Cost-benefit study of the feasibility of providing dialysis in the Cook Islands

Executive Summary

The Cook Islands Ministry of Health contracted Carla Wilson (Eve Bay Research) to undertake a study of the costs and benefits of providing dialysis treatment under the current arrangements (provided in New Zealand) compared with the costs, benefits and feasibility of providing dialysis services in the Cook Islands.

This study identifies: the current trends in Cook Islands dialysis patients, (i.e. numbers, the types of treatments); the costs and feasibility of both Haemodialysis (HD) and Peritoneal dialysis (PD), in developing countries; the costs of dialysis treatment in New Zealand and the potential costs of dialysis treatment in the Cook Islands; and key issues and considerations for further discussion when considering the costs, benefits and feasibility of providing dialysis treatment in the Cook Islands.

Given the limited scope of this assessment, the key focus is on assessing the direct medical and direct non-medical costs of providing dialysis treatment in the Cook Islands. However, where possible, reference has also been made to key indirect costs (e.g. social welfare provision, loss of productivity) and intangible costs (e.g. stress associated with not being treated at home).

From reviewing the literature on dialysis in developing countries, it is evident that there is a lack of published rigorous economic evaluations, and therefore it is difficult to assess the true costs of dialysis treatment. A number of authors stress the significant investment in economic, human and technical resources required for long-term dialysis in developing countries. When considering treatment options in developing countries, cost and access to equipment and trained professionals are the two biggest barriers.

Many Pacific Island countries appear to have ruled out developing HD capacity on-island because of the costs and staffing requirements. The few HD units operating in the Pacific are mostly funded privately by foundations and rely on donated equipment in the set up phase, and have difficulties with the ongoing costs. The examples provided in the report from Samoa, Fiji and New Zealand highlight the significant set up and operating costs required for a HD unit.

PD is often seen as a less expensive treatment than HD, as the same level of capital 'set up' costs are not required, although the operating costs per patient are similar. The economics of PD are driven primarily by variable or 'disposable' costs, such as the costs of solutions and dialysis tubing. The total cost of providing PD for ten patients in the Cook Islands is estimated to be $438,700 in the first year and $379,700 for each of the following years. These costs include the cost of dialysis as well as the primary care treatment for co-morbidites and the non-medical costs.

These figures are based on an assumption that ten patients would be available to start PD in the Cook Islands. These patients will include a mixture of new patients and patients returning to the Cook Islands. This number is the minimum required to start a PD service (in terms of ensuring staff skills are maintained). However, at this stage, it is unclear whether there would be even ten patients ready and able to undertake PD in the Cook Islands. Currently, it is estimated that on average four new dialysis patients come from the Cook Islands each year for HD or PD and approximately half of

these patients may be suitable for PD. However, out of those who may be suitable for PD, some might still choose to receive treatment in New Zealand (e.g. to be on the transplant waiting list, to access welfare payments, to have access to ongoing specialist care). In addition, a key requirement of PD is that patients can manage their own treatment and not all patients would be able to, or would want to, self manage. Many Cook Islands patients have demonstrated a preference for hospital based HD treatment rather than home based care. A significant proportion of Cook Islands patients may therefore chose to to be based in New Zealand. It is recommended that further analysis is undertaken to ensure that there are at least ten suitable and willing patients.

Although a very small number of patients may personally benefit if they could receive PD close to home, overall there are no health benefits to be gained for the population for this additional cost (patients currently receive this treatment in New Zealand at no cost to the Cook Islands government). In fact, there may be a decline in health outcomes due to the lack of specialist care available and the generally high infection rate in Pacific countries which would add to the patient's pain and discomfort.

Thus, in relation to the Ministry of Health budget, the costs of PD are very high for a small number of people at the end stage of their life. Discussions with key informants indicates that this type of initiative would not be supported by the New Zealand Aid Programme as their health policy gives priority to effective disease management including diabetes management, and New Zealand Aid Programme has noted that funding renal dialysis therapy is not an effective use of their resources.

Given the financial and logistical limitations with providing dialysis treatment in the Cook Islands, the potential lack of numbers to make it feasible, and the lack of positive health outcomes, it is recommended that the Ministry of Health does not establish a treatment service. The status quo allows for patients on PD who are stable and capable of self managing their own treatment to be able to return to the Cook Islands for three month 'holidays'. With the support of their DHB, patients transport their own consumables and supplies to the Cook Islands, at no cost to the Ministry of Health. While outside the scope of this review, it is also recommended that the Cook Islands further consider actively promoting and encouraging renal transplantation, currently the most cost effective treatment for end-stage kidney disease.

1. Introduction

The Cook Islands Ministry of Health contracted Carla Wilson (Eve Bay Research) to undertake a study of the costs and benefits of providing dialysis treatment under the current arrangements (provided in New Zealand) compared with the costs, benefits and feasibility of providing dialysis services in the Cook Islands.

Renal or kidney failure describes a medical condition in which the kidneys fail to adequately filter toxins and waste products from the blood. The two main types of dialysis, Haemodialysis (HD) and Peritoneal dialysis (PD), remove waste and excess water from the blood in different ways.

This study identifies:

- The current trends in Cook Islands dialysis patients, (i.e. numbers, the types of treatments).
- The costs and feasibility of both HD and PD in developing countries.
- The costs of dialysis treatment in New Zealand and the potential costs of dialysis treatment in the Cook Islands.
- Key issues and considerations for further discussion when assessing the costs, benefits and feasibility of providing dialysis treatment in the Cook Islands.

The findings from this work will be used to inform policy advice for Cook Islands health services. Given the limited scope of this study, the final section of this report recommends further work that would need to be undertaken before making any decisions on the feasibility of dialysis treatment.

This report first provides an overview of the approach used to collect information for the study, and then identifies current trends in numbers and treatment options of Cook Islands dialysis patients in New Zealand. The report then summarises key findings from a scan of international literature on the economics of dialysis treatment in developing countries. More detailed analysis is then provided on the potential costs and feasibility of HD and PD in the Cook Islands. Finally, the report summarises the key issues to consider when assessing the costs, benefits and feasibility of providing dialysis treatment in the Cook Islands.

2. Methodology

This study used a multi-method approach and included:

- A review of documents provided by the Cook Islands Ministry of Health;
- A scan of relevant international literature on the costs and benefits of dialysis treatment, particularly in developing countries;
- A scan of relevant literature, documents and costings from New Zealand, Samoa and Fiji on the provision of dialysis treatment;
- Discussions with 37 key informants in New Zealand, the Cook Islands and Samoa (listed in Appendix One).

In order to protect the anonymity of informants, and the confidentiality of some of the information provided, key informants, or their places of work, are not identified in the report by name.

Due to the very limited scale of this review, the costs proposed for the Cook Islands are based on broad approximations by key stakeholders, based on their previous experiences, and a review of available documentation. The figures used were often suggested by a number of key stakeholders, and frequently echoed what was presented in the literature, thus adding some rigour to the process. However, in order to develop more accurate costings, it would be necessary for the Cook Islands Ministry of Health to consult and negotiate directly with a supplier.

3. Cook Islands Dialysis Patients in New Zealand

There is limited information available on the treatment of patients specifically referred to New Zealand from the Cook Islands for dialysis treatment. However, information on general trends in renal dialysis in New Zealand helps to set the scene and provides a broader framework for considering the options available for dialysis treatment.

In New Zealand, over the decade from 1995 to 2004, the number of renal dialysis patients grew by 7.2 percent per annum on average (NRAB, 2006). The key drivers of the growth in dialysis patient numbers across the population are an increasing incidence of patients with CKD (Chronic Kidney Disease) either presenting or being referred for dialysis, combined with improved survival rates. The key drivers of growth are:

- Improved survival (especially cardiovascular) of the general population;
- Type II diabetes epidemic (the primary cause of renal disease for the majority of Cook Islands dialysis patients);
- Greater acceptance of and demand for dialysis services from Maori and Pacific Island peoples who have high rates of CKD and ESKD (End-Stage Kidney Disease);
- Greater acceptance of and demand for dialysis services from elderly patients who have the highest rates of CKD and ESKD; and
- 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. (NRAB, 2006, 3).

Among those receiving dialysis treatment in New Zealand in December 2004, 19 percent were Pacific peoples (NRAB, 2006, 10). The higher prevalence of type II diabetes and its impact at an earlier age in Pacific peoples contribute to higher rates of ESKD in these populations. (Ashton and Marshall, 2007; NRAB, 2006)

Projections estimated by the New Zealand Ministry of Health indicate that renal replacement therapy (RRT), particularly dialysis, is expected to grow between 2005 and 2015, at an annual rate of at least 5 percent per year, and up to half of the total projected growth in demand for RRT would be due to the impact of type II diabetes (NRAB, 2006).

Currently Cook Islands patients, as citizens of New Zealand, receive dialysis treatment within the New Zealand tax-funded public health system (Ashton and Marshall, 2007). Data collected by the DHBs does not provide any insight into whether Cook Island patients are already living in New Zealand, or have moved to New Zealand specifically for dialysis treatment. However, the following statistical information helps to develop a picture of the level and nature of Cook Islands patients in dialysis.

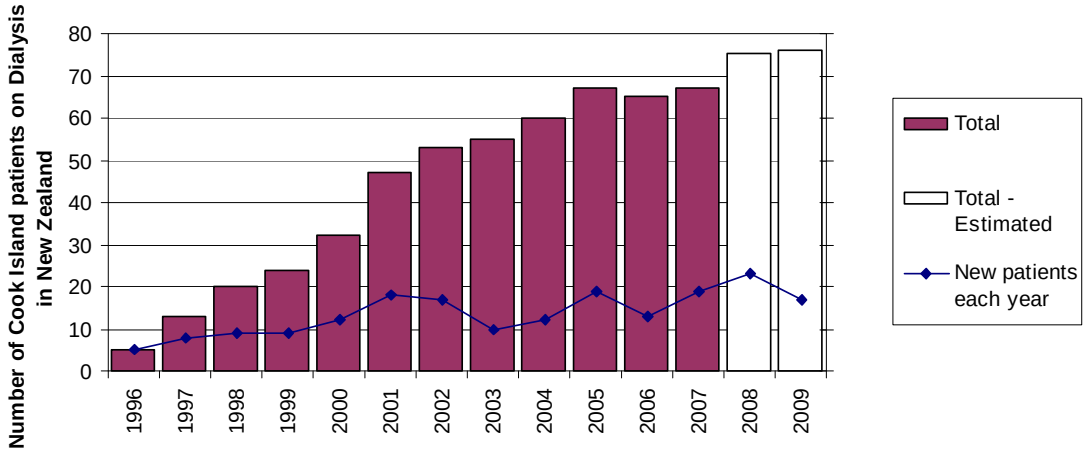


Figure 1: Number of Cook Island patients on dialysis in New Zealand over time
Source: Marshall, personal communication, 2011

Figure 1 highlights that there has been steady growth in the numbers of Cook Islands patients on dialysis in New Zealand since 1996. The average (or median if you have it) duration of dialysis treatment is four years (see Figure 2). The rate of growth of new patients has slowed down in more recent years. The total number receiving treatment each year mirrors the trends in numbers of new patients as well as the cumulative number of existing patients on dialysis each year.

Cook Islands patients on dialysis have an average life expectancy of four years. The distribution of life expectancy of Cook Island patients on dialysis is show in Figure 2 below. The relatively short period that a patient survives on dialysis is a key factor to consider when determining the costs and feasibility of providing dialysis treatment. Note that these data are from 2007, and survival rates may have changed over the past four years.

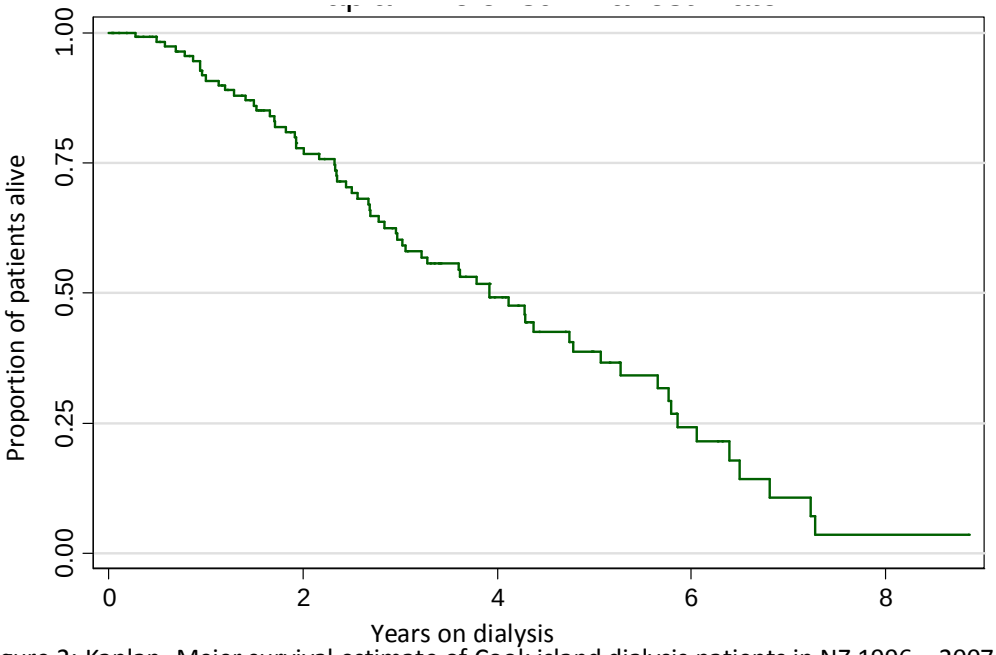


Figure 2: Kaplan- Meier survival estimate of Cook island dialysis patients in NZ 1996 – 2007
Source: Marshall, personal communication, 2011

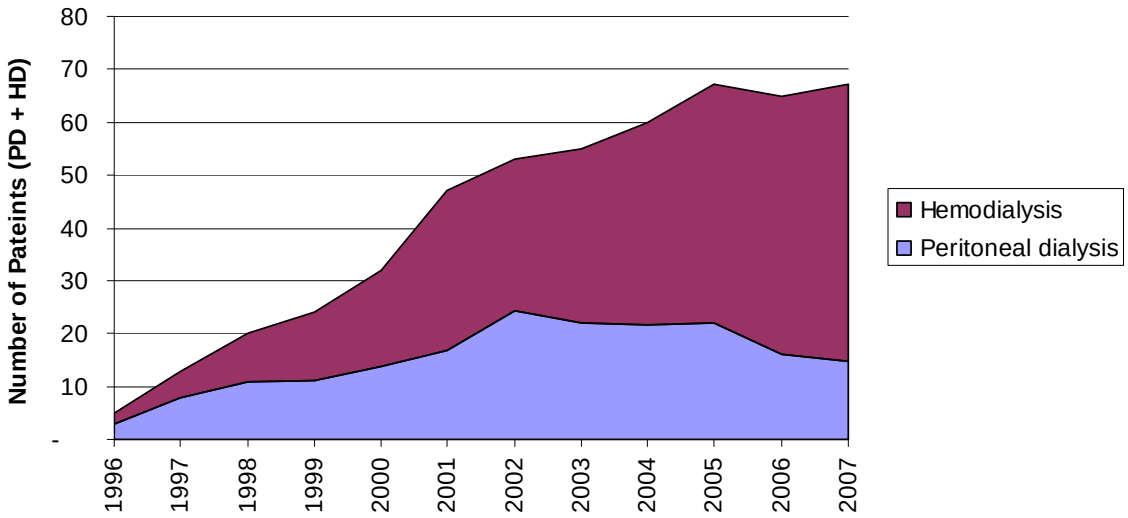


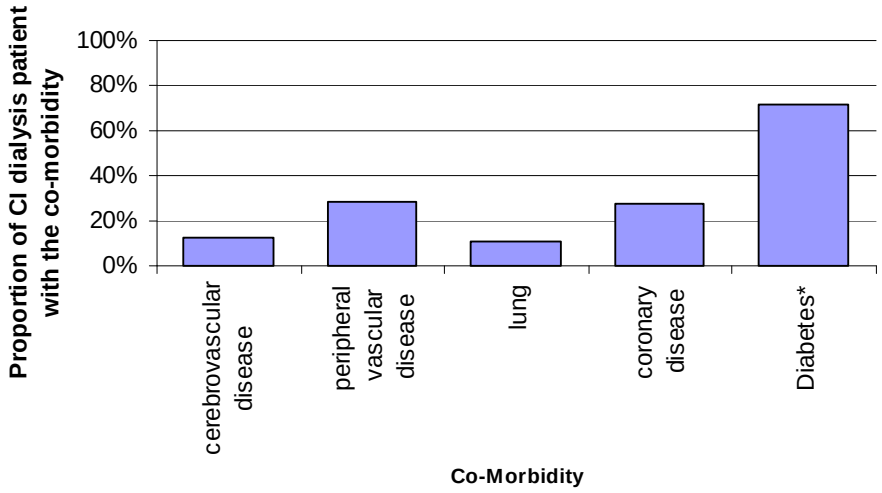
Figure 3: Numbers of Cook Islands dialysis patients by modality
Source: Marshall, personal communication, 2011

Figure 3 provides an overview of the type of treatment received by Cook Islands patients in New Zealand. There has been an increase over time in the number of patients receiving hospital based HD. Interviews with key informants indicate that while approximately 50 percent of Cook Islands patients may be suitable for PD, many patients prefer to have HD. Patient preference is a key issue to consider when assessing the feasibility of providing dialysis treatment.

The trends in dialysis modality for Cook Island patients differ from that for the New Zealand population overall. Most patients (59 percent) in New Zealand receive home based treatment. Forty five percent of ESRD patients are treated with PD, 41 percent are treated at HD units, and 14 percent are treated with home HD (ANZDARA, 2004). As Nicholls (in Ashton and Marshall (2007 244) explains, the preference for home-based treatment reflects:

> Both the philosophical stance of nephrologists historically, and the fact that [home based] options are less costly for a DHB to provide than facility based care. For individual patients, the choice between home and facility dialysis is influenced by quality of life, clinical characteristics, ability to train patients for self-care, the level of family support, and what dialysis options are available where they live.

In terms of the causes and co-morbidities that result in the need for dialysis, Figure 4 highlights the high prevalence of type II diabetes on the Cook Islands population (69 percent of patients on dialysis in 2009). The high rate of type II diabetes in the Cook Island population in New Zealand and the Cook Islands is a strong indicator that there will be an ongoing need for dialysis services. The costs associated with these co-morbidities is another key factor to consider when assessing the costs of providing dialysis treatment.



*Most of the diabetes is type 2 diabetes

Figure 4: Co-morbidities of CI patients on dialysis in New Zealand in 2009

Source: Marshall, personal communication, 2011

Figure 5 below shows the average age of Cook Islands patients in New Zealand when they start dialysis treatment

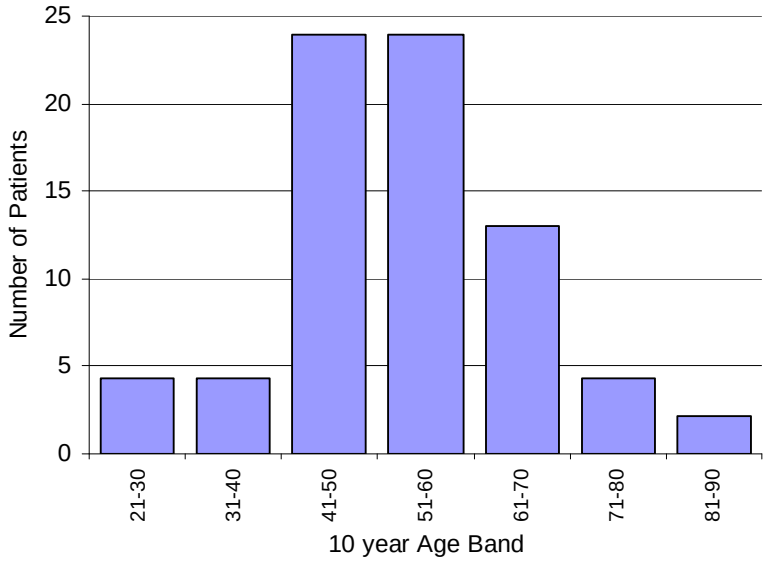


Figure 5: Estimated* age band of Cook Island patients receiving dialysis treatment in New Zealand
*Estimated using patient age data from 35 patients treated at Counties Manukau DHB NZ
Source: Marshall, personnel communication, 2011

The average age of all Cook Islands patients starting dialysis treatment in New Zealand is 56 years. As the majority of Cook Islands patients are 'working age', it is important to consider the best treatment options if the patient is able to work or needs to provide for a family.

As discussed previously, the information above is for all Cook Islands patients receiving dialysis in New Zealand, and does not distinguish between those resident in New Zealand and those resident in the Cook Islands at the time they required dialysis. However, referral data from the Cook Islands Ministry of Health indicates that since 2003, on average four patients per year have been referred from the Cook Islands to start dialysis treatment. The average age of these patients is 52 years, and 74 percent of the patients referred since 2003 were of working age (under 60 years). However, these figures do not capture patients who may have moved to New Zealand independently in anticipation of needing future treatment, or patients who are referred for other treatment, and then eventually need dialysis.

4. Potential future rates of dialysis for patients based in the Cook Islands

When considering the potential future rates of dialysis, the following factors were taken into account:

- the current rates of referral from Cook Islands and trends in referral numbers
- trends in the Cook Islands population numbers
- Cook Islands population projections (including population numbers, age ranges)
- trends in the rate of causal factors (e.g. diabetes) amongst the Cook Island population
- the current rate of untreated ESKD in Cook Islands population

Discussions carried out as part of this review indicate that the demand for dialysis services is unlikely to either decline or increase markedly in the immediate future. When considering the potential

future demand for dialysis treatment, discussions with key informants indicate that they expect the current number of referrals to continue or increase slowly.

Although there has been a decline in the resident population (illustrated in Figure 6) the Cook Islands Statistics Department has projected a relatively steady population base to 2030. However, given the increase in rates of type II diabetes amongst the resident population, referral numbers may increase over time.

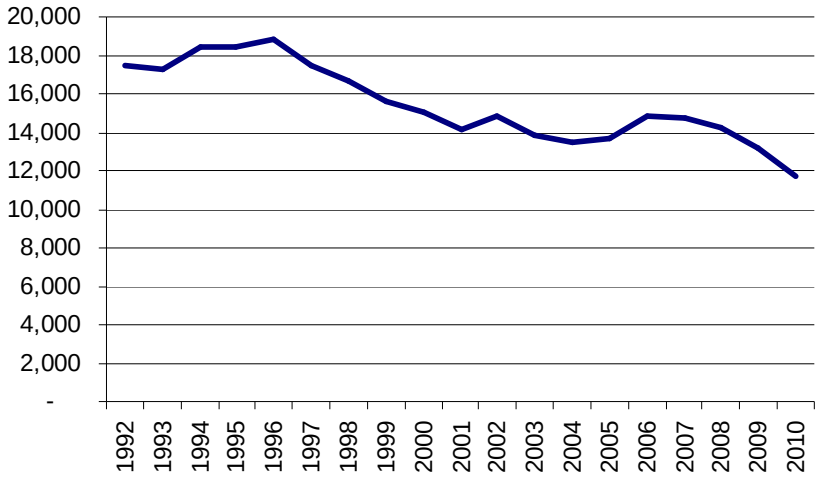


Figure 6: Resident population of the Cook Islands 1992 – 2009

Source: Statistics Cook Islands, 2010

When assessing possible future numbers of referrals for dialysis, this review also considered whether projected numbers will vary with higher numbers projected if a service is provided in the Cook Islands. Previous experience has found that if there is an increase in the supply of dialysis services, this can increase the demand for dialysis (Ashton and Marshall, 2007). There may, for example, currently be significant under counting of patients who move to New Zealand before they reach the stage of needing referral for dialysis, or who chose not to accept the offer of moving to New Zealand to have dialysis (e.g. patients older than 65, more-dependent or disabled patients). Ashton and Marshall (2007, 235), for example, note that areas with limited services often have 'a large burden of untreated ESRD' Demographic groups in the Cook Islands such as patients who are frail, elderly or with significant co-morbidities, may be more likely to accept the offer of dialysis if they did not need to move to another country. Thus, the 'offer' and 'acceptance' rates may vary depending on the location of the service that is available. However, discussions with key informants in the Cook Islands indicated that nearly 100 percent of patients who need dialysis chose to move to New Zealand and therefore there was not 'a large burden of untreated ESRD' that needed to be considered in any projections.

5. Costs of dialysis treatment

A brief literature scan concerning the provision of dialysis treatment internationally highlights that the costs vary markedly depending on local market conditions, for example 'local production and distribution factors, import duties, the presence or absence of local suppliers and purchasing power' (Just et al, 2008, 2367).

Even within a country the size of New Zealand the costs can vary, for example although District Health Boards (DHBs) in New Zealand have relatively similar needs, different DHBs have different financial arrangements for the procurement of dialysis related goods and services. While some DHBs purchase machinery, equipment, and consumables, others have a price per treatment arrangement with a commercial dialysis company, which is inclusive of the lease and maintenance of machinery, equipment, and the provision of all consumables. According to Ashton and Marshall (2007, 245):

> Even when using the same financial arrangements, the overall cost of providing dialysis for a given number of patients varies by as much as 28 percent between DHBs, mainly as a result of the volumes involves and also the degree of competition between commercial dialysis companies involved in the particular negotiation.

The following table outlines the key factors to consider when assessing the costs of dialysis in relation to the four categories of: direct medical costs, direct non-medical costs, indirect costs and intangible costs (Just et al, 2008, 2369)

COST	**DESCRIPTION**
Direct medical costs	Staffing costs, physician fees or salary, costs of dialyzers and tubing (HD), costs of solutions and tubing (PD), costs associated with radiology, laboratory and medications, capital costs of HD machines and PD cyclers, costs of hospitalisations and costs of outpatient consultations from other specialists
Direct non-medical costs	Building costs, facility utilities and other overheads
Indirect costs	Productivity losses for patients and their families or caregivers
Intangible costs	The costs associated with pain, suffering and impairment of quality of life, as well as the value of extending life

Figure 7: Costs of dialysis (information derived from Just et al,. 2008, 2369).

Just et al (2008, 2369) note that while direct non-medical costs are often difficult to estimate they are an important element of an economic evaluation of dialysis modalities. However, intangible and indirect costs are rarely assessed and incorporated into economic evaluations of dialysis.

Given the limited scope of this assessment, the key focus will be on assessing the direct medical and direct non-medical costs of providing dialysis treatment in the Cook Islands. However, where possible, reference will also be made to key indirect costs (e.g. social welfare provision, loss of productivity) and intangible costs (e.g. stress associated with not being treated at home).

From reviewing the literature on dialysis in developing countries, it is evident that there is a lack of published rigorous economic evaluations, and therefore it is difficult to assess the true costs of dialysis treatment (Just et al, 2008). A number of authors stress the significant investment in economic, human and technical resources required for long-term dialysis in developing countries (Brown University 2006; Jha and Chugh, 2003). According to Jha and Chugh (2003, 239):

> A significant lack of resources exists in developing countries, making the provision of highly technical and expensive care like dialysis a challenge.

Brown University (2006, 7) elaborates on this in more detail, and states that when considering treatment options in developing countries, cost and access to equipment and trained professionals are the two biggest barriers.

Aviles-Gomez et al (2006, 70) also highlights the significant differences in access to dialysis between developed and developing nations due to the high cost and complexity of treatment and states:

> Dialysis is so costly that it is out of reach for low-income countries, which are struggling to provide preventive and therapeutic measures for communicable diseases and other basic needs. Therefore less privileged countries simply cannot afford RRT for all patients with kidney failure.

A New Zealand Aid (2007, 5) paper noted that few dialysis facilities are available in the Pacific due to the 'considerable complexities around establishing and maintaining renal units in developing countries including practicalities of staffing and financing issues, and the logistics of access to services for people on remote islands'.

The following sections explore in more detail the potential costs associated with providing HD and PD in the Cook Islands. However, the report also focuses on the feasibility of providing these treatments, particularly in relation to the two key barriers identified of access to (and maintenance of) equipment, and access to trained professionals.

5.1 Feasibility of Haemodialysis in the Cook Islands

Haemodialysis is a treatment that cleans and filters blood by removing the waste products and extra fluid that the kidneys can no longer eliminate. HD requires a machine and an artificial kidney called a dialyzer. During the treatment blood is pumped by the machine through tubing to the dialyzer. The blood is then filtered and waste products and extra fluids are removed. The filtered blood is then returned to the body. HD treatments are usually performed three times each week and usually last from 3 to 5 hours[1].

Haemodialysis services are provided either:

- In-centre (hospital based with nurse and/or technician assistance, for people unable to manage dialysis independently)
- Satellite bases (closer to patients' homes, for people who can manage dialysis with varying degrees of independence, with some nursing or technician support)
- Home settings or community bases, where no staff are present and dialysis is management either independently or with family support (NRAB, 2006).

A significant capital investment in required to set up a HD unit, and, therefore, there has been a reluctance by governments in developing countries to commit to the often overwhelming cost of establishing these units (Bamgboye, 2003). The lack of human resources, in particular, is a key limitation to setting up a HD unit.

[1] Counties Manukau District Health Board Renal http://www.healthpoint.co.nz/default,20986.sm (viewed 20 July 2011)

> Skilled manpower is in short supply in developing nations. The number of nephrologists is insufficient to meet the growing demand. Skilled nurses and dieticians are also equally lacking, as well as trained technicians to maintain dialysis equipment (Gomez et al, 2006, 71).

A report from the Renal Society of Australasia (RSA) has also highlighted the shortage of nephrology health professionals (nurses and technicians) in Australia and New Zealand (Bennett et al, 2009, 1).

The key factors that appear to limit HD being feasible in developing countries according to international literature (Bamgboye, 2003; Brown University, 2006) include the following:

- Remuneration is often poor so it is difficult to attract and retain specialists (including kidney specialists, dialysis nurses and technicians).
- Second hand out-dated or obsolete machines are often donated from other countries and can have multiple problems (e.g. frequently break down, lack of technical support, and lack of spare parts).
- Limited regular maintenance of machines.
- Frequent power outages.
- Erratic water supply.
- Machines restricted to urban centres and many patients live far away from existing dialysis centres, so that they have to travel long distances to receive dialysis.
- Reuse of dialysers to cut costs is common so potential complications of infections.

Brown University (2006, 7) provides more detailed information on this last point:

> Inadequate dialysis and the high risk of contracting an infection either from the (lack of) sterility of the procedure or the water are both complications of the procedure that are very prevalent in developing countries compared to developed countries. Dialysis is a procedure that requires very close maintenance and a strict schedule of treatments. In many of these countries with emerging economies, the ability of the physicians to closely monitor these patients and their treatment schedules is minimal. The risk of infection and potential for inconsistency in treatment could be considered to cause more harm to patients in these countries than benefit.

An investigation into the feasibility of HD in the Cook Islands has previously been undertaken and the reported conclusions reached by the then Ministry of Health staff were that it was cost prohibitive. Unfortunately a copy of this feasibility study could not be located for this current review. While the brief for this current study indicated that there had been technological advances in dialysis, interviews with key stakeholders do not indicate that there have been any significant advances in the haemodialysis process since this review was undertaken that would significantly reduce the costs to the Cook Islands.

There are currently few facilities for renal dialysis available in the Pacific and limited information available on costs. These units are mostly funded privately by Foundations and rely on donated equipment in the set up phase, and have difficulties with the ongoing costs (New Zealand Aid, 2007). Many Pacific Island countries appear to have ruled out developing HD capacity on-island because of the costs and staffing requirements. As a New Zealand Aid report (2007) noted, these have high opportunity costs in terms of the provision of other health services, in that they divert health funds to a high-cost treatment away from other treatments that benefit a larger number of patients.

Due to the significant limitations with developing a HD unit in the Cook Islands as discussed above, this report does not provide a detailed analysis of the costs of HD. However, the following case studies provide some insight into the costs of setting up and running a HD unit. As outlined in the section above, the costs will vary markedly depending on local market conditions and purchasing power. These costs should therefore simply be viewed as broadly indicative of the costs associated with HD treatment, rather than any definitive statement of potential costs.

Samoa

Samoa opened a 12-machine dialysis unit in 2002 in a refurbished nurses' home, with assistance from the Singapore National Kidney Foundation. Set up costs totalled about NZ$500,000 (including water purification plant, two storage water tanks, generator for uninterrupted electricity). The unit employs 6 nurses, trained in Singapore, a technician and a doctor. Operating costs for the unit are about NZ$1 million annually for 20 patients (almost ten percent of the total Samoan health service budget in 2007/08). New Zealand expert opinion is that the unit appears to be running well, but is struggling to maintain clinical oversight (New Zealand Aid, 2007).

Fiji

A renal unit previously opened up in Fiji in the 1990s and closed within six months, due to difficulty retaining staff and resources (New Zealand Aid, 2007). As stated in the literature, there is a significant lack of specialist resources available in developing countries. The current four machine dialysis unit was established through the Kidney Foundation of Fiji in refurbished hospital rooms, with set-up costs of NZ$427,553 (NZ$500,000 in 2011) and total operating costs per year of NZ$328,759 (NZ$385,000 in 2011) (New Zealand Aid, 2007). The Foundation relies on a user pays system for non-residents and funding from the government to cover operating costs. However, lack of funding and lack of trained personnel have been identified as the greatest risks for this project (KFF, 2004). Thus, while it may be possible to get initial support to establish a unit (in the form of second hand machinery and expert advice), it is important that any initiative is sustainable for the long term, with ongoing provision of funds and professional expertise.

New Zealand

The following costs, from a satellite six-bed renal unit set up in an altered building in Northland in 2003, to dialyse 24 patients provide some insight into the costs associated with setting up a HD unit in New Zealand. The set up costs were $451,694 and the operating costs for a 12 month period were $840,948 (New Zealand Aid, 2007). The costs once adjusted for inflation for 2011 are $530,000 (set up costs) and $100,000,000 (annual operating costs).

Group	Cost*	Note
Set up costs		
Renovations	$200,000	
Dialysis machines	$150,000	6 Machines (4008S)
Reverse Osmosis Unit	$130,000	1 machine
Other	$50,000	Include a vital signs monitor, hydraulic bed and other costs
Total set up costs	$530,000	
Operating	$990,000	Includes wages (excluding physicians), dialysis fluids and consumables and other cost
Total	**$1,500,000**	

Source: New Zealand Aid, 2007 *Original reported figures adjusted for inflation to 2011 costs

Figure 8: Cost of six machine Haemodialysis Unit in Northland New Zealand

Overall, the estimated costs per patient per year for HD in New Zealand, have been estimated as:

Modality	Routine dialysis	Hospital	Non-dialysis services (outpatient)	Total Cost
Hospital HD	$50,000	$22,000	$3,000	$75,000
Satellite HD	$37,000	$16,000	$3,000	$56,000
Home HD	$24,000	$11,000	$4,000	$39,000

Source: Ashton and Marshall (2007) *original reported figures adjusted for inflation[2]

Figure 9: Estimated costs for HD modalities in New Zealand

These estimates include all costs incurred by the hospital, including hospital costs for transporting patients. However, they do not include the indirect costs incurred by the patients (e.g. time off work for patient and/or carer) and the government (e.g. benefit costs if patient is unable to work). An invalid's benefit in New Zealand is approximately $250 per week after tax.

Summary

In summary, the literature reviewed for this study suggests that developing countries often lack the technical, human and economic resources for HD. The examples provided from Samoa, Fiji and New Zealand also highlight the significant set up and operating costs required for a HD unit. The remainder of this report therefore focuses on the feasibility, costs and benefits of providing PD in the Cook Islands.

[2] These costs are based on 2002-2004 patient data from one major hospital only. However, more recent work indicates that costs in the largest hospital providing ESRD services in New Zealand are similar (Ashton and Marshall, 2007).

6. Feasibility of Peritoneal Dialysis

Peritoneal dialysis is a treatment where the peritoneal membrane is used to filter and clean impurities, waste products and extra fluid from the body. A fluid called dialysate removes fluid and waste products from the abdominal cavity and places them in the dialysate (a permanent catheter implanted in the peritoneal cavity). PD, either continuous ambulatory peritoneal dialysis (CAPD) or ambulatory peritoneal dialysis (APD), must be done every day and is undertaken in the home environment[3].

PD is often preferred by DHBs in New Zealand because it is a less expensive treatment than HD, as the same level of capital 'set up' costs are not required, although the operating costs per patient are similar. As Just et al (2008, 2367) explains, the economics of PD are driven primarily by variable or 'disposable' costs, such as the costs of solutions and dialysis tubing. Just et al (2008, 2370) also notes that as PD 'requires less technology than HD so it would seem particularly well suited for developing nations'. Gomez et al (2006,) also argue that as PD is less expensive and requires less technology it seems more appropriate for developing nations.

The following authors reinforce this point of view:

> PD is used considerably in the developing world especially in remote populations that have restricted access to dialysis centres. The cost benefit, autonomy and flexibility associated with PD have made this treatment option a growing success (Brown University, 2006, 5).
>
> The growth of PD over the past decade has been particularly marked in the developing world ... looking into the future, therefore, it is likely that the majority of PD patients will be living in the developing world (Blake, 2010, 5).

The following Figure 10 outlines the estimated costs per patient per year of CAPD and APD in New Zealand

Modality	Routine dialysis	Hospitalizations	Non-dialysis services (outpatient)	Total Cost
APD	$32,000	$18,000	$3,000	$54,000
CAPD	$22,000	$18,000	$3,000	$43,000

Source: Ashton and Marshall (2007) *original reported figures adjusted for inflation[4]

Figure 10: Estimated costs for PD modalities in New Zealand

These estimates include all costs incurred by the hospital, including hospital costs for transporting patients. However, they do not include the indirect costs incurred by the patients (e.g. time off work for patient and/or carer) and the government (e.g. benefit costs if the patient cannot work). As mentioned previously, an invalid's benefit in New Zealand is approximately $250 per week after tax.

[3] Counties Manukau District Health Board Renal http://www.healthpoint.co.nz/default,20986.sm

[4] These costs are based on 2002-2004 patient data from one major hospital only. However, more recent work indicates that costs in the largest hospital providing ESRD services in New Zealand are similar (Ashton and Marshall, 2007).

6.1 Potential costs of Peritoneal Dialysis in the Cook Islands

This section outlines in more detail the approximate costs associated with providing PD treatment to Cook Island patients in the Cook Islands. As discussed previously, costs will vary markedly depending on local market conditions, numbers of patients and purchasing power and therefore this analysis can only provide an initial broad approximation. In order to secure more accurate detailed figures, the Cook Islands Ministry of Health would need to first talk directly to a supplier of PD consumables in order to start negotiating costs.

Just et al (2008, 2368) also cautions against comparing costs of treatment based on a procurement basis only, and the need to evaluate dialysis treatment costs 'as a total therapy rather than simply thinking of dialysis costs as the procurement expense of the supplies' (Just et al, 2008, 2368). Given this, the following analysis draws on the categories in Figure 7 and estimates: direct medical costs; direct non-medical costs; and potential indirect costs. The intangible costs (the costs associated with pain, suffering and impairment of quality of life, as well as the value of extending life) are referred to in the discussion following the analysis.

The following approximate figures in Figure 11 are derived from a review of available literature and reports, and discussions with key stakeholders. Before reviewing the costs in more detail, it is important to note that these figures are based on an assumption that ten patients would be available to start PD in the Cook Islands. These patients will include a mixture of new patients and patients returning to the Cook Islands. This number is the minimum required to start of PD unit (in terms of ensuring staff skills are maintained. However, at this stage, it is unclear whether there would be even ten patients ready and able to undertake PD in the Cook Islands.

Currently, it is estimated that on average four new dialysis patients come from the Cook Islands each year for HD or PD. While most Cook Islands patients currently prefer HD, the numbers accepting PD treatment may increase if PD services were provided locally. One specialist concluded that 50 percent of Cook Islands patients may be suitable for PD (ie currently two patients per year).

However, out of those who may be suitable for PD, some might still choose to go to New Zealand so they could be on the transplant waiting list (patients living in the Cook Islands on dialysis would not be eligible for deceased donor transplantation). If a patient is also of working age and expected to support their family, they may prefer to receive treatment in New Zealand so they can access welfare payments. Key informants also referred to patients they knew who would prefer to stay in New Zealand as they were satisfied with their doctor and the standard of medical care they received. Some key informants mentioned that many of these patients had other health conditions and would therefore prefer to stay in New Zealand where they could get easier access to ongoing specialist care.

Finally, a key requirement of PD is that patients can manage their own treatment. A number of key informants raised concerns about whether some patients would be able to, or would want to, self manage. As indicated in Figure 3, many Cook Islands patients have demonstrated a preference for hospital based HD treatment rather than home based care.

From discussions with key informants, there does not appear to be a significant number of untreated patients with ESRD in the Cook Islands who might choose to accept treatment if it was offered

locally, and instead nearly all patients who require dialysis currently choose to move to New Zealand.

It therefore does not appear likely at the current time that ten suitable patients would be available to ensure a PD service would be feasible. It is therefore recommended that further analysis is undertaken to ensure that there are ten suitable and willing and suitable patients for the treatment. This number has been identified as the minimum required to sustain a PD service (i.e. maintaining staff skills etc).

This analysis is based on an assessment of the costs of CAPD (rather than APD) as this was considered by key informant interviews to be the most relevant to the Cook Islands. CAPD is performed manually (three to five exchanges per day) while APD is performed by a machine while sleeping.

The total cost of providing PD for ten patients in the Cook Islands is estimated to be $438,700 in the first year and $379,700 for each of the following years. These costs include the cost of dialysis as well as the primary care treatment for co-morbidites and the non-medical costs.

Following Figure 11 below, the report provides further detailed explanation of the key components and costs of the PD treatment process in the table.

Figure 11: Approximate financial costs to the Cook Islands of providing PD to ten patients

Cost	Description	First year	Ongoing	Notes
	Patients	10	10	It is assumed that 10 patients would be available for PD. The rate would stay constant at approx 10 patients (i.e. patients will stay on PD for an average of 3 years and approx 3 new patients would start PD each year). Further work is needed to confirm current and potential future number of PD patients.
Start up costs				
Direct medical costs	Nurse training	$16,800	$5,600	Cost of training in New Zealand for 3 month (i.e. airfare $1400, daily allowance $100/day, salary $25,000/annum). Send once in the first year and every 3 years thereafter
	Doctor training	$6,700	$2,200	Cost of training in New Zealand for 3 weeks (airfare $1400, daily allowance $100/day, salary $50,000/annum). Send once in the first year and every 3 years thereafter
Direct-non medical costs	Building	$0	$0	Storage of thirty cubic metre of consumables – assumption they can be stored in current facilities
	Hospital project manager (.25 FTE)	$5,500	$0	Set up contract with supplier and DHB (salary $22,000/annum)
On-going costs				
Direct medical costs	Patient catheter placement and training in NZ	$4,600	$4,600	A minimum of approximately three patients per year in New Zealand for two months (fights $1400 return and $145 for the ambulance to the hospital (assuming they will be in hospital)). Assume Work and Income cover living costs
	Consumables	$200,000	$200,000	$20,000/year/patient
	Freight of consumables	$40,000	$40,000	$4000/year/patient
	Nurse (.5FTE)	$12,500	$12,500	Nurse salary is $25,000/year
	NZ renal physician visit	$81,600	$54,400	Every 4 months in 1st year then every 6 months

	Laboratory and medications	$21,850	$21,850	$5 per day per person for diabetes medication $30/month per person for lab tests
	Outpatient consultation	$2,400	$2,400	Assume go to the doctor every 2 months at $40 per visit
	Contingency for complications	$14,000	$1,400	1 rtn flight to NZ for 10 patients ($1,400/flight)
Direct non-medical costs	Hospital project manager (.25 FTE)	$5,500	$5,500	Salary $22,000/annun
Indirect costs	Benefit payments	$29,250	$29,250	$75/fortnight for infirm allowance and $200/fortnight if over 60 (pension). Based on assumption that 3 patients are over 60 and 7 patients are working age.
Total Costs		**$438,700**	**$379,700**	

6.2.2 Direct medical costs

Patient catheter placement and training in New Zealand

Secure access to the peritoneal (abdominal) cavity is one of the important determinants of successful PD (Ansari, 2011). While a local physician could be trained to insert catheters this is not perceived to be feasible because of the lack of specialist staff in the Cook Islands. It is therefore proposed that patients would come to New Zealand to have a peritoneal catheter inserted in the peritoneal cavity. As part of this visit they will also receive training on undertaking PD. They would need a relatively lengthy period here (approximately two months) as placement of a peritoneal catheter is undertaken at least two weeks prior to the first planned use.

There will therefore be higher start-up costs for all PD patients and this will result in higher costs per patient for each patient's first year of dialysis compared to subsequent years (i.e. a peritoneal catheter must be inserted and patient training is required). The costs are based on the assumption that patients stay on PD for three years and therefore in every year approximately a third of patients will also incur the start up costs.

These costings are based on the assumption that Work and Income and family based in New Zealand can cover the living costs of the patient while in New Zealand. However, discussions indicate that Cook Islands patients coming to New Zealand for treatment do not always receive a benefit and there was not a consistent approach from Work and Income.

Consumables

The approximate costs of consumables included in Figure 12 are derived from interviews with key stakeholders who have previously been involved in supplying PD medication to Pacific countries. However, as discussed previously, this is simply a broad approximation. A review of the international literature suggests that the annual costs of PD materials can range from $5,000 to $25,000 annually per patient (Just, et al, 2008, 2367). Costs will vary markedly depending on local market conditions, numbers of patients and purchasing power and therefore this analysis can only provide an initial broad approximation.

The lack of 'critical mass' of patients in countries like the Cook Islands can also mean that the government may not be able to encourage many suppliers to market their products in the Cook Islands at a reasonable price. As PD fluids would need to be imported into the Cook Islands, this could also make the cost of PD expensive (Gomez et al, 2006, 70). The broad approximation of freight costs is based on discussions with staff at Auckland DHB and Counties-Manukau DHB. The exact price of transportation would need to be specifically negotiated with a freight company.

Nurse training

There is no official training programme in nephrology nursing, however key stakeholders suggested that a renal nurse could train for approximately three months in New Zealand.

International best practice for PD states that there should be one renal nurse for every 20 patients. The above costs are based on one nurse being trained in collaboration with a renal unit in New

Zealand. The nurse would also be responsible for education regarding CKD and the associated dialysis therapies in the six to twelve months prior to a patient needing them.

This approach is based on the assumption that there are sufficient nursing resources available in the Cook Islands to allow a nurse to be trained in New Zealand and to specialise in this area of care.

Renal physician visit

Given the limited availably of renal physicians, any PD service would need to be overseen by a visiting renal physician from New Zealand. This renal physician (and nurse) would need to visit the Cook Islands every six months to review dialysis patients. The costs listed above assume that the physician and nurse would, in the first year, visit every four months but from year two this would then reduce to visiting every six months. The visiting renal nurse would also provide ongoing support and training to the Cook Islands renal nurse. These costings are based on information provide by ADHB on the costs of providing renal consultancy services to another Pacific country.

One key informant suggested that the costs of these visit could be included under the New Zealand Aid Programme for Health Specialist Visits.

Doctor training

Although New Zealand renal physicians would need to oversee the service, a local medical officer would need to have some PD training to ensure they had expertise to manage any patient problems that presented (e.g. infections).

Hospitalisations, radiology, laboratory, medications and outpatient consultation

Approximately 75 percent of Cook Island patients with renal failure have diabetes and it is therefore important to consider the clinical requirements and costs of other disease related co-morbidities. According to Collins and Metcalf, (2003, 5), 'patients with diabetic nephropathy usually have or develop major problems with visual impairment, peripheral neuropathy, peripheral vascular disease and coronary artery disease'.

Additional costs associated with dialysis are physician fees, medications, laboratory and other diagnostic investigations and hospitalizations. Regular laboratory and clinical monitoring, for example, is required to ensure PD orders are individualised depending of the hemodynamic status of the patient (Ansari, 2011). Patients with ESKD are on approximately ten prescription medications (e.g. iron, vitamin D in the form of calcitrol, and phosphate binders). Antibiotics are also often needed to treat infections, which are a complication of dialysis.

6.2.3 Direct non-medical costs

Building

A key consideration with PD is that adequate space is available for consumables. Given the amount of storage space that is required (approximately three cubic metres per patient for a three months supply), it is assumed that many patients will not have this room available for storage at home. Instead, the above costings assume that room can be made available to store up to three months supply for each patient at a time.

Project Manager

It is important that someone at the Ministry of Health has overall responsibility for initially negotiating a contract with a supplier to provide consumables and also with a DHB to provide a renal specialist and nurse training. An ongoing project manager is then required to coordinate the freight of consumables, liaise with customs and distribute consumables to patients. Only three months worth of supplies can be purchased at one time and therefore these tasks will need to be undertaken regularly.

6.2.4 Indirect costs

Another key factor to consider is the potential costs on the social welfare system. The costings are based on the assumption that all patients will not be working and will therefore access the infirm persons allowance or the pension. However, many of these patients are of working age and people on PD can continue to work and therefore the proportion of patients who need social welfare may be much less. There is also the potential that if PD is available in the Cook Islands people may present earlier and therefore have a better chance of being able to continue working.

The costings are also based on the assumption that all patients will be based on Rarotonga and therefore there will be no additional costs to transport PD supplies to the outer islands.

6.2.5 Intangible costs

An intangible cost refers to the 'costs associated with pain, suffering and impairment of quality of life, as well as the value of extending life' (Just et al. 2008, 2369). While these costs have not been quantified in Figure 11, it is important to refer to them in any assessment of the costs of dialysis.

While there a common philosophy that it is better to be treated as close as possible to home as this provides a higher quality of life, and an increasing expectation that dialysis treatment should be made available to all (reference), there are also the following potential intangible costs associated with providing dialysis treatment in the Cook Islands:

- Not all patients will be satisfied with a life on dialysis. There is evidence to suggest that older patients are more satisfied with a lifestyle on dialysis than the young (Collins and Metcalf, 2003, 3). Patients who are younger and of working age may be more likely to want to go to New Zealand so they would be eligible for a transplant.

- A younger patient who is responsible for supporting a family may also prefer to move to New Zealand as they can then access social welfare assistance to support their family, compared with the infirm persons allowance in the Cook Islands.

- Dialysis patients often do not have a high quality of life. One key informant described it as being 'full of pain and stress'. The generally high infection rate in Pacific countries adds to people's pain and discomfort.

- A number of key informants referred to patients in New Zealand who have confidence in their specialists and the health system and would prefer to stay in New Zealand to have continuity of care.

- Because PD requires a high level of self management, the patients will need to be able to self administer the treatment, or have someone look after them which is another cost to the family.

6.3 Holiday Peritoneal Dialysis

Currently, a number of Cook Islands PD patients do come back to the Cook Islands for three month 'holidays'. With the support of their DHB, patients transport their own consumables to the Cook Islands. This treatment option works for patients who are stable and can self manage their own dialysis. The only potential cost to the Cook Islands with this treatment option if the patient experiences complications (e.g. the patient gets an infection or something goes wrong with the catheter). However, given the infrequency with which this happens, key informants in the Cook Islands suggested this was best dealt with by consulting Counties Manukau DHB at the time, rather than providing staff training on PD complications.

7. Discussion and Conclusions

This report has outlined the potential costs of providing dialysis treatment (HD and PD) in the Cook Islands. As mentioned previously, international experience suggests that developing countries often lack the technical, human and economic resources for HD. Although international literature often advocates for PD as a more suitable treatment option for developing countries, this report has highlighted the potential high costs of providing PD in the Cook Islands.

Although a very small number of patients may personally benefit if they could receive PD close to home, overall there are no health benefits to be gained for the population for this additional cost (patients currently receive this treatment in New Zealand at no cost to the Cook Islands government). In fact, there may be a decline in health outcomes due to the lack of specialist care available and the generally high infection rate in Pacific countries which would add to the patient's pain and discomfort).

The health benefits for the increased costs are therefore nil as Cook Islands patients are already entitled to this service in New Zealand. While there may be some potential intangible benefits associated with quality of life (i.e. being able to be treated at home) these could easily be offset by the potential increase in stress, pain and infections as experienced in other Pacific countries.

Thus, in relation to the Ministry of Health budget, the costs of PD are very high for a small number of people at the end stage of their life. Discussions with key informants indicates that this type of initiative would not be supported by the New Zealand Aid Programme as their health policy gives priority to effective disease management including diabetes management, and New Zealand Aid Programme has noted that funding renal dialysis therapy is not an effective use of their resources.

Aside from the costs of dialysis, a key factor that influences the feasibility of providing PD treatment is whether there are enough suitable patients available. This analysis was based on ten people being available for PD (the minimum). However, it is unclear whether ten people would be available as some patients may prefer to be based in New Zealand so they can access HD (the current preference for Cook Island patients), access ongoing specialist care, be on the transplant waiting list, and access welfare payments, for example. For those patients that want to undertake PD treatment in the Cook Islands, not all patients will be suitable. PD suits only some patients i.e. those who are stable, have

less severe acute illnesses, and can self-manage their dialysis. A significant proportion of Cook Islands patients may therefore need to continue to come to New Zealand.

Given the financial and logistical limitations with providing dialysis treatment in the Cook Islands, and the potential lack of numbers to make it feasible, it is recommended that the Ministry of Health does not establish a treatment service. Instead, self managing Cook Island PD patients currently based in New Zealand continue to be encouraged to come back to the Cook Islands for holidays provided they bring their own consumables and supplies, at no cost to the Cook Island Ministry of Health.

While outside the scope of this review, renal transplant has been readily identified as the most cost effective treatment for ESRD (Ashton and Marshall, 2007). Renal replacement would allow patients to move back to the Cook Islands once they are stable and also ensures improvements in their intangible 'quality of life'. Currently, rates of transplantation for Cook Islands patients are very low, and statistics show that the probability of being accepted onto the renal transplant waiting list and then receiving a kidney transplant is significantly low for Pacific Island dialysis patients (Ashton and Marshall, 2007). As the traditional approach of waiting on the deceased donor list is not effective, and a more effective approach is that anyone waiting for a transplant proactively identifies a potential donor. A key informant indicated that many of the Cook Island patients currently on dialysis in New Zealand would be suitable for a transplant if they could find a live donor. Although there may be some considerations or concerns with this option for some patients and families, it is recommended that the Cook Islands further consider actively promoting and encouraging live donation as the most cost effective treatment for ESRD.

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Appendix A: People spoken to

The following people(in alphabetical order) have been spoken to as part of this review:

Temarama Anguna - Manager Human Resources, Ministry of Health Cook Islands

Doctor Zaw Aung – Consultant Physician, Ministry of Health Cook Islands

Professor Chellaraj Benjamin – previous New Zealand Aid Programme coordinator of the New Zealand medical treatment scheme for Pacific countries.

Christine Briasco – Health Advisor, New Zealand Aid Programme

Doctor Ian Dittmer – Renal Clinical Director, Auckland District Health Board

Jean Duffus – Nurse Advisor, Auckland District Health Board

Doctor Bob Eason – Consultant Physician, Counties Manakau DHB

Debbie Eastwood – Renal Unit Manager, Counties Manukau DHB

Hilda Fa'assalele – General Manager Pacific Health, Auckland DHB

Doctor Rangiau Fariu, Director of Community Health Services and Acting Secretary General, Ministry of Health Cook Islands

Hon. Nandi Glassie – Minister of Health, Cook Islands

Tearoa Iorangi, Manager Medical Records, Ministry of Health Cook Islands

Associate Professor Peter Kerr – Renal Physician, Monash Medical Centre, Australia

Dr Fran McGrath – Public Health Medicine physician and previous Director of Funding and Planning, Cook Islands Ministry of Health

Dr Mark Marshall – Clinical Head Renal Unit, Counties Manukau DHB

Ngatuaine Maui – Director of Welfare, Ministry of Internal Affairs Cook Islands

Kiki Maoate - Director, Health Specialists

Iokopeta Ngari – former Director of Nursing, Ministry of Health Cook Islands

Nick Polaschek – Senior Project Manager, Ministry of Health, New Zealand

Elizabeth Powell – Director of Pacific Development, Counties Manukau DHB

Doctor Teariki Puni – Medical Officer, Tupapa Community Clinic, Ministry of Health Cook Islands

Helen Sinclair – Director of Outer Islands Health Services

Manu Sione – General Manager Pacific Health, Counties Manukau District Health Board

Ana Silatolu – Finance Manager and Acting Director of Funding and Planning

Doctor Voi Solomone, Chief Medical and Clinical Services Officer and Acting Director of Hospital Health Services

Debbie Sorrenson – Director, Health Specialists

Dr Api Talemaitoga – Clinical Director, Pacific Health, Ministry of Health New Zealand

Taggy Tangimetua – Chief Statistician, Statistics Department, Cook Islands

Destiny Tata – Welfare Officer – Ministry of Internal Affairs Cook Islands

Peggy Teiotu, Patient Referral Coordinator, Ministry of Health Cook Islands

Biribo Tekanene – Chief Pharmacist, Ministry of Health Cook Islands

Tatuava Tou – Laboratory Manager, Ministry of Health Cook Islands

Mann Unuia – CEO to the Minister of Health, Cook Islands

Dr Satu Viali – Specialist Physician, Samoa

Dr David Voss – Renal physician, Auckland

Mereana Worth – Pacific Family Support Unit, Auckland DHB

Elizabeth Wright – Director of Policy Division, Prime Minister's Department, Cook Islands