no change' scenario

The figures generated by the simulation model are based on the estimated costs of different modalities. The simulation estimates current costs for dialysis at around $7.5 million per annum. Whilst exact costs within MidCentral are difficult to obtain, as the new costing system is currently being implemented, estimates provided are in line with the simulation outputs, giving confidence that the numbers being generated by the model are in line with reality. Projections indicate that these costs will rise to over $10 million per annum in the next 5 years and to just under $14 million per annum within the next ten. The cumulative costs amount to

$43.7 million for the next five years and $56.9 million for the five years between 2012 and 2017.

2.6.4 Modality Mix

Under this scenario there is very little change in the modality mix apart from a continuing decline in transplants, taken up by a slight increase in CAPD and ICHD.

Modality of Treatment	Current Rates %	Rates 2012 %	Rates 2017 %
Transplants	32	29	25
CAPD	21	23	25
ICHD	33	33	36
SSCHD	0	0	0
HHD	14	14	15

Table 5: Modality Mix Under Scenario 1

2.6.5 Summary

Simple extrapolation indicates an increasing patient and financial burden that will be imposed upon MidCentral Health if it adopts a passive position, accepting the rises as inevitable. The nature of chronic disease and renal in particular means that there will be a gradual rise in demand and MidCentral will have to respond. Every DHB around the country and health providers and funders around the world are all facing the same challenge. The opportunity is to respond to this inevitable rise in a proactive and creative way rather than carrying on with current practices hoping that somehow the response will be different.
The next two scenarios outline the impact of two policy platforms that are feasible and backed by research findings. They represent policy directions that MidCentral could consider. The simulation model explores the impact that these changes could bring about in the size and nature of renal demand.

2.7 Scenario 2 - Improved Modality Choices

Currently around 60% of patients are first seen by the renal service very late i.e. with a GFR of less than 15. These patients are often sick and in need of immediate dialysis. Proper work up cannot take place, dialysis is started with temporary access and patients are not in the best position to make the best choices possible. The renal team estimates that around 50% of the patients currently receiving in-centre dialysis could have been provided other options if they had been seen earlier so that a more comprehensive pre-dialysis programme could have been undertaken and permanent access provided before the first dialysis session.

The following figures show the potential impact of improved referral to the renal service. The graphs show two scenarios. The first is the 'no change' scenario discussed above. The second shows the impact of 'best practice' in terms of early referral to and involvement of the renal service, allowing a more considered choice and preparation for the most appropriate response to ESRF when it occurs. Under this scenario the model reduces the percentage of new patients going to ICHD by 30% and spreads them across the other three modalities i.e. CHD, HHD, and CAPD. The model also assumes that changes of this magnitude would not occur instantly so it has incorporated a five year delay in which the changes are brought in and fully implemented over a five year period.

2.7.1 Total Dialysis Numbers

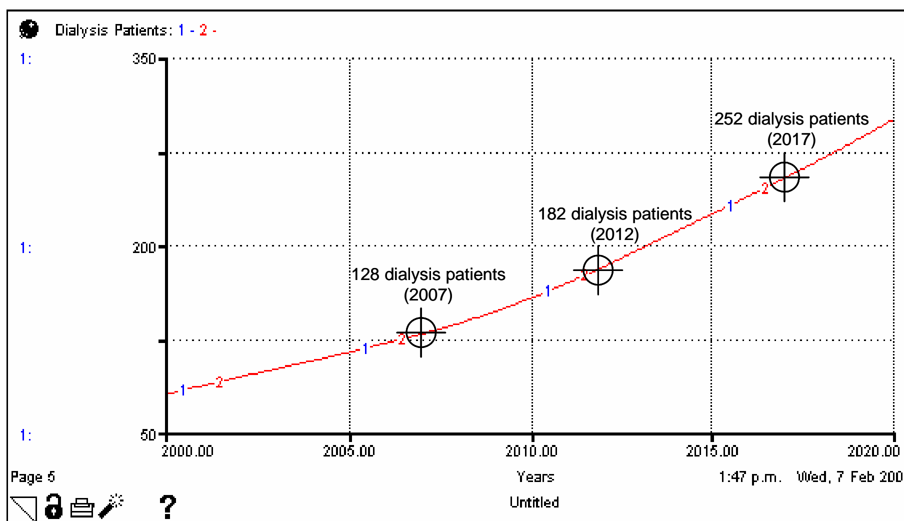

Figure 17: Total dialysis numbers under an 'improved referral practices' scenario

This scenario does nothing to reduce the number of patients entering the renal service; it simply improves the way they enter i.e. earlier referral means that they arrive more independent, healthier, and therefore able to obtain appropriate pre-dialysis education and permanent access. While this change does not affect the total number of dialysis patients it does have some other significant impacts which are outlined below.

2.7.2 In-Centre Numbers

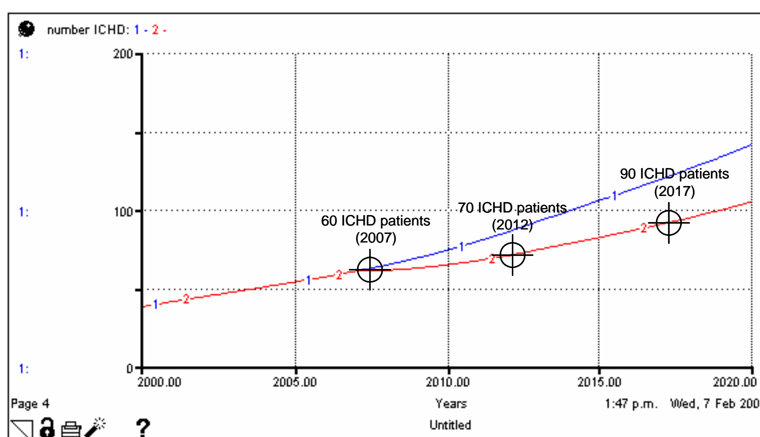

Figure 18: In-centre dialysis numbers under an 'improved referral practices' scenario

What this scenario does however is make significant reductions in the number of patients entering ICHD. Based on the assumptions noted above the numbers receiving ICHD by 2012 would reduce from the base case of 85 to 70, and by 2017 they would reduce from 119 to 90. These projected reductions are based on a clinical assessment of current in-centre patients and the estimated number that could have been moved to other modalities if they had been seen at the optimal time and that best practice care could have been instigated.

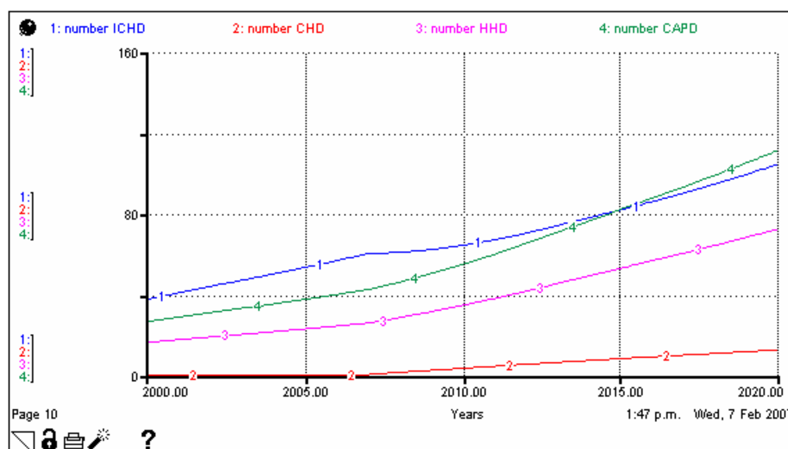

Figure 19: Changing modality numbers under an 'improved referral practices' scenario

Under this scenario the relative numbers on each modality changes significantly. By 2014 the numbers on CAPD rise above the numbers on ICHD and there is a gradual rise in the number of patients in supported self care facilities (CHD). The rise in numbers on CAPD is supported by research indicating that CAPD is a suitable treatment modality for patients over the age of 65[20].

2.7.3 Costs

Because in-centre dialysis is the most expensive option this shift in modalities has a significant impact upon costs.

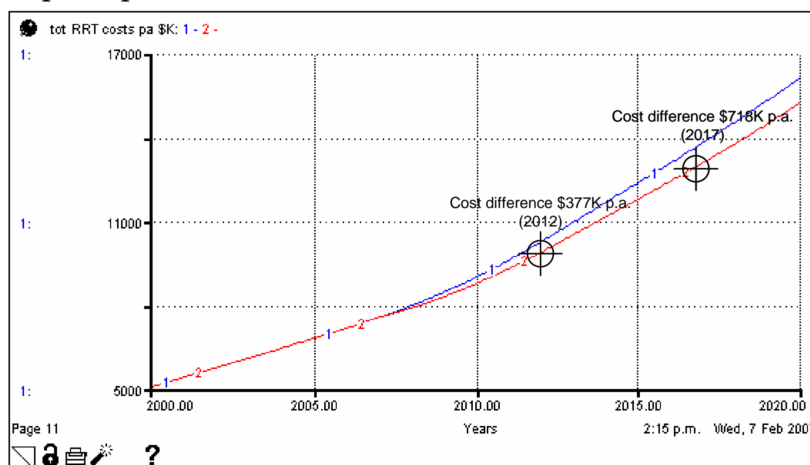

Figure 20: RRT costs under an 'improved referral practices' scenario

[20] Baek, M.Y. (1997). CAPD, an acceptable form of therapy in elderly ESRD patients, a comparative study. *Advances in Peritoneal Dialysis*, vol. 13. pp 158-161.

Figure 20 shows the impact upon per annum dialysis costs. Under this scenario the annual dialysis costs with 5 years would be just under $9.9 million rather than the 'no change' scenario of just over $10.2 million. This is an annual reduction in dialysis costs of $377,000. Within 10 years the reduction in costs would be $718,000 per annum. Improving the referral practices into the renal service has the potential to save a cumulative amount over the next ten years of around $3.7 million.
From this it can be seen that changes in practice, both within the renal service and in primary care, can have a significant impact upon the costs of the service as well as upon the nature of the service provided.

2.7.4 Modality Mix

This scenario has a significant impact upon the percentage of patients undertaking ICHD. The percentage decreases from 33% to 27%, driven largely by the increased numbers entering SSCHD.

Modality of Treatment	Current Rates %	Rates 2012 %	Rates 2017 %
Transplants	32	29	25
CAPD	21	24	27
ICHD	33	27	27
SSCHD	0	5	7
HHD	14	14	15

Table 6: Modality Mix Under Scenario 2

2.8 Scenario 3 - Improved Management of CKD

There is significant evidence to show that the progression of CKD can be slowed and this is important as it is the only strategy that can have an impact upon reducing the numbers of people with CKD requiring RRT. We also know that that, except in isolated cases, best practice in primary care does not exist for patients with CKD in New Zealand, let alone the MidCentral region. Screening for renal disease is not in place and the management of people with renal disease is variable. There is however scope for greater involvement of primary care in managing CKD, and MidCentral could take a more proactive role than has been achieved elsewhere in New Zealand. This relies on establishing effective processes between primary and secondary care to allow such innovations to take place. Information tools under development for cardio-vascular disease risk assessment and management in primary care have potential to be expanded to CKD (work for example is underway in Counties Manukau DHB in this area). In this scenario the model takes a conservative approach to what can be achieved and assumes that with best practice in place there will be a 20% reduction in the growth rate. That is, best practice will not reduce the intake, but will simply slow its rate of growth.

2.8.1 Total Dialysis Numbers

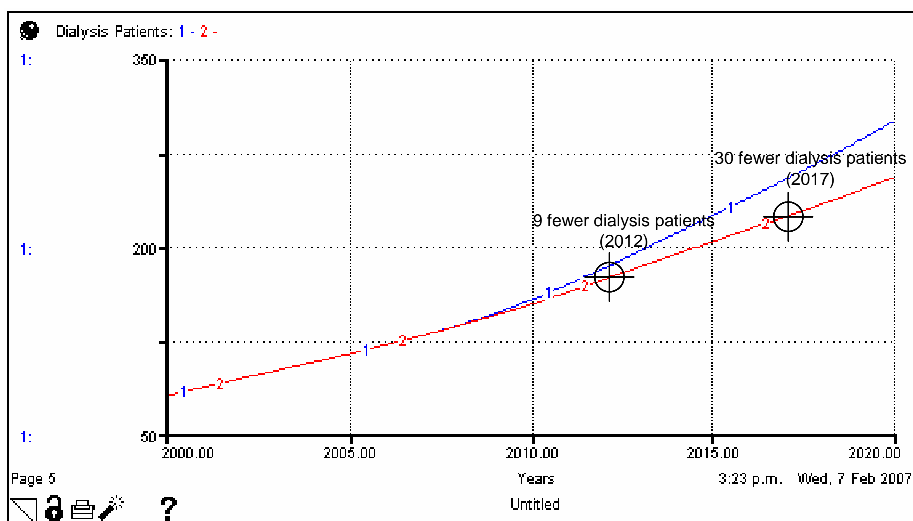

Figure 21: Total dialysis numbers under an 'improved management of CKD' scenario

Under this scenario the number of dialysis patients would continue to rise but at a reduced rate. By 2012 there would be 173 rather than 182 as in the base case of 'no change'. By 2017 this would be 223 rather than 253.

2.8.2 In-Centre Numbers

This overall reduction in dialysis patients would also be reflected in the numbers of patients receiving in-centre dialysis.

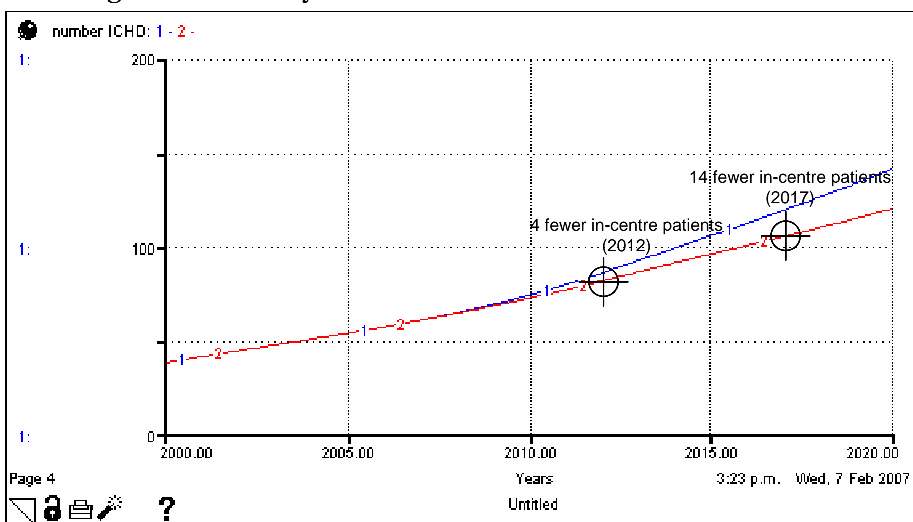

Figure 22: In-centre numbers under an 'improved management of CKD' scenario

In this case the number of in centre patients would, over the next five years reduce from the base case of 85 to 81. By 2017 this would be 105 rather than 119 as in the base case

2.8.3 Costs

Given these reductions there would also be a reduction in costs.

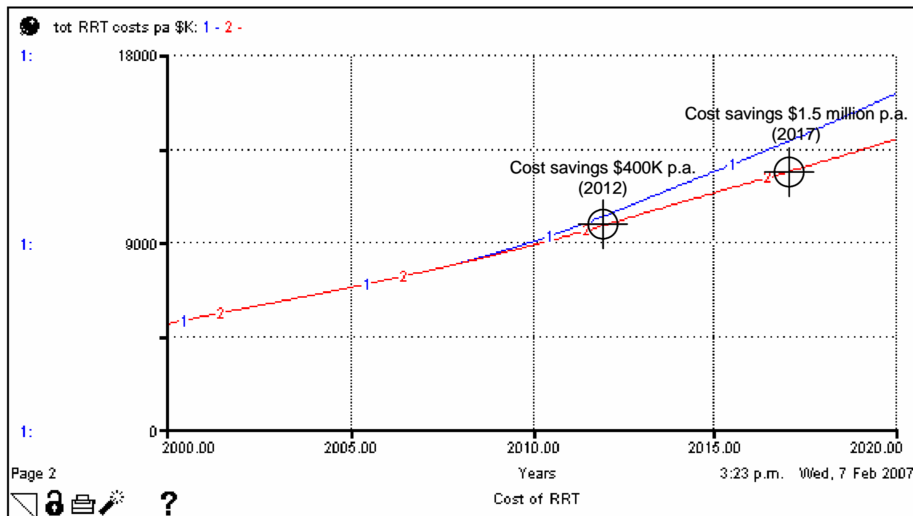

Figure 23: RRT costs under an 'improved management of CKD' scenario

Under this scenario the annual savings in dialysis costs would be around $400,000 by 2012, reducing annual costs from $10.2 million to $9.8 million. By 2017 the annual savings would be around $1.5 million, reducing annual costs from $13.8 million to $12.3 million.

2.8.4 Modality Mix

This scenario has a little impact upon the modality mix. Current trends continue with the decrease in the transplant rate being taken up by slight increases in CAPD and ICHD.

Modality of Treatment	Current Rates %	Rates 2012 %	Rates 2017 %
Transplants	32	30	27
CAPD	21	23	24
ICHD	33	33	35
SSCHD	0	0	0
HHD	14	14	15

Table 7: Modality Mix Under Scenario 3

2.9 Scenario 4 - Best Practice

This scenario combines scenarios 2 and 3 to simulate something close to best practice renal care. Under this scenario there is effective management of CKD within primary care, thus reducing the growth rate of renal patients into ESRF. In addition, there is timely referral to the renal unit allowing effective pre-dialysis education and timely vascular access. Under this scenario the combined impacts are quite significant.

2.9.1 Total Dialysis Numbers

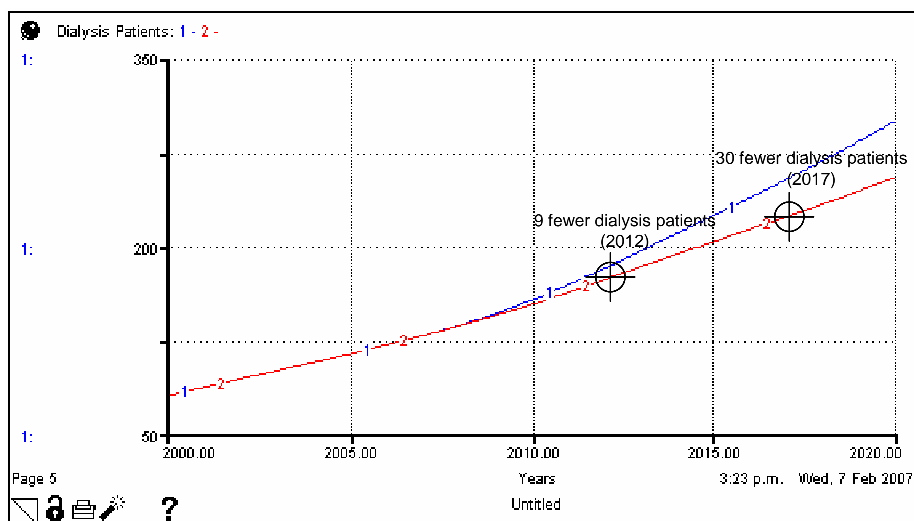

Figure 24: Total dialysis numbers under a 'best practice' scenario

Over the next five years the projected numbers of dialysis patients receiving treatment would be 173 rather than 182 as in the base case. By 2017 this would be 223 rather than the base case of 253.

2.9.2 In-Centre Numbers

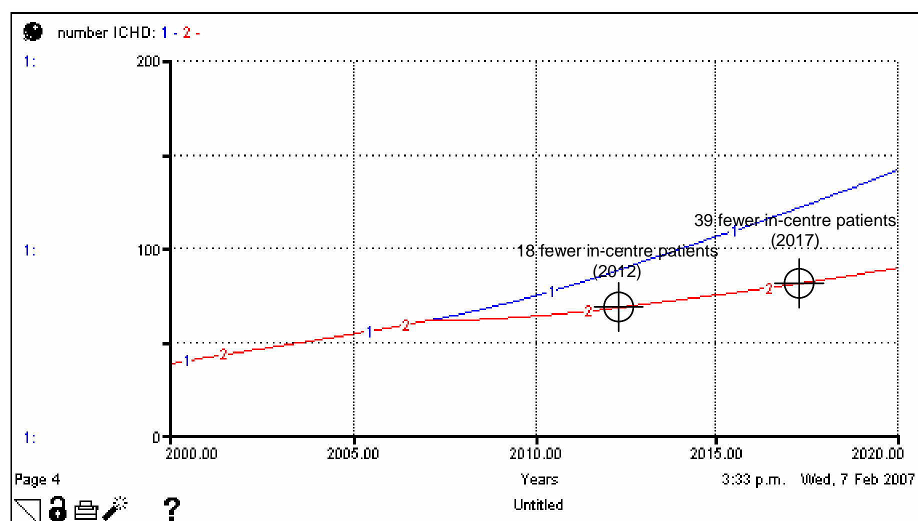

Figure 25: In-centre numbers under a 'best practice' scenario

In-centre numbers would be significantly fewer under this scenario. Within five years this scenario projects an in-centre patient load of 67 as opposed to the base case of 85. By 2017 the numbers would be 80 rather than the base case of 119. This is because not only is the growth in overall demand being reduced by better management of CKD in primary care but also improved referral practices mean more patients can take up options other than in-centre dialysis i.e. those patients who do require RRT have an early involvement with their renal physician who can manage their progress through to dialysis, ensuring appropriate work up,

timely access and, as a result, increased opportunity to take up options other than in-centre dialysis.

2.9.3 Costs

The reduction in numbers, combined with a lower percentage going into hospital-based in-centre dialysis provides a significant impact on costs.

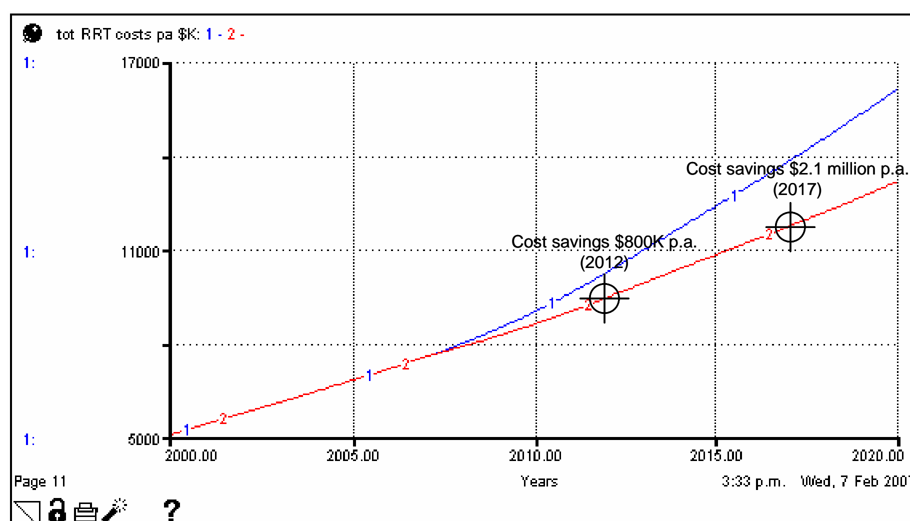

Figure 26: RRT costs under a 'best practice' scenario

Under this best-practice scenario costs at five years would reduce from the base case estimate of $10.2 million per annum to $9.4 million. At 10 years this would be $11.7 million per annum rather than the base case of $13.8 million a saving over $2 million per annum.

Over the ten year period this accumulates to a difference of $8.8 million in dialysis costs. In addition, as fewer in-centre facilities would be required there would be additional positive cost impacts in terms of capital expenditure requirements.

2.9.4 Modality Mix

This scenario has a similar impact to scenario 2. The percentage of ICHD decreases as increased opportunities are opened up for SSCHD.

Modality of Treatment	Current Rates %	Rates 2012 %	Rates 2017 %
Transplants	32	30	27
CAPD	21	24	26
ICHD	33	27	26
SSCHD	0	5	7
HHD	14	14	15

Table 8: Modality Mix Under Scenario 4

2.10 Scenario 5 – Best Practice Combined with Maintenance of the Transplant Rate

This scenario brings together best practice, in primary care and in the renal unit, with the maintenance of the transplant rate.

2.10.1 Total Dialysis Numbers

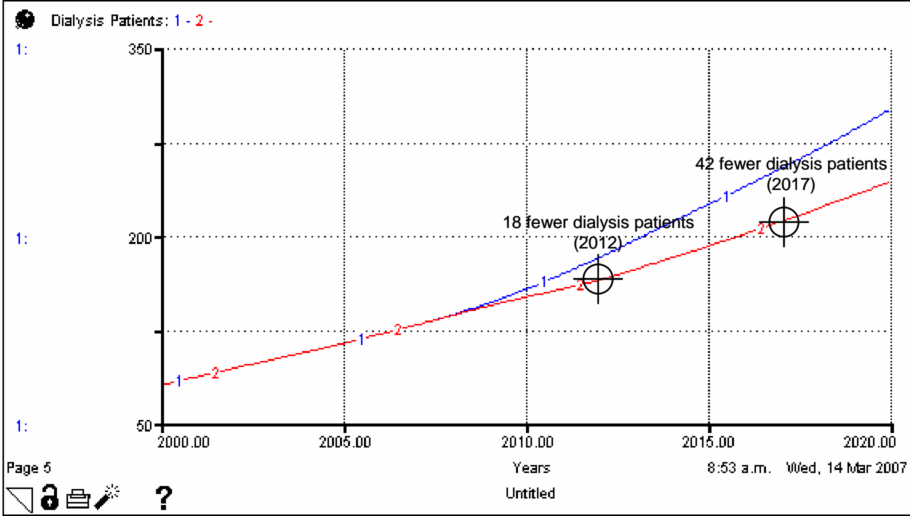

Figure 27: Total dialysis numbers under a 'best practice combined with maintenance of transplant rate' scenario

Best practice, combined with maintenance of the transplant rate has a significant impact upon dialysis numbers. Under this scenario, by 2012 there would be 18 fewer patients receiving dialysis as against the base case. By 2017 there would be 42 fewer.

2.10.2 In-Centre Numbers

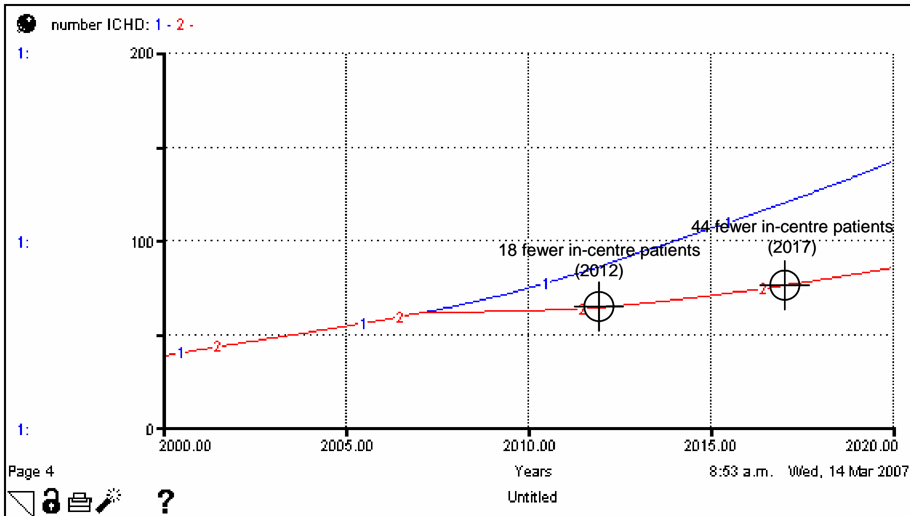

Figure 28: In-centre numbers under a 'best practice combined with maintenance of transplant rate' scenario

There is a significant impact upon in-centre numbers under this scenario with 18 fewer patients receiving in-centre dialysis within five years and 44 fewer by 2017.

2.10.3 Costs

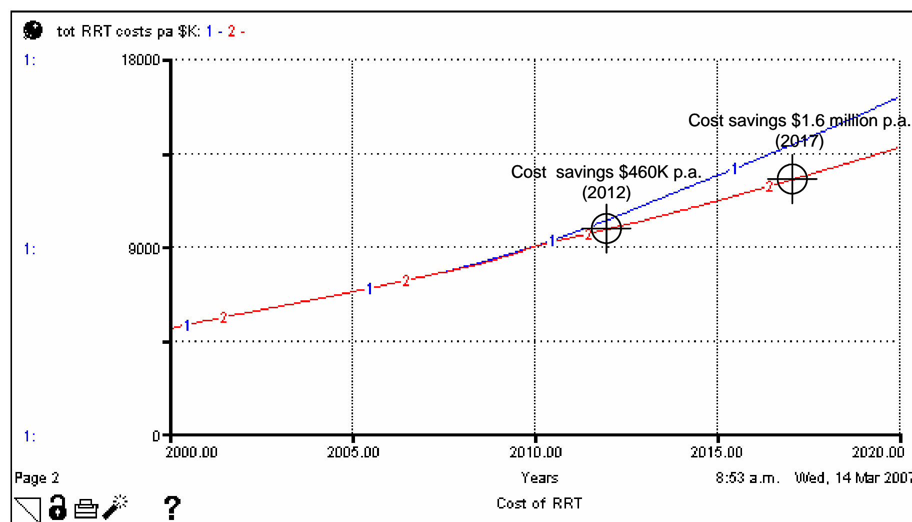

Figure 29: RRT costs under a 'best practice combined with maintenance of transplant rate' scenario

The impact upon costs is less significant. The reason for this is that transplant patients have far better outcomes resulting in a significant increase in renal patients over the period of the simulation. While the ongoing costs per patient of transplants is significantly lower, the initial cost of the transplant combined with the increased life span of transplant patients means that the net cost impact is not as significant as has been assumed by some people. Compared with scenario 4 there are 9 more patients receiving RRT in 2012 and 30 more by 2017.

2.10.4 Modality Mix

This scenario has the biggest impact upon the numbers receiving ICHD. Within this scenario the percentage of patients receiving ICHD decrease from the current level of 33% to 25% within five years and 23% within 10 years

Modality of Treatment	Current Rates %	Rates 2012 %	Rates 2017 %
Transplants	32	34	34
CAPD	21	22	23
ICHD	33	25	23
SSCHD	0	5	6
HHD	14	14	14

Table 9: Modality Mix Under Scenario 5

2.11 Model Scenarios – Summary

The scenarios shown above illustrate that the size and nature of renal demand can be influenced by MidCentral. While population demographics have a significant impact, good

primary care practice and optimal care within the renal unit can have a substantial impact upon the quality of life for patients and on costs for MidCentral. None of the scenarios discussed however offer an immediate respite and all require investments to be made if the gains are to be achieved.

3. Recommendations

3.1 Overview

From the analysis undertaken and from the results of the simulation modelling we have put forward five broad recommendations for MidCentral Health to consider for the development of a sustainable renal service. These are:

- enable the renal service to intervene earlier in the course of CKD
- achieve an appropriate mix of treatment modalities
- increase the awareness of live donor kidney transplants
- improve the process of choice to the management of ESRF including palliative care
- reduce the number of patients requiring emergency dialysis

To assist MidCentral to evaluate the implications of these recommendations we have described each, in the following sections and outlined a number of actions that could be undertaken to implement them. Recommendations 1 & 2 are the main recommendations being made as they will have the largest impact upon patient numbers and upon costs. Recommendations 3, 4 & 5 provide additional options which can enhance the benefits gain from the first two. Following the description of these recommendations we have, in section 4 developed an outline of a project plan, including key tasks and milestones. The plan describes the key activities, over the next two years, that we believe will enable MidCentral to make significant progress in implementing the recommendations listed above.

3.2 Key Recommendation 1 – Intervene Earlier in the Course of CKD

Currently, the way hospital services are structured and managed, no one person is responsible for the overall management of a patient with multiple conditions. This is the case for patients with CKD and ESRF. This leads to sub-optimal care for the patients and increased costs due to increased hospital visits. It also makes earlier intervention in the course of CKD difficult. The key goals of early intervention are to:
Slow the progression of CKD by better management in primary care e.g. of hypertension

Reduce the development of complications of CKD e.g. bone disease, anaemia

Enable better anticipation and preparation for ESRF, especially to enable wise choice of the best option to manage ESRF, and to reduce the number of patients coming on to In-Centre Haemodialysis as emergencies

Possible actions:

- Viewing CKD and ESRF as a chronic disease and integrating the renal service within MidCentral's CCM programme.
- Address preventative strategies and actions including health promotion activities e.g. invite patients who suffer from a range of chronic conditions and supportive caregivers to group sessions where they can discuss, with clinical staff, issues that are common to many of them. Such sessions could include patients with CKD and/or coronary disease, and/or diabetes.
- Screening for renal disease.
- Increased focus on the needs of elderly patients including early intervention with elderly patients to help prevent more rapid decline in condition; cross unit collaboration to improve management of elderly patients with co-morbidities and supportive caregivers; involvement of geriatricians in undertaking a comprehensive assessment beyond the renal specialty and expanded options outside of the hospital to assist in the management of elderly patients with CKD.
- Risk factor identification and management e.g. blood pressure.
- Education of primary health care practitioners.
- Increased primary care access to nephrologists through the use of email and a dedicated mobile phone and funding support for this prompt response by the nephrologist rather than have the patient wait on an FSA list.
- Development of chronic care management nurses.
- Shared database between primary and secondary care.
- Education support material for primary care practitioners.
- Specialist support – nurses, medical staff.
- Development of staffing plan to ensure that there is an investment in staff resources beyond that needed to simply meet minimal requirements for treatment of ESRF, enabling them to bring about increased understanding and capability within the primary sector.

3.3 Key Recommendation 2 – Appropriate Mix of Modality Options

Best practice in RRT places a major emphasis on self care, wherever possible. The premise underlying self care is that because patients live with their condition 24 hours a day they develop a level of expertise that is different from, but as least as important, as that held by the clinician. A focus on supported self care has been shown to increase patient self-responsibility and sense of control and decrease use of hospital services. It is important therefore that MidCentral increase the supported self care options available. It is unlikely that the percentage of home dialysis patients can be increased. However, a recent survey of current patients indicates that the number of patients coming onto in-centre dialysis could be decreased by up to 50% if there was much better management of early CKD especially in regard to anticipation and preparation for ESRF. A range of supported self care options would be essential for this to be achieved. The new supported self care facility is a significant step towards this.
Possible actions:

Timely decisions about RRT to enable promotion of self care options where appropriate for patient.

Increase availability of self-care units e.g. Whanganui and Horowhenua.

More education for supported self-care options i.e. CAPD, home dialysis, supported self care unit.

Increase nurse education to support self care options.

Early involvement of nephrologist in stage IV of the disease.

Improve timeliness of vascular and peritoneal access.

Utilise the new costing system to undertake a thorough analysis of the costs of different modalities using the methodology provided by Counties Manukau DHB.

Support for "by Maori, for Maori" services and similar services for Pacific Peoples.

3.4 Additional Recommendation 3 – Increase the Awareness of Live Donor Kidney Transplants

Transplants provide a much better quality of life for patients and currently New Zealand has a very low, and decreasing, number of transplants being undertaken each year. Transplants also provide a significantly lower ongoing cost as opposed to dialysis.

Efforts are underway nationally to increase the number of people willing to donate kidneys in the event of untimely death (cadaveric donors). However, this programme has not been successful to date. An alternative is for the kidney to be donated by a living donor, usually a relative. Of the kidney transplants performed in New Zealand, 45% came from live donors in 2004. This has risen considerably since 2000.

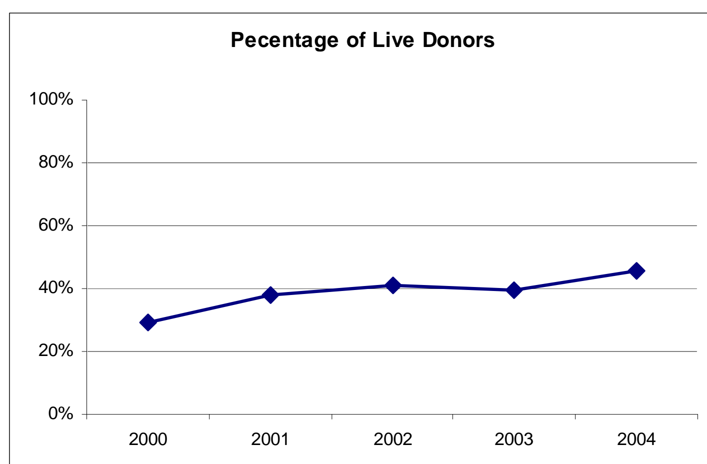

Figure 30: Percentage of Live Donors within New Zealand

However this graph hides the real story, which is the fact that the overall number of transplants is not increasing. In fact, since 2002 it has declined from a high of 117, to 105 in 2004; the major decline being in the number of cadaveric donors.

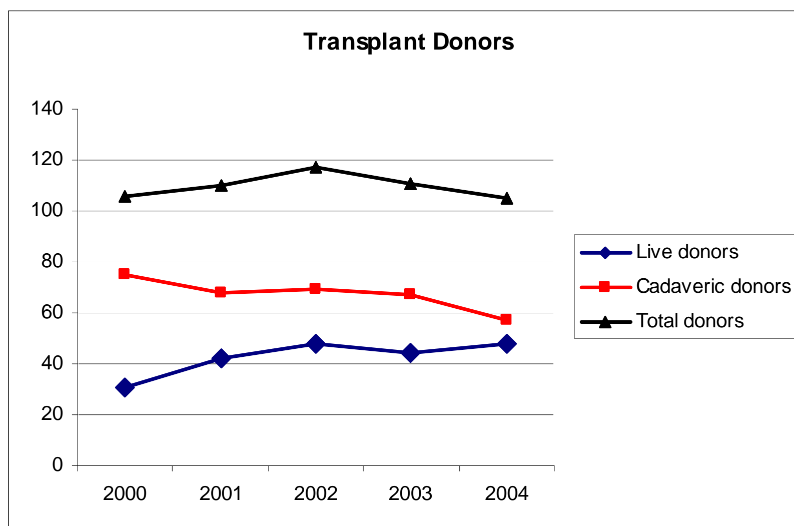

Figure 31: Source of Live Donors within New Zealand

The decision to donate a kidney to another person is a major one. These decisions are best made when there is adequate time for potential donors to be fully assessed and informed, and for all parties to make their decisions without undue pressure. There is evidence that, when the possibility of live related donation of a kidney is raised early with families with adequate support, the rate of donor transplants increases.

In general, patients do better (in relation to survival, complications, etc) if they receive their kidney transplant before their renal disease and its complications become too far advanced. In addition to the limited supply of donors MidCentral faces another problem in that Capital and Coast District Health Board, who carry out the transplants for MidCentral patients has limited theatre time allocated and is therefore unable to perform all of the transplants possible. It is important therefore that MidCentral engage in discussions with Capital and Coast to explore how this constraint can be addressed.
Possible actions:
Promote timely consideration of transplantation from live donors.

Ensure all patients are assessed early and put on the transplant list where appropriate.

Instigate conversations with Capital and Coast to explore ways in which transplant volumes could be increased.

Facilitate the work-up of transplants

3.5 Additional Recommendation 4 – Improve the Process of Choice to the Management of ESRF Including Palliative Care

Palliative care is an option for all patients who are facing end-of-life choices which they should be able to consider. This is best done in a non-crisis environment where patients and family can consider the options. This requires earlier involvement in the disease progression.
Possible actions:
All patients given opportunity to consider palliative care at the most appropriate time.

Ensure discussion is undertaken early enough to avoid inappropriate dialysis.

3.6 Additional Recommendation 5 – Reduce Number of Patients Requiring Emergency Dialysis

Emergency dialysis is costly, disruptive and very bad for patients, who end up with much worse mortality and morbidity rates. It also leads to increased use of ICHD and makes discussions about palliative care as an option very difficult and often impossible.
Possible actions:

- Mapping of the 'patient journey' to identify blockages and 'failure points' within the system that result in patients requiring emergency dialysis
- Education of primary health care practitioners, patients and supporters/caregivers
- Screening for renal disease
- Regular monitoring of the progression of CKD
- Early involvement of specialist renal service in stage IV of the disease
- Pre-dialysis education to allow timely decisions about options for managing ESRF (dialysis, transplantation, palliative care)
- Adequate availability of alternatives to ICHD (especially supported self-care dialysis)
- Timely preparation for the chosen option for managing ESRF, including education and surgical preparation of vascular and peritoneal access.

3.7 Recommendations: Summary

It can be seen that there is considerable synergy in these recommendations. Many of the actions recommended contribute in several ways to improving the overall quality of life for the patients and the cost-effectiveness of renal services. Equally, achieving the potential benefits is often dependent on implementing several of the recommendations as an integrated package. Because of the interdependent nature of the system we are dealing with, it is important that any plan takes account of the synergies and the key networks involved, identifies key leverage points for change and engages key stakeholders in a collaborative yet directed manner.

Section 4 provides the framework for an implementation plan that brings together the recommendations and the range of possible actions into a coherent plan that, if implemented, could take MidCentral Health a long way towards providing world-class renal care for its population.

4. Implementing the Changes

4.1 The Opportunity

Whilst the four scenarios discussed in section 2 show a range of possible futures, minor investments and changes at the margins will not be enough to change the trends currently underway. Business as usual will bring with it increasing costs and increasing medical risk as more and more patients require RRT, and more and more arrive at the renal centre already desperately sick and in need of emergency dialysis. As the case described in section 1.3 tried to highlight, the needs of chronic patients are different and providing services in a manner designed to meet the needs of acute patients who have episodic bouts of illness and/or injury will not bring about the changes required. Changing the base-case scenario requires a shift in thinking from episodic interventions to designing a system that acknowledges the specific requirements of patients with chronic conditions.

The major potential of change is in improvements in the quality of life for people with ESRF, with more patients able to manage their condition in a confident empowered way. The unusual aspect of renal care however, is that the ongoing cost of best-practice care is less expensive than the current practices. Whilst investments will be required to bring about changes, once implemented they provide a far better cost profile.

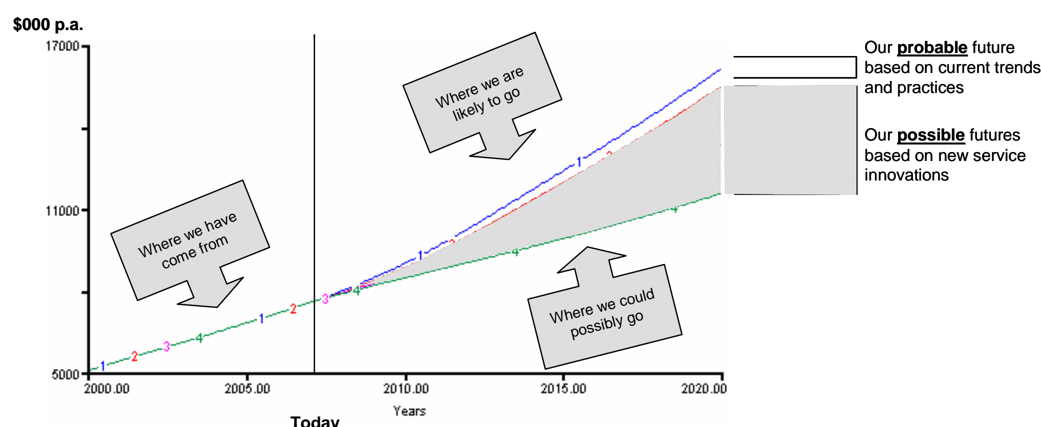

Figure 32: The Financial Opportunities of Best Practice

Given the nature of renal disease, and what is known about the factors that contribute to it, the future for MidCentral is fairly clear if current trends and practices continue. While all plausible future scenarios show an increase in numbers and in costs, there are considerable opportunities for MidCentral to have an impact on the future trajectory of numbers and costs. To capitalise on these opportunities however will require some bold action.

4.2 Implementation Plan Outline

If the challenges and opportunities of this report are to be tackled then MidCentral needs to develop an implementation plan that goes beyond single initiatives. Instead it needs to be part of a comprehensive, long-term programme to bring about significant changes in service delivery, and thereby bringing about significant improvements in quality of life for patients and significant reductions in costs.

What follows is a description of the key aspects that would need to be included in the plan with key objectives and timelines:

4.2.1 Implementation plan – patient flows

A key part of any implementation plan is the mapping of patient flows and provider networks. To be successful this work needs to engage a wide range of stakeholders, including patients and their families, and providers involved in community, primary, secondary and tertiary services.

Specific objectives that MidCentral should strive to achieve are the mapping of patient flows and provider networks involved in:

the transition from primary care through to the renal unit,

surgical access,

preparing for, booking and undertaking transplant operations.

4.2.2 Implementation plan – facilities

A key theme of this part of the implementation plan would be to shift dialysis out of the hospital. There is only a need for about two or three chairs within the hospital, for patients with acute kidney failure, and those who require hospitalisation for reasons other than dialysis. Dependent patients, requiring the support of professional clinical staff should be housed in a facility that, while still being in the hospital grounds, should be separate from the main hospital wards. This would not only make a significant improvement in the quality of life for patients but would make it easier to create an environment that would support greater independence. Such a facility would assist in increasing the numbers who would be willing and able to shift to supported self care options, which are better for the patients and significantly less expensive. Such separate units have been in place for years in Auckland and Counties Manukau.

We would recommend the following objectives for facilities planning:

facilities plan for a supported self-care unit at Horowhenua and Whanganui,

assessment of rest homes, or other suitable provider organisation who can provide dialysis for dependent patients within their own facilities,

plan for shifting the in-centre unit for dependent patients to a building separate from the main hospital facilities.

4.2.3 Implementation plan – staffing

As noted in the document, staffing is below what is needed for optimal care. What we are proposing in this report is that MidCentral not only increase staffing to the levels required for good patient care but that they also, over the next two years provide additional staffing to help support the changes in primary and secondary care of renal patients needed to bring the patient and financial benefits discussed above.

The specific objectives we would recommend for staffing would be:

development of a workforce plan to bring MidCentral renal services up to the standards recommended for optimal care, including specialist nursing roles

assessment of the staffing required to bring about changes in practices in both primary and secondary care.

4.2.4 Implementation plan – education

Education, of both patients and providers, will be a crucial part of any plan designed to bring about the changes described in this report. With the staffing to undertake such work, we would also recommend:

investment is made in the development of suitable curriculum materials,

the establishment of an education programme for patients and providers.

4.2.5 Implementation plan – information

A renal database shared between primary and secondary care is an important part of any plan to make significant changes in current practices. While the information in this report could provide considerable insight into what such a database would need to cover we are not in a position to provide detailed specification. However we would recommend that:

MidCentral undertake work to provide the detailed user requirements of a shared database,

The user requirements are used to explore the many different ways they could be met using a range of information technology options.

4.2.6 Implementation plan – evaluation

The issues described in this report will require substantial investment if they are to be addressed. Given both the size of the challenge and that fact that it will require innovative practices it is important to instigate an evaluation programme as early as possible. This is important as successful evaluation will require the engagement of key stakeholders. The specific recommendations we would make in respect to evaluation are:

A commitment to develop an evaluation programme alongside the implementation plan.

4.3 Managing the Change Process

Section 4.2 described the key elements that would need to be in any implementation programme. Section 4.3 describes some key themes that need to be kept in mind as the implementation programme is being designed.

4.3.1 Build change as part of an integrated pathway

To be successful changes need to be co-ordinated, starting with small focused interventions that address immediate issues, but ensuring that these are consistent with i) a broader set of stakeholders involved in CKD and ii) a focus on longer term development. For example, it is important that the arrival of the new renal physician is not seen as an opportunity to simply see more patients, i.e. meet the immediate short-term requirements, but as an opportunity for the renal team to spend time with primary practitioners, supporting changes to the referral practices of GP's by the provision of guidelines, education and communication. Whilst it maybe appropriate to begin by looking at process changes that can be taken within the hospital only e.g. processes to improve surgical access, it must be undertaken within the longer-term context of improved processes between primary and secondary care.

4.3.2 Make changes to the renal service within the context of the broader CCM programme being developed by MidCentral DHB

CKD is a chronic condition that has much in common with other chronic conditions such as heart disease. Most benefits will be gained if the interventions that take place to improve the management of CKD and ESRF are integrated into a broader programme involving other disease conditions. For example, making sure that any efforts to improve primary care's management of the early stages of CKD is integrated within the broader CCM programme being implemented by MidCentral.

4.3.3 Think prevention, anticipation and long-term

As the simulation outputs show, chronic disease is a condition that can only be addressed through long-term sustained change. We have a society and a health system that focuses on heroic gestures; the new 'miracle cure', the operation that brought the patient back from the brink of death, etc. Unfortunately these crisis interventions are often less than ideal for the patient (frightening, disempowering and disabling, and often associated with complications) and often very expensive. Chronic disease is slower, less dramatic and often relentless. It creeps up on us - as patients and as service providers. It is not amenable to quick cures, but requires long, persistent and consistent adherence to an agreed programme supported by long-tem investment. This is particularly so in renal disease. Because of this any decisions made by MidCentral to address the issues of renal disease need to be within a minimum five to ten year time-frame and any funding associated with such decisions should be committed to for that period.

5. GLOSSARY OF TERMS AND ABBREVIATIONS[20]

Acute: Occurring suddenly or over a short period of time.

ANZDATA: Australia and New Zealand Dialysis and Transplant Registry

CAPD: Continuous Ambulatory Peritoneal Dialysis

Continuous Ambulatory Peritoneal Dialysis: Form of dialysis in which dialysis fluid is exchanged at regular intervals throughout the day

Cerebro Vascular Disease: disease involving the blood vessels supplying the brain, including cerebro vascular accident (CVA), also known as a stroke.

CKD: Chronic Kidney Disease

Chronic Kidney Disease: Slow and progressive deterioration of kidney function. Also called kidney failure, usually irreversible

Chronic: Continuing over a certain period of time; long-term.

Chronic Lung Disease: Long term lung disease such as asthma, chronic bronchitis and emphysema

Comorbidity: The presence of multiple disorders in one individual. These simultaneous conditions may be independent of each other, or they may be correlated. Comorbidities often influence the risk of complications for surgery as well as overall prognosis.

Coronary Heart Disease: This is the most common form of heart disease, which involves a reduction in the blood supply to the heart muscle by the narrowing or blockage of the coronary arteries.

DHB: District Health Board.

Diagnosis: The process of identifying the nature of a disorder.

Dialysis: the process of cleaning wastes from the blood artificially with special equipment. The two major forms of dialysis are haemodialysis and peritoneal dialysis.

Early Intervention: A process used to recognise warning signs for health problems and to take early action against factors that put individuals at risk. Early intervention can help people get better in less time and can prevent problems from becoming worse.

ESRF: End-Stage Renal Failure

End-Stage Renal Failure: the final phase of kidney disease; treated by dialysis or kidney transplantation.

Glomerular Filtration Rate (GFR): GFR is the glomerular filtration rate and is a measure of the health of the kidney. It refers to the ability of the kidney to filter out toxins and CKD is considered to be present when this rate drops below 90 millilitres per minute.

Haemodialysis: a method for removing waste products such as potassium and urea, as well as free water from the blood when the kidneys are incapable of this (i.e. in renal failure). It is a form of renal dialysis

HHD: Home haemodialysis

Home haemodialysis: the provision of haemodialysis at the home of the patient with end-stage renal failure

Hypertension: Persistently elevated blood pressure; also called high blood pressure.

ICHD: Incentre haemodialysis

Incentre haemodialysis: the provision of haemodialysis at a secondary care facility such as a hospital

Intersectoral: Between sectors.

Kidneys: organs in the body that filter wastes (such as urea) from the blood and excrete them, along with water, as urine.

Maori: Indigenous people of New Zealand.

Morbidity: Illness.

Mortality: Death.

Pacific peoples: The population of Pacific Island ethnic origin (e.g., Tongan, Niuean, Fijian, Samoan, Cook Islands Maori and Tokelauan), incorporating people born in New Zealand as well as overseas.

Palliative care: The active total care of patients whose disease is not responsive to curative treatment. Palliative care seeks to improve patients' quality of life by relieving physical, emotional, and spiritual pain for patients and their caregivers.

Peripheral Vascular Disease: Diseases of blood vessels outside the heart and brain. It is often a narrowing of the vessels that carry blood to leg and arm muscles.

Peritoneal Dialysis: a method for removing waste such as urea and potassium from the blood, as well as excess fluid, when the kidneys are incapable of this (i.e. in renal failure). It is a form of renal dialysis, and is thus a renal replacement therapy

Renal: kidney, relating to the kidneys.

Risk factor: An aspect of personal behaviour or lifestyle, an environmental exposure, or an inborn or intended characteristic that is associated with an increased risk of a person developing a disease.

Renal Failure: The loss of the kidneys ability to adequately filter the blood.

RRT: Renal Replacement Therapy

Renal replacement therapy (RRT): a term used to encompass life supporting treatments for renal failure. Renal Replacement Therapy is required when the kidneys are functioning at less than 10% to 15%.It includes: haemodialysis, peritoneal dialysis, and renal transplantation.

SSHD: Supported self care haemodialysis

Supported self care haemodialysis: the provision of haemodialysis at a facility outside a hospital environment

Type II Diabetes: mild form of diabetes mellitus that develops gradually in adults; can be precipitated by obesity or severe stress or menopause or other factors; can usually be controlled by diet and hypoglycaemic agents without injections of insulin

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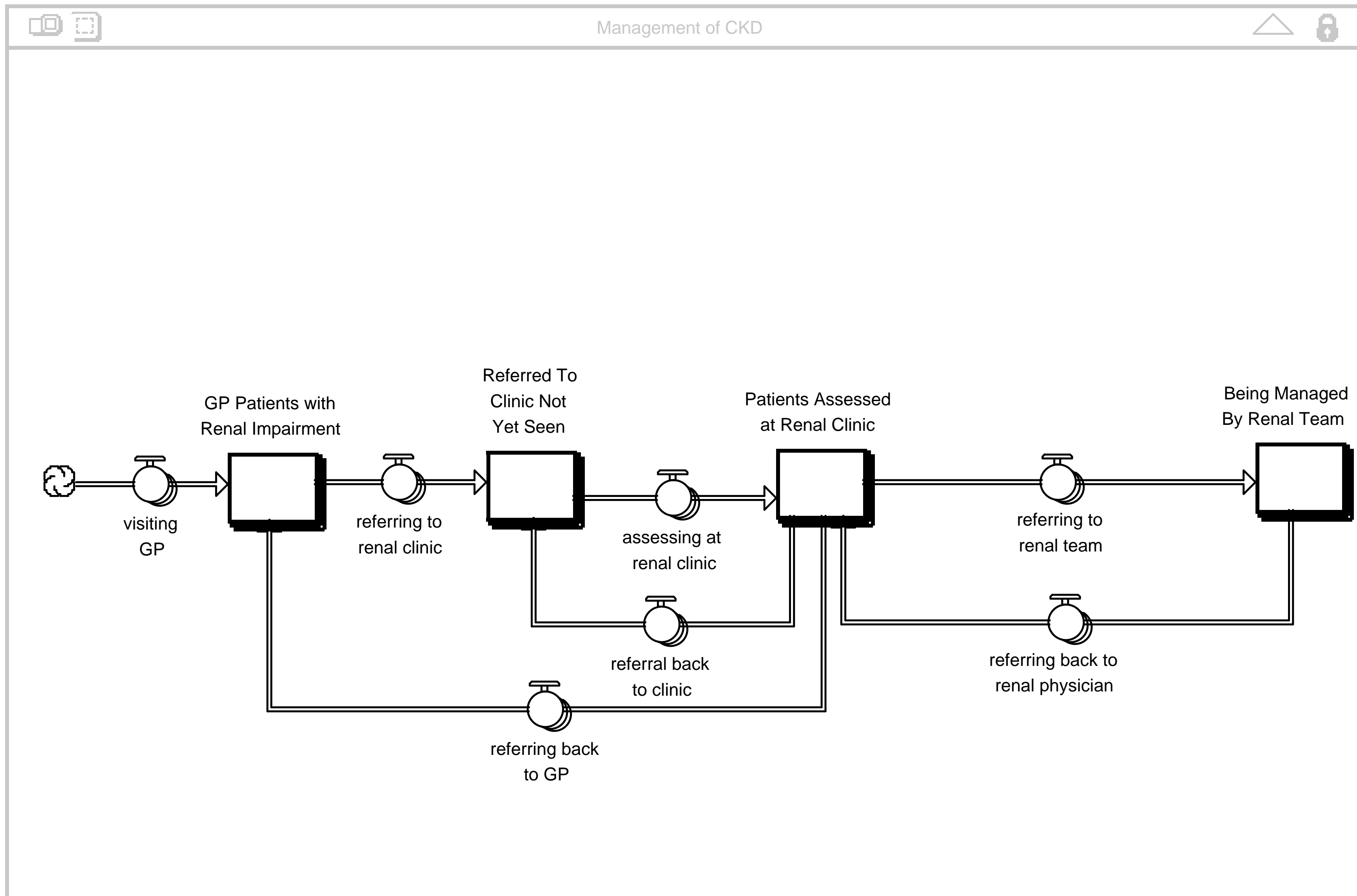
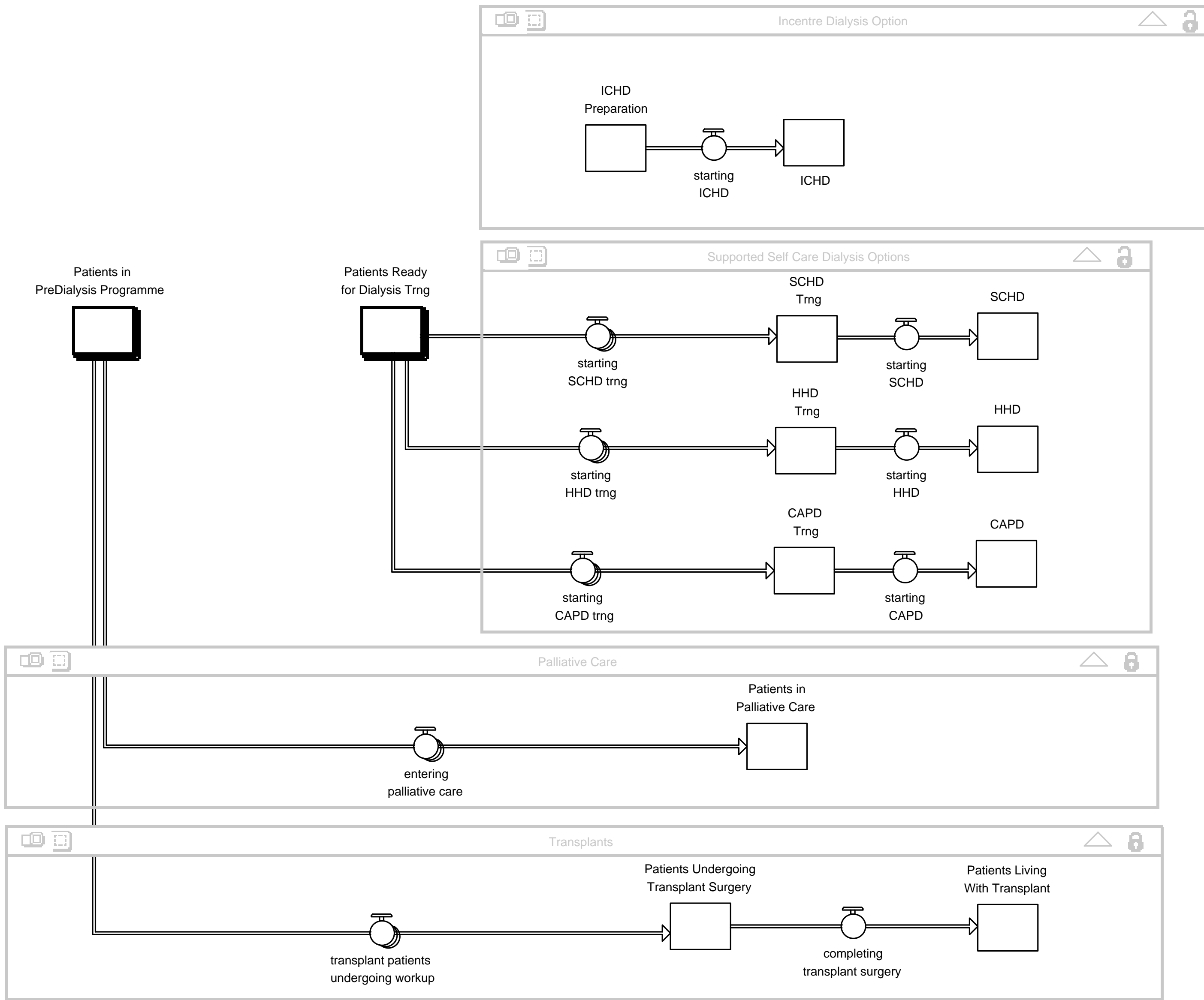
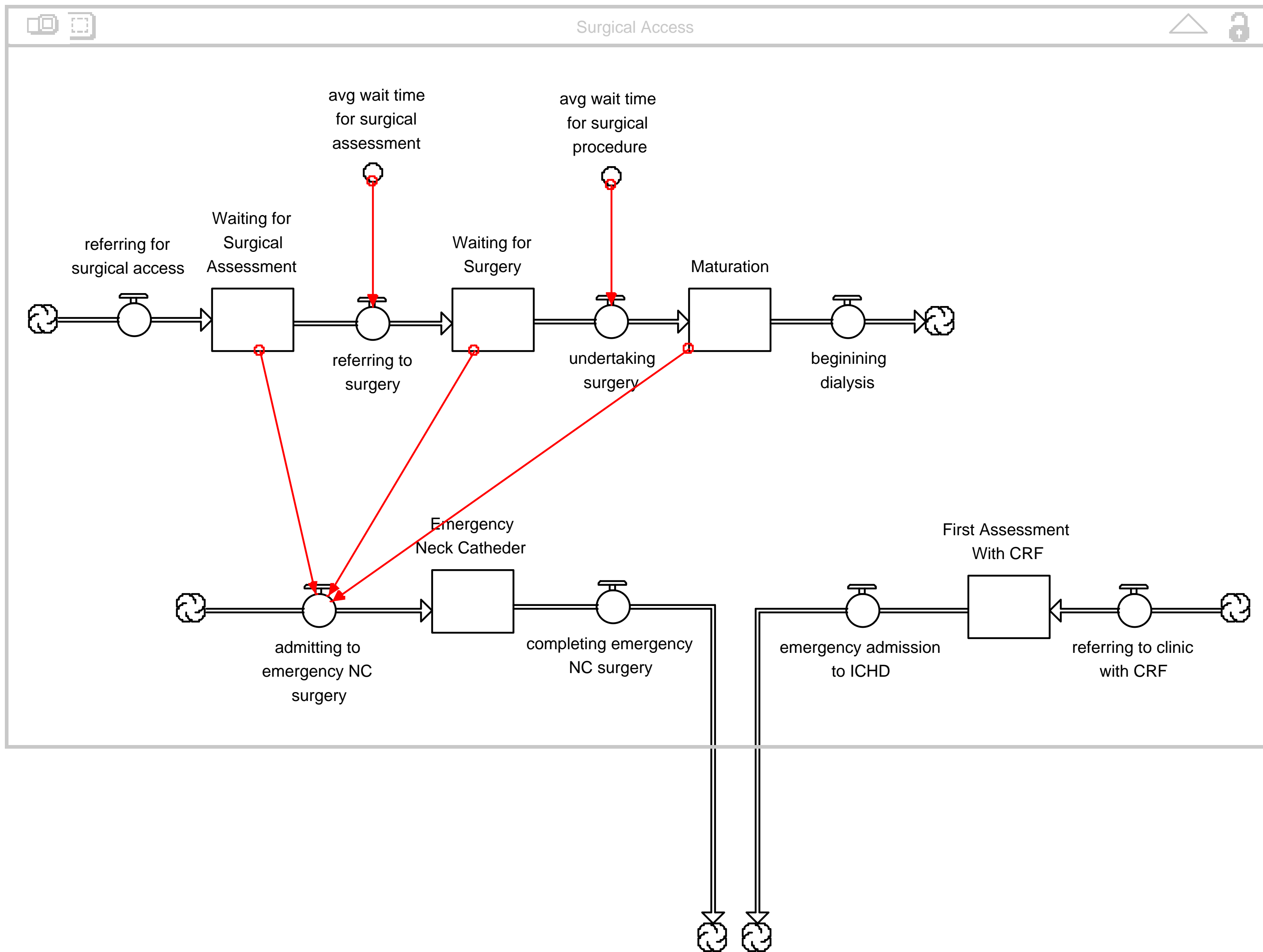
7. Appendix 1 – Flow Models





Incentre Dialysis Option
ICHD Preparation
starting ICHD
ICHD
Supported Self Care Dialysis Options
Patients in PreDialysis Programme
Patients Ready for Dialysis Trng
SCHD Trng
SCHD
starting SCHD trng
starting SCHD
HHD Trng
HHD
starting HHD trng
starting HHD
CAPD Trng
CAPD
starting CAPD trng
starting CAPD
Palliative Care
Patients in Palliative Care
entering palliative care
Transplants
Patients Undergoing Transplant Surgery
Patients Living With Transplant
transplant patients undergoing workup
completing transplant surgery


Surgical Access
avg wait time for surgical assessment
avg wait time for surgical procedure
referring for surgical access
Waiting for Surgical Assessment
Waiting for Surgery
Maturation
referring to surgery
undertaking surgery
beginining dialysis
Emergency Neck Catheder
First Assessment With CRF
admitting to emergency NC surgery
completing emergency NC surgery
emergency admission to ICHD
referring to clinic with CRF