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# *Home Delivered Dialysis Costing study to inform the National Efficient Price 2015*

## Final Report

11 November 2014

Independent Hospital Pricing Authority



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# *Executive summary*

PwC was engaged by the Independent Hospital Pricing Authority (IHPA) to perform a review of existing costing studies on Home Delivered Dialysis Services. The purpose of this review is to inform the development of the National Efficient Price 2015-16 (NEP15) as IHPA has indicated that it would like to fund these services under the Activity Based Funding (ABF) model for 2015-16.

The project involved:

- A literature review of local Australian and International sources to identify cost drivers, costing studies and international models of counting and pricing these services under activity based funding models;
- Consultations with participating jurisdictions to identify costing studies conducted and understand their different care pathways for delivering home dialysis services; and
- A review of existing costing studies to estimate the costs associated with delivering home-based haemodialysis (HD) and peritoneal dialysis (PD) to help inform the NEP15.

## **Literature review**

A large part of the literature review focused on investigating existing funding models both within Australia and internationally. In Victoria, although dialysis is under the ABF funding, home dialysis continues to be funded as a block grant per patient for 2013–14 of \$52,379 per patient per annum. In addition, small annual payments are provided to patients who conduct home dialysis.

Internationally, the funding arrangements of seven countries were reviewed: USA, Canada (Ontario), Belgium, France, Germany, the Netherlands, and the United Kingdom. There are significant differences between each country's reimbursements for renal dialysis, with a 3.3-fold difference between the highest and lowest reimbursement rates for chronic haemodialysis. Reimbursement for peritoneal dialysis (PD) compared to haemodialysis (HD) was lower in most countries except Germany and the USA. Although home haemodialysis (prolonged or daily dialysis) allows greater flexibility and better patient outcomes, reimbursement is only incentivised in the Netherlands.

## **Consultations**

Consultations with all participating jurisdictions, their nominated site representatives and other relevant stakeholders were undertaken to gather information on existing costing studies, costing processes, relevant cost drivers and resources consumed and the different care pathways and models utilized in costing. There was consensus across all jurisdictions that the primary cost drivers of home delivered dialysis treatments are: staff salary (including nursing, clinical and support staff), pharmacy cost, pathology costs, consumables/supplies and training for staff and patients.

In relation to the proposed funding model, the majority of jurisdictions responded that they were supportive in principle to a bundling approach. They recognised that bundling has the potential for administrative efficiencies through simpler reporting, reducing the requirement for a dated entry in the patient's medical record for each service event and potentially merging the payment for all streams involved in patient care; as well as incentivising a more consistent approach to service delivery. A one month period for bundling was suggested as the most appropriate length of time.

They expressed concern around the volatility and current level of accuracy for the non-admitted data which could compromise the robustness of using a bundled approach. The

poor quality of underlying data creates the potential for perverse incentives for establishing inappropriate clinical practices. Furthermore one of the challenges is that there is variation in the service levels and mix of long and short term patients and if the bundling process is not standardised, it provides an opportunity for gaming.

### Cost Study Findings

To estimate current costs of home-based dialysis, two studies were identified for analysis.

1. NSW Dialysis Costing Study, conducted in 2008 by Health Policy Analysis for the NSW Department of Health (“NSW study”); and
2. Queensland Health Renal Replacement Therapy Costing Study, conducted in 2008 by KPMG for Queensland Health (“Qld study”).

The findings from the review of existing costing studies are shown in Table 1. This analysis found that costs are roughly comparable between the NSW and Qld studies. Estimates for ongoing (annual) costs ranged from \$27,084 to \$57,280<sup>1</sup>, although given the numerous assumptions made during the cost estimation process, these figures should not be taken to be precise. Based on the results in Table 1, it can be concluded that all modalities have ongoing (per annum) treatment costs in the neighbourhood of \$45,000, and set up and training costs of between \$5,000 and \$10,000. HD modalities appear to be on the more expensive side with PD modalities being slightly cheaper.

**Table 1: Comparison of 2013-14 estimated costs for home-based modalities from the NSW and Qld studies**

Estimated Per Person Per Year (\$)		Home HD	Home PD
<b>2013-14</b>			
Annual ongoing treatment costs	NSW study	46,676	48,265
	QLD study <sup>2</sup>	45,386	35,914
<i>Average</i>		46,031	42,089
Training and set-up costs	NSW study	12,092	5,778
	QLD study <sup>2</sup>	9,625	3,943
<i>Average</i>		10,859	4,860
<b>Total average</b>		<b>56,890</b>	<b>46,950</b>

The many advantages to developing a bundled payment process under ABF must be acknowledged. Conversely, there are also significant difficulties in developing a single price funding model for home-based dialysis. As pointed out by the jurisdictions, and verified by this costing analysis, the model of care and indeed, individual patient experiences, vary greatly. Secondly, the data available is such that many assumptions have to be made throughout the costing process (to make allowances for data that is either unavailable or inaccurate). Based on this, any funding model is likely to introduce the opportunity for perverse incentives and gaming and this should be explored in more detail before the funding model is introduced.

<sup>1</sup> Refer results for NSW in Table 16 and for Qld in Table 28.

<sup>2</sup> The HD results shown here are an average of the HHD and NHHD results reported in Table 28. Similarly, the PD results are an average of the APD and CAPD results.

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# 1 Introduction

## 1.1 Background

PwC has been engaged by the Independent Hospital Pricing Authority (IHPA) to undertake a review of existing costing studies that have been carried out on Home Delivered Dialysis Services to inform the development of the National Efficient Price 2015-16 (NEP15).

### Reporting

Home delivered dialysis services are counted and funded using the Tier 2 Non-Admitted Care Services classification system. Prior to 2013-14, home delivered dialysis was grouped together with hospital or clinic dialysis in one Tier 2 clinic in terms of reporting and funding. Following feedback received from jurisdictions around the different cost structures between these two services, IHPA decided to split them into three separate clinics for the 2014-15 year.

The relevant clinic names and definitions for home dialysis as set out in the Tier 2 Non-Admitted Services Definitions Manual 2014-15 (Manual), are:

- Tier 2 clinic number 10.15 described as ‘Renal dialysis - haemodialysis - home delivered’ is defined to include haemodialysis performed by the patient in their home without a health care provider present.
- Tier 2 clinic number 10.16 described as ‘Renal dialysis - peritoneal dialysis - home delivered’ is defined to include automated peritoneal dialysis (APD), continuous ambulatory peritoneal dialysis (CAPD) and continuous cycling peritoneal dialysis (CCPD) performed by the patient in their home without a health care provider present.

The Manual contains definitions for which activities should be included and excluded within that clinic description. Both clinic 10.15 and 10.16 specifically exclude renal dialysis performed in a non-admitted hospital setting and consultation or education where no dialysis is performed. These are captured in Tier 2 clinic number 10.10 described as ‘Renal dialysis - hospital delivered’, and Tier 2 clinic number 20.35 described as ‘Nephrology’.

### Funding

Limited cost information for home-based dialysis treatments have been submitted to IHPA as part of the National Hospital Cost Data Collection. These services were funded using the NEP14 price weights in 2013-14, however due to concerns over the underlying cost and activity data that the funding was based on, the funding model was changed to block funding for the 2014-15 year. IHPA has indicated that it would like to fund these services under the Activity Based Funding model for 2015-16, and so has commissioned a piece of work to help inform the National Efficient Price for 2015-16 (NEP15).

## 1.2 Scope of work

The scope of work included the following:

- A literature review of local Australian and International sources to identify cost drivers, costing studies and international models of counting and pricing these services under activity based funding models;
- Consultations with participating jurisdictions to identify costing studies conducted and understand their different care pathways for delivering home dialysis services; and
- A review of existing costing studies to estimate the costs of delivering home-based haemodialysis and peritoneal dialysis to help inform the NEP15.

## **1.3 Methodology**

### *Literature review*

The literature review was conducted using Google scholar, PUBMED, NHSEED and Econolite searches for terms such as 'home', 'renal', 'dialysis', 'risk', 'adjustment', 'funding', 'economics'; and "Home AND Renal AND Dialysis AND Costs".

Further details have been provided in Appendix B.

### *Consultations*

Consultations with all participating jurisdictions, their nominated site representatives and other relevant stakeholders were undertaken to gather information on the following:

- Identify and discuss any existing costing studies performed in their jurisdiction;
- the process of counting and recording home delivered dialysis activity information;
- the relevant cost drivers and resources consumed; and
- A high level overview of different care pathways and the methodologies used to perform costing.

### *Data analysis*

The purpose of the data analysis component is to review existing costing studies that have been conducted on home delivered dialysis to inform a price for these services under the NEP15 pricing model.

Jurisdictions and other stakeholders were contacted to identify existing costing studies for home delivered dialysis services. The selection of costing studies to be reviewed were made based on the following:

- Costs and estimates being generated as part of the study, not referencing other studies undertaken;
- Availability of the model and assumptions made for the costing study;
- Anticipated ability of the study authors to provide the required information and participate in the study; and
- Length of time since the study was conducted.

The following studies were identified which were selected for review:

1. NSW Dialysis Costing Study, conducted in 2008 by Health Policy Analysis for the NSW Department of Health; and
2. Queensland Health Renal Replacement Therapy Costing Study, conducted in 2008 by KPMG for Queensland Health.

Although the literature review identified a number of more recent studies and reports on home delivered dialysis, most of these referenced historical studies that had been conducted and therefore did not meet the selection criteria listed above.

### **Analysis of original costing studies**

An analysis of the two selected costing studies was undertaken which included a review of the methodology applied, the analysis model and the findings report. The following information was extracted and summarised in this report:

1. The type of costs included in the costing study (for example training costs, pharmaceuticals, direct and overhead costs etc.);



2. A summary of the methodology applied in conducting the original study, including the source of the costs, number of patients and relevant time period and sites;
3. Any assumptions applied in determining the original costs or data; and
4. A summary of the models of care applied for the costing study.

### **Estimating current costs**

The estimated costs from each of the costing studies were updated to reflect current costs through the following process:

1. Indexing the costs using IHPA's indexation methodology applied to the NEP model;
2. Updating certain specific costs using current cost schedules; and
3. Updating the cost profile for any significant changes to the models of care.

### **Benchmarking the costs**

A comparison of the current costs derived from both costing studies was undertaken to provide an estimate of the national costs of delivering these services.

A third costing study was used to test the feasibility of the costs derived. This study was entitled "The organisation and funding of the treatment of end-stage renal disease in Australia", conducted by Tony Harris in 2007. The estimated costs in this study were updated to current costs using the same methodology explained above.

## 2 Findings

In considering an appropriate funding model for Australia, international experience would indicate that bundled payment models are an appropriate strategy. The majority of models used bundles that provided for service payments of varying lengths (e.g. capitated payments over a year, bundled monthly payments etc.).

Whilst this type of model is one that Australia could consider, current ABF models operate on the basis of setting a price per service event. In the case of dialysis, a ‘service event’ occurs each time a patient dialyses.

The challenge with funding on this basis is that for home-based dialysis, the record-keeping of individual service events is lacking – there is no definitive system or process to document these events. Furthermore, based on the findings in the consultations with jurisdictions and this analysis of existing costing studies, the frequency of dialysing is very often dependent not only on the modality of dialysis, but on the specific patient’s condition. It is important to note, however, that this does not necessarily mean that more frequent dialysis results in significantly higher costs. A large portion of the dialysis costs are related to items which are to a large extent not dependent on the frequency of dialysis service events, for example, overheads and specialist visits.

For this reason there is a strong argument that Australia align with significant international experience: adopting a bundling approach. Not only does this address the challenges with record-keeping, it has the potential to deliver administrative efficiencies through simpler reporting, as well as incentivising a more consistent approach to service delivery.

There is, however, a major challenge with implementing a bundling model. Whilst this review found that costs are roughly comparable between the NSW and Qld studies examined, there were numerous assumptions made during the cost estimation process. As a result it seems reasonable to conclude that all modalities have ongoing (per annum) treatment costs in the neighbourhood of \$45,000, and set up and training costs of approximately \$10,000, these figures are not precise. Additional study information found in the course of the review also indicated different costings and conclusions (e.g. the “Harris study”).

This analysis confirmed a key point: the frequency of dialysis treatments is difficult to identify for home-based patients. No information obtained in this study pinpointed actual costs per treatment. As a result, this report’s core findings are that:

- There are many advantages to developing a bundled payment process under ABF for Home Delivered Dialysis, however
- There are significant difficulties in developing a single price funding model for home-based dialysis. The model of care and indeed, individual patient experiences, vary greatly, and the data available is such that many assumptions have to be made throughout the costing process. As a result, without further data and analysis, any funding model is likely to introduce the opportunity for perverse incentives and gaming.

Given the above, a potential next step would be to undertake a study to understand and capture real costs. Despite the concerns of jurisdictions over low data quality and reliability, it is likely that further investigation would provide both a more rigorous and accurate cost model for consideration, and serve as a step towards the process of improving data quality in the jurisdictions.

# 3 *Current NEP model*

## 3.1 *Current NEP model (NEP15)*

Home Delivered Renal Dialysis events are reported under clinic 10.15 (haemodialysis) and clinic 10.16 (peritoneal home dialysis) as defined in the Tier 2 Non-admitted services definitions manual 2014-15.

The definition of one non-admitted service event is defined as:

*“an interaction between one or more healthcare provider(s) with one non-admitted patient, which must contain therapeutic/clinical content and result in a dated entry in the patient’s medical record.”*

The counting of home delivered dialysis events are set out in the “IHPA Tier 2 Non-admitted services compendium 2014-15” which states:

*“Renal dialysis performed by the patient in their own home without the presence of a healthcare provider may be counted as a non-admitted patient service event, provided there is documentation of the procedures in the patient’s medical record.”*

Appendix I of the National Efficient Price Determination 2014-15 includes the following Non-admitted Price Weights per Episode for renal dialysis services:

- 10.15 Renal dialysis - haemodialysis home delivered – price weight 0.0774
- 10.16 Renal dialysis - peritoneal dialysis home delivered – price weight 0.0332

The funding is determined by applying the price weights to the National Efficient Price for 2014-15 (\$5,007) and accounting for any relevant adjustments (for example the Indigenous Adjustment) for all reported service events.

In 2013-14, activity reported under clinics 10.15 and 10.16 were funded using the NEP14 price weights. Due to uncertainty relating to the underlying costing and activity data, these clinics were changed to be block funded in 2014-15. IHPA intends to fund this activity under the ABF model from 2015-16.

# 4 Literature Review

The literature review was conducted on both Australian and International sources covering the following areas:

- Home dialysis definitions;
- Australian literature around costing studies and funding models; and
- International models of cost allocation and reimbursement for home dialysis.

Section 4.1 discusses the different types of dialysis treatments and includes some information on the frequency and resources required for this.

Section 4.2 covers Australian costing studies and discusses a number of studies conducted by Kidney Health Australia and a number of the jurisdictions.

Section 4.3 discusses the Victorian funding model.

Section 4.4 discusses an analysis of seven international funding models covering the USA, Ontario in Canada, Belgium, France, Germany, the Netherlands, and the United Kingdom.

## 4.1 Dialysis: Description and costs involved

### *Description*

Kidney Health Australia in “A Model for Home Dialysis – Australia” outlines the two main modalities of dialysis treatment. Haemodialysis (HD) uses a dialysis machine to circulate blood from the patient’s body through an artificial kidney (dialyser) for purification and then returns it to the patient.

Peritoneal Dialysis (PD) involves filling the peritoneal cavity with dialysis solution through a catheter. Waste and extra fluid are exchanged across the membrane and then transferred to the dialysis solution. After a pre-determined period, the solution is then drained out of the body and replaced with a fresh solution. Each repetition of this cycle is called an exchange. There are two types of peritoneal dialysis, the first is Continuous Ambulatory Peritoneal Dialysis (CAPD) which requires the patient to connect and disconnect sterile bags of dialysis fluid to a tube with the dialysis exchange occurring throughout the day. The second is automated Peritoneal Dialysis (APD) which uses a machine overnight to control the dialysis fluid (Kidney Health Australia, 2012).

The way in which public hospital services are delivered is evolving, with many services now being provided in different settings such as dialysis frequently being provided in a person’s home rather than a public hospital. Home delivered dialysis can take the form of either HD or PD and the decision between the two is dependent on patient parameters and availability of resources.

These therapies can be delivered across different settings, such as:

- In a hospital (also referred to as “in centre”);
- At a satellite clinic (a non-tertiary or secondary hospital or a health facility); or
- At the patients’ home.

Each delivery setting requires a different pattern of resource utilisation, infrastructure and staffing and accordingly will have a different cost per patient and per treatment. Further

detail on each of the types of treatment (haemodialysis or peritoneal dialysis) is included below, which impacts on the frequency of the treatment and associated costs.

### **Haemodialysis**

- Standard HD is performed 3 times per week for 4-5 hours at a time. This is the usual regime for hospital and satellite units and some individuals at home
- Enhanced HD sessions may be required where patients dialyse every second day or 4-5 times per week. This could include nocturnal and short daily sessions. Short Daily HD is performed 6 times a week for an average of 2-3 hours. This may be referred to as enhanced HD. Nocturnal Haemodialysis is performed overnight for an average of 8 hours. This procedure is performed up to 6 times per week.

### **Peritoneal Dialysis**

- With CAPD, a simple manual bag exchange is usually performed four times a day taking about 30 minutes to complete each 2-3 litre exchange.
- APD involves the use of an automated cyclor to perform the fluid exchanges which is done by a machine overnight. The exchange may occur 6-8 times in one evening.

### **Costs involved**

The remainder of the literature review explores different costing studies that have been conducted on home-based dialysis treatments, with the following cost categories usually included:

- Staff costs covering nursing, allied health, nephrologists and other clinicians. This covers medical care, patient evaluation, review and 24hr call service;
- Pharmacy costs including dialysis fluid and consumables;
- Pathology costs;
- Depreciation;
- Overheads;
- Costs associated with the infrastructure in the patients home to facilitate dialysis, including utility costs such as electricity and water treatment; and
- Training for staff and patients using home-based therapies.

In addition to these, some other costs associated with performing home peritoneal dialysis include (*ANZSN and Kidney Health Australia, 2013*):

- Competency assessment costs for the patient. Prior to installation each patient completes competency assessment that demonstrates their understanding of peritonitis prevention, including touch contamination;
- The administration of preventative antibiotics for catheter insertion and the use of anti-staphylococcal agents to prevent exit site infections; and
- Costs associated with the use of bio-compatible PD solutions

## **4.2 Australian costing studies**

A search was conducted for Australian costing studies that have examined the cost of providing home dialysis compared to hospital or satellite services. These studies have been reviewed in the pages that follows to provide context for the current analysis:

- Kidney Health Australia: Economic Impact of End Stage Kidney Disease
- Western Australia:
  - Framework to increase the uptake of home dialysis

- Costing study on renal dialysis services funded by the WA government
- New South Wales:
  - NSW Dialysis Costing Study (2008)
  - South Western Sydney LHD – Enhancing the home dialysis program
- ACT Health: Renal Health Services Plan
- Victoria:
  - Home haemodialysis in Australia and Nocturnal haemodialysis
  - Costs and payments for the treatment of End Stage Renal Disease (ESRD)
- Tasmania: State Plan for Renal Services
- South Australia: Home dialysis costing study

## *Kidney Health Australia*

### **Economic Impact of End Stage Kidney Disease**

A costing study commissioned by Kidney Health Australia (2010) was conducted to estimate the economic impact of End Stage Kidney Disease (ESKD) in Australia to 2020. The study reported on the projected number of ESKD patients and the costs of treatment to 2020. The original analysis was conducted in 2005, projecting the burden of disease out to 2010. Based on developments in the fields of public health, clinical medicine and health policy that have influenced awareness of Chronic Kidney Disease, the report has been updated and the cost of the disease burden projected to 2020. (*Kidney Health Australia, 2010*)

The key findings of the study were:

- New patients - The number of Australians projected to commence renal replacement therapy in 2020 will be between 3,335 and 4,472. This equates to an increase of between 25% and 81% over the number of individuals being treated in 2008. The majority of this increase is driven by new cases in the non-indigenous population aged 75 and over.
- Existing patients - The number of Australians projected to receive renal replacement therapy on 31 December 2020 will lie between 27,013 and 30,293. This equates to an increase of between 54% and 72% in the number of patients above 2008 figures calculated in the original study.
- The annual cost of treating these patients is estimated to be between \$1.58 billion and \$1.86 billion in 2020 dollars. These costs exclude the following:
  - The cost of providing these services to Australians under 25 years of age,
  - The cost of providing services for co-morbid conditions, and
  - The indirect and non-health sector costs associated with ESKD.
- The cumulative costs of renal replacement therapy by the end of 2020 (using 2009 dollars) for all current and new cases were estimated to be between \$11.3 billion and \$12.3 billion.
- An increase in the utilisation of home-based therapies (HD or PD) was projected to lead to net savings of between \$378 million and \$430 million. This assumes that in the first year of renal replacement therapy, approximately 40-60% of patients would be established on home-based dialysis.

A summary of the activity and cost inputs used in this analysis has been included in the following two sections, and a summary of the findings of the analysis follows.

## Modality utilisation patterns

In preparing their report, Kidney Health Australia obtained data from the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA), a comprehensive database monitoring end stage kidney disease patient trends, service utilisation and patient outcomes. The data shows the national variability in dialysis utilisation patterns between the jurisdictions and identified the change in modality utilisation patterns from 2005 to 2009, with most jurisdictions providing satellite or hospital haemodialysis rather than the less expensive home-based treatment options of home HD or PD.

The following trends with respect to home-based dialysis were noted:

- There has been limited expansion of home-based dialysis services since 2005
- Current patterns of usage emphasise the long periods required to establish people on home HD
- There are limited resources and facilities available for training
- There has been an increase in the proportion of patients receiving dialysis in satellite centres.

The report noted that number of Australian States and Territories have recently developed plans for the delivery of renal services, emphasising the provision of better coordinated care, promotion of self-management and investments in home-based therapies and transplantation in the provision of RRT. In particular, NSW and Queensland have set benchmarks for home-based dialysis with a target of 50% of all dialysis services to be delivered as home-based self-care dialysis.

## Cost of treatment

Cost data was obtained from the following sources:

- Cost weights for relevant Diagnosis Related Groups (DRGs) were extracted from the National Hospital Cost Data Collection for Round 13 (2008-09)
- The cost of each dialysis modality was based on the NSW Dialysis Costing Study 2008 (discussed in section 4.2.3 below), with prices indexed to 2009 dollars as it was presented in the study. This included the following:
  - nursing and allied health staff costs
  - price per treatment payments
  - direct costs associated with dialysis such as pharmacy, fluids and consumables, depreciation and overheads
  - Other costs such as medical services, access surgery, pathology and pharmacy costs.

**Table 2: Annual cost per modality, indexed to 2009 dollars**

Dialysis modality	Cost per patient per annum	Comments
Hospital	\$85,128	
Satellite	\$70,409	
Home HD	\$53,268	Excluding one off costs of training and other patient costs of \$15,093
Home PD	\$56,910	Excluding one off costs of training and other patient costs of \$3,823

A breakdown of these costs into cost categories (e.g. nursing, allied health, medical, etc.) has been included in Appendix C.

## Findings around home-based dialysis

The report discusses the lower cost of delivering home-based dialysis as it requires lower infrastructure and staffing ratios than hospital or satellite dialysis. It also acknowledges that home dialysis avoids some of the psychosocial, financial and vocational pressures for patients and their families as satellite and hospital dialysis units are less flexible and required repeated travel. There is substantial benefit to patients from rural and remote areas being able to relocate if they can receive home dialysis.

An increase in home dialysis will require the support of an adequately developed and maintained infrastructure and workforce supply, the provision of support networks for patients and adequate resources for training. Training for home-based haemodialysis would require a purpose built training facility, whereas training for peritoneal dialysis can be provided in the patients home.

One of the other barriers to increasing the extent of home dialysis was found to be the financial cost required to make infrastructure changes to the patients home (such as plumbing and electrical) as well as the high usage of water and electricity utilised by the HD machines. A copy of the financial support made available to home HD or PD patients by each state has been included in appendix D (*Kidney Health Australia, 2013*).

## Western Australia

### Framework to increase the uptake of home dialysis

The WA Department of Health produced a report providing a framework to increase the update, maintenance and quality of home dialysis therapies in Western Australia (*WA Department of Health, 2011*).

It quoted that currently 25.2% of dialysis patients in WA were receiving this treatment in the home with 3.4% of these patients receiving HD and 21.8% receiving PD. WA has set home-based dialysis targets of 33% and 35% respectively, as reported in the 'WA Dialysis Plan 2008-2013' and the WA Country Health Service (WACHS) Renal Dialysis plan 2010-2021.

Using an averaged metropolitan satellite HD price per treatment as the reference cost of \$1, the relative costs for dialysis treatment were estimated as shown in Table 3.

**Table 3: WA - Relative costs for dialysis treatments**

Description	Hospital HD	Satellite HD	Home HD	Home CAPD	Home APD
Relative unit dollar cost by price per treatment	\$1.7	\$1	\$0.46	\$0.57 - 0.62	\$0.83 - 0.99

The report recommends an increase in home-based dialysis as they consider it is less expensive than hospital and satellite based therapies in terms of direct costs, reduced admissions and complications. They identified a number of benefits to home dialysis therapies, such as:

- The provision of autonomy, flexibility and reduced travel expenses;
- Improvement in quality of life and more family engagement;
- Remote patients being able to stay in their own homes;
- Easier ability to work, lower mortality rates, reduced hospitalisations;
- Improved medical outcomes from extended hours of dialysis; and
- Reduced costs of home dialysis compared to hospital or satellite dialysis.



They also identified a number of barriers to the uptake of home therapies, which were mainly timely access to training and the inertia that develops once patients are established in a hospital or satellite based system.

WA has engaged a private contractor to manage all home dialysis therapies in WA for metropolitan and remote home HD and PD. Under this Western Australian Home Dialysis Program (WAHDiP), they believe they have the potential to consolidate existing training methodologies, establish consistent learning outcomes for patients and enhance sustainability of home dialysis across WA. The services include modality training, equipment installation, transition to home, assessment visits and ongoing clinical, consumables and technical support.

### **Costing study on renal dialysis services funded by the WA government**

Another report produced in WA, was a study conducted by Bird Cameron Chartered Accountants in 1999 for the WA government to conduct a cost analysis of their funding of renal dialysis services. This was referenced in the Tasmania State Plan for renal services 2010-2012 produced by the George Institute for International Health in 2009. (Tasmania Government, 2009).

The study used 1997-98 financial data from three public hospitals in WA, Royal Perth Hospital, Sir Charles Gairdner Hospital and Fremantle Hospital to estimate the cost of delivering each dialysis modality and to recommend a benchmark price to fund dialysis services. This study was described as a rigorous, bottom up costing process and found the costs of home dialysis (HD or CAPD) are lower than the costs of providing in centre/hospital dialysis. These have been summarised in Table 4.

**Table 4: Costs and pricing by modality for teaching hospitals in Western Australia, 1997-98, annual costs**

<b>Modality</b>	<b>Royal Perth Hospital</b>	<b>Sir Charles Gairdner Hospital</b>	<b>Fremantle</b>	<b>1997-98 Health Dept of WA Price Schedule</b>
In Centre HD	58,410	47,981	50,077	57,195
Metropolitan Home HD	20,064	-	-	32,136
Remote Home HD	34,819	-	-	40,872
Training Home HD	27,059	-	-	27,924
Metropolitan Home CAPD	27,564	29,016	30,139	26,473
Remote Home CAPD	32,154	24,413	30,351	29,705
Training Home CAPD	9,831	2,036	2,819	8,030

## ***New South Wales***

### **NSW Dialysis Costing Study (2008)**

A NSW dialysis costing study was undertaken by Health Policy Analysis in 2008 for the NSW Department of Health. The study looked at costs by modality in NSW split across rural and metropolitan locations for the 2006-07 and 2007-08 period. (*Health Policy Analysis, 2009*)

The study collected the following information across 49 sites:

- The characteristics of services provided by each site. This included the number of patients by modality, number of chairs and sessions, size of centres, nursing staff, nurse/patient ratio, arrangements for dialysis/renal-related drugs, transport arrangements, contractual arrangements, training, medical staff, allied health staff and technicians. Each site also provided protocols for outpatient appointments, pathology tests ordered and pharmacy provided.
- Cost information was provided by the site and through other sources. Direct and overhead costs were provided by the site, including nurse salaries, consumables and other operational costs as well as overheads like electricity, water and depreciation. Drug costs

were captured via a sub study undertaken by a renal pharmacist and costed used PBS fees. Pathology costs were identified by medical staff and NUMs and costed using MBS fees.

- Patient out-of-pocket costs, including drugs and pathology were collected via survey. Data was also captured from patients on the types and frequency of health professional visits including nephrologists, GP's and allied health professionals.

A distribution of the costs across the different modalities is shown in Table 5 and an estimate of the total expenditure per person per year is shown in Table 6.

**Table 5: Distribution of costs across different modalities, NSW, 2006-07 and 2007-08**

	Acute	In-Centre	Satellite	Home HD	Home HD training	Home PD	Home PD training	Total
<b>2006-07</b>								
All services (\$m)	1.38	54.99	51.35	22.49	1.80	37.08	1.28	170.36
Metropolitan services (\$m)	1.18	40.39	34.60	19.35	1.64	31.26	1.12	129.54
Rural services (\$m)	0.20	14.59	16.75	3.14	0.16	5.82	0.16	40.82
All services (%)	1%	32%	30%	13%	1%	22%	1%	100%
Metropolitan services (%)	1%	31%	27%	15%	1%	24%	1%	100%
Rural services (%)	0%	36%	41%	8%	0%	14%	0%	100%
<b>2007-08</b>								
All services (\$m)	1.48	58.74	53.34	23.45	1.80	40.14	1.29	180.24
Metropolitan services (\$m)	1.26	42.13	35.75	20.30	1.63	33.62	1.11	135.81
Rural services (\$m)	0.23	16.61	17.58	3.15	0.16	6.53	0.18	44.43
All services (%)	1%	33%	30%	13%	1%	22%	1%	100%
Metropolitan services (%)	1%	31%	26%	15%	1%	25%	1%	100%
Rural services (%)	1%	37%	40%	7%	0%	15%	0%	100%

**Table 6: Estimated expenditure per person per annum, NSW, 2006-07 and 2007-08**

	In-Centre	Satellite	Home HD	Home PD
<b>2006-07</b>				
All services (\$)	75,322	67,034	47,854	50,719
Metropolitan services (\$)	77,808	67,430	47,857	51,533
Rural services (\$)	76,813	76,471	46,910	43,744
<b>2007-08</b>				
All services (\$)	76,881	63,505	47,775	51,640
Metropolitan services (\$)	74,797	63,256	48,011	52,271
Rural services (\$)	80,260	77,120	48,393	50,988

The study found that there was a higher cost for acute and satellite/in centre services compared to home dialysis. With respect to a geographical difference in costs, rural services were more costly than metropolitan services for centre based units only. A detailed analysis of this costing study has been undertaken in Section 6 – Data Analysis.

### **South Western Sydney LHD – Enhancing the home dialysis program**

The literature review identified a presentation prepared by South Western Sydney Local Health District (SWSLHD) to support the appointment of a home dialysis support nurse as an effective cost reduction approach in providing home delivered dialysis services (*South Western Sydney Local Health District, 2013*).

The presentation describes the benefits of home dialysis as including increased dialysis hours, improved compliance and increased quality of life for patients. Their proposed model works with the nurse visiting patients to ensure that ongoing support is provided. This happens weekly for the first month, monthly for the next three months, and then less frequently.

An analysis of the cost saving was made. The analysis estimated 151 service incidents over 17 months. The salary of a registered nurse providing home support (\$76,000 p.a., therefore \$108,000 for 17 months) was compared to the potential costs of 151 occasions of readmission in a hospital (\$5-600 a day) and each hospital based dialysis session (\$592). This analysis concluded that there was a potential cost saving of approximately \$210,000 by providing a home support nurse. No further analysis of the costs of home-based dialysis was presented.

## **ACT**

### **Renal Health Services Plan**

The ACT Health Renal Health Services Plan 2010-2015 states that in terms of home dialysis, the rate of home dialysis across Australia has been decreasing, from 52% in 1977 for haemodialysis to current levels of 10% and from 30% in the late 1990's for peritoneal dialysis to about 20% currently (*ACT Health, 2010*).

The ACT public sector offers a mixture of acute inpatient haemodialysis, satellite (in-centre on hospital grounds) dialysis, and home haemodialysis and home peritoneal dialysis. There are no hospital based private services in the ACT, in contrast to other states, and no plans for renal dialysis to be provided in the private sector. Their plan includes a target of 20% home/community dialysis by 2022.

The document discusses the plan to provide dialysis at Community Health Centres, which will offer the benefits of services closer to where people live and allow for even more flexible options for dialysis than satellite or hospital options.

The report also mentions that the ACT Renal Service investigated the option of assisted Peritoneal Dialysis (APD) in 2010 which has recently been reviewed by a European survey as a suitable form of home dialysis particularly for the patients over 75 years (*Brown et al*). APD was developed because of the increasing proportion of frail elderly patients starting on dialysis. It allows the elderly to remain in their homes and receive assistance rather than needing to travel to a Dialysis Centre, offering patients a better quality of life by remaining in their own homes. This report provided no specific cost information in relation to dialysis services – where costs were discussed, it relied on results from Kidney Health Australia studies.

## **Victoria**

### **Home haemodialysis in Australia and Nocturnal haemodialysis**

A paper was prepared in 2010 by Agar et al entitled “Home haemodialysis in Australia - is the wheel turning full circle” (*Agar, 2010*). This paper discusses the benefits of home

haemodialysis compared to other treatments. These include the lifestyle and social benefits for the patient, as well as the treatment being cost effective.

The same author conducted a costing study in 2005 entitled “Nocturnal haemodialysis: An Australian cost comparison with conventional satellite haemodialysis” (Agar, 2005). This study analysed nocturnal home haemodialysis (NHHD) compared to conventional satellite haemodialysis (SHD) within the renal program at the Geelong Hospital in Victoria, Australia.

The authors selected a low acuity, limited care SHD facility for the cost comparison with NHHD. Only NHHD and SHD patients who had completed an uninterrupted, complete 12-month dialysis program during 2003-04 were included in the patient-based cost study.

For both NHHD and SHD, the study estimated the staff and recurrent (consumables) expenditure as well as capital and other infrastructure costs. The findings (per month and per annum) are presented in Table 7 (shown in 2005 dollars):

**Table 7: Estimated cost per month and per annum, VIC, 2005 dollars**

<b>Description</b>	<b>Satellite HD (\$)</b>	<b>Nocturnal Home HD (\$)</b>
Total estimated cost per patient per month of treatment	3,023	2,699
Wage and recurrent costs (included in the above figures)	2,496	2,336
Total estimated cost per patient per annum	36,284	32,392

### **Costs and payments for the treatment of End Stage Renal Disease (ESRD)**

A study was conducted by Tony Harris in 2007, entitled “The organisation and funding of the treatment of end-stage renal disease in Australia” which estimated a total annual expenditure by modality.

To estimate the total annual expenditure per ESRD patient in Australia, modality costs were estimated separately and then weighted by the proportion of the ESRD population receiving that modality in 2004. The population weights were derived from ANZDATA and the costs were determined from the following sources for each category shown in Table 8.

- “Payment costs” were estimated based on Victorian dialysis payment rates per modality in 2004. As these do not cover hospitalisation costs unrelated to dialysis treatment and physician visits for reasons other than dialysis, these costs were added in.
- Hospitalisation costs were estimated based on a 2002 report on “current and future treatment costs of End Stage Renal Disease in the NT”<sup>3</sup>
- Physician/MD visit costs were estimated based on a report by the United States Renal Data Systems from 2005.

Whilst outdated, these costs are consistent with the other costing studies, showing the lower cost of home versus satellite or hospital dialysis treatments.

<sup>3</sup> Reference from Harris study: You, J. Hoy, W., Zhao, Y., Beaver, C., & Eagar, K. (2002). End-stage renal disease in the Northern Territory: Current and future treatment costs. *Medical Journal of Australia*, 176, 461–465.

**Table 8: Annual expenditure estimations for ESRD in Australia, by modality, 2004**

Modality	Weight <sup>4</sup>	Payment (AU\$)	Hospital (AU\$)	MD office visits (AU\$)	Total Expenditure (AU\$)	Weighted Expenditure	
						AU\$	US\$ <sup>5</sup>
<i>Dialysis</i>							
Hospital HD	0.15	47,432	22,697	6,767	76,896	11,196	8,172
Home HD	0.06	33,228	22,697	5,396	61,321	3,434	2,507
Satellite HD	0.24	47,438	22,697	6,767	76,902	18,087	13,202
CAPD	0.07	42,031	22,697	6,246	70,974	5,167	3,771
APD	0.05	50,825	22,697	7,094	80,616	4,063	2,966
<i>Transplant (TX)</i>							
Year of TX	0.05	81,209	-	-	81,209	3,716	2,712
First full year as TX	0.05	28,936	-	-	28,935	1,324	966
Other years	0.35	10,749	-	1,037	11,786	3,589	2,319
<b>Total</b>						<b>50,576</b>	<b>36,917</b>

<sup>4</sup> Reference from Harris study: *Weights derived from ANZDATA (2005)*

<sup>5</sup> Reference from Harris study: *Purchasing Power Parities (PPPs) for OECD countries 1980-2005*. Paris: Organisation for economic cooperation and development. Retrieved February, 2007, at [http://www.oecd.org/statisticsdata/0,2643,en\\_2649\\_34357\\_1\\_119656\\_1\\_1\\_1,00.html](http://www.oecd.org/statisticsdata/0,2643,en_2649_34357_1_119656_1_1_1,00.html)

## Tasmania

### State Plan for Renal Services

The Tasmanian government published a State plan for renal services 2010-2012 which was prepared by the George Institute for International Health in 2009. The report includes some cost estimates for economic modelling of renal dialysis and transplantation which were based on:

- The NHCCD Round 11 (2006-07) AR-DRG cost weights for relevant DRG-based costs,
- ANZDATA information on renal patient admissions, and
- The following two costing studies:
  - the WA Costing Analysis of the Renal Dialysis Services referred to in 4.2.2 above, and
  - the Agar Home haemodialysis in Australia study referred to in 4.2.5.

The cost estimate of a dialysis treatment per patient per year by modality is shown in Table 9.

**Table 9: Unit cost of dialysis per patient per year by modality (AU\$, 2008)<sup>6</sup>**

<i>Description</i>	<i>Home HD \$ unit cost pa</i>	<i>Satellite HD \$ unit cost pa</i>	<i>PD \$ unit cost pa</i>	<i>Hospital HD \$ unit cost pa</i>
Dialysis costs (including fixed costs, salaries and wages, consumables)	38,373	42,984	45,249	80,652
Drugs (including Epoietin alfa, Darbepoetin alfa, Calcitriol & Iron)	9,666	9,666	9,666	9,666
Hospitalisation due to infection/ other complications / access revisions*	2,483	2,483	7,923	2,483
Specialist consultations and review	530	530	530	530
Work up costs for patients on transplant waiting list	730	730	730	730
<b>Total annual cost (not including initial access)</b>	<b>51,782</b>	<b>56,393</b>	<b>64,099</b>	<b>94,061</b>
Initial access (including temporary access)	15,490	15,490	12,762	15,490

## South Australia

### Home dialysis costing study

A study was undertaken in 2000-01 to examine the costs of home-based dialysis in South Australia. This study has been used in subsequent years by SA Health on the basis of indexing the costs from the original costing analysis. The jurisdiction could not provide any

<sup>6</sup> NB these costs are estimated from ANZDATA record hospitalisations for peritonitis in peritoneal dialysis (PD) patients and access revisions in haemodialysis (HD) patients and are therefore likely to underestimate the true cost of inpatient resource use for renal and non-renal causes in these patients.

reporting detail on this study and so this report cannot provide any further information about conclusions drawn from this study.

## **4.3 Funding models**

### ***Australian funding models***

A search was conducted on funding models across Australia for home dialysis services. The section below summarises the model in Victoria with no other jurisdiction data being available.

#### **Victoria**

Up to 2011, the Victorian government funded dialysis services through a two-tier funding model that includes a capitation grant that was paid to the hub hospitals and a variable payment that was paid directly to the in-centre and satellite providers.

The variable case payment was based on the number of annual attendances and covered costs such as nurse care, waste management, power, water and patient transport. The Capitation Grant was paid to the hub provider and covered the consumables, acute dialysis treatments, nurse training, medical care, pathology and pharmacy.

From 2013, they changed their model to align to activity based funding with the new model consisting of two components:

- An admitted patient component for dialysis separations based on the relevant DRG (L61Z); and
- A non-admitted component for clinical consultations, including medical, nursing and allied health clinics.

Home dialysis continues to be funded as a block grant per patient for 2013–14 of \$52,379 per patient per annum. In addition, payments are provided to patients who conduct home dialysis as follows:

- home peritoneal dialysis - \$755 per patient per annum
- home haemodialysis - \$1,990 per patient per annum

## **4.4 International studies**

A number of international studies relating to costing and reimbursement models for renal dialysis were identified.

### ***International comparison of seven countries reimbursement models***

A report entitled 'Reimbursement of Dialysis: A Comparison of Seven Countries' analysed seven different countries to compare reimbursements for various dialysis modalities, including home delivered renal dialysis. (*Vanholder et al, 2012*)

The countries included USA, Canada (Ontario), Belgium, France, Germany, the Netherlands, and the United Kingdom. The dialysis services they analysed were self-care haemodialysis, home haemodialysis, CAPD, APD and hospital haemodialysis.

The report noted:

- There are significant differences between each country's reimbursements for renal dialysis, with up to a 3.3-fold difference between the highest and lowest reimbursement rates for chronic haemodialysis. (This is after adjusting for different foreign exchange rates and per capita GDP).

- In general, the reimbursement across all dialysis modalities was the lowest in the United States and Canada. However the specific reimbursement for CAPD was lowest in the UK.
- Reimbursement for PD compared to HD was lower in most countries except Germany and the USA.
- The UK implemented an incentive if patients use an arteriovenous fistula (a surgical connection between an artery and a vein created for dialysis purposes).
- Although home haemodialysis (prolonged or daily dialysis) allows greater flexibility and better patient outcomes, reimbursement is only incentivised in the Netherlands.

A summary of the specific reimbursement levels for each country is shown in Table 10.

### **Specific elements included in the reimbursement**

The difference in the size of the reimbursements is partly impacted by the different elements which are included in the price with variations around intravenous drugs, pathology and nephrologists' fees. These differences are shown in Table 11.

### **Adjustments to the reimbursement**

There are also differences in adjustments to the reimbursement model based on a number of factors – such as the patient having other diseases (for example Hepatitis B or C, HIV infections or diabetes), if the patient has a central venous catheter for dialysis access, their age and the number of sessions a week (although this adjustment is only done by the UK and Canada). These adjustments are shown in Table 12.



**Table 10: Reimbursement per week for dialysis services in the different countries in US\$**

Modality	Belgium	Germany	The Netherlands	United Kingdom <sup>7</sup>	France	United States	Ontario, Canada <sup>8</sup>
Self-care HD	1,045 <sup>9</sup>	675	1,668	744	909	689	502
Home HD	1,045	675	1,246/1,905 <sup>9</sup>	744	816	689	385
CAPD	985	1077	1,126	502	718	689	636
APD	985	1077	1,126	612	925	689	733
Hospital HD	1,608	675–1,131 <sup>10</sup>	1,668	744	1,364 <sup>10</sup>	689	745

**Table 11: Specific elements included in the reimbursement package<sup>11</sup>**

Details	Belgium	Germany	The Netherlands	United Kingdom	France	United States	Ontario, Canada
ESAs	N	N	Y	N	N	Y	N
Intravenous iron	N	N	Y	Y/N <sup>12</sup>	Y	Y	Y
Intravenous vitamin D analogs	N	N	Y	Y	Y	Y	Y
Heparin	Y	Y	Y	Y	Y	Y	Y
Oral medications	N	N	N	N	N	N	N
Biochemical (laboratory) analysis	N <sup>13</sup>	N <sup>13</sup>	N	N	Y/ N <sup>14</sup>	Y	Y
Nephrologist's fees	Y	N	Y	N	Y/ N <sup>15</sup>	N	N

<sup>7</sup> Reference from Vanholder et al, 2012: *Reimbursement in the United Kingdom corresponds to standard treatment, no hepatitis B/C or HIV, and AVF as access in haemodialysis patients.*

<sup>8</sup> Reference from Vanholder et al, 2012: *Data refer to the province of Ontario only; in Canada, substantial regional differences exist.*

<sup>9</sup> Reference from Vanholder et al, 2012: *The cost is \$1246 if haemodialysis is performed with patient's own partner and \$1905 if performed with the help of a nursing assistant.*

<sup>10</sup> Reference from Vanholder et al, 2012: *These values are references; regulations for hospital haemodialysis in Germany and France are complex and more extensively explained in the text.*

<sup>11</sup> Reference from Vanholder et al, 2012: *Y means no separate payment for this factor.*

<sup>12</sup> Reference from Vanholder et al, 2012: *Intravenous iron is included in the reimbursement package for hemodialysis but not peritoneal dialysis.*

<sup>13</sup> Reference from Vanholder et al, 2012: *Limited number of tests allowed per sample collected (Belgium) or per month (Germany).*

<sup>14</sup> Reference from Vanholder et al, 2012: *Y stands for public hospitals, and N stands for all other options.*

<sup>15</sup> Reference from Vanholder et al, 2012: *Y is for hospital hemodialysis; N is for other options.*

**Table 12: Reimbursement adjustments for nonstandard dialysis strategies or specific patient groups<sup>16</sup>**

	Belgium	Germany	The Netherlands	United Kingdom	France	United States	Ontario, Canada
High-flux hemodialysis	N	N	N	N	N	N	N
On-line hemodiafiltration	N	N	N	N	N	N	N
Nocturnal hemodialysis	N	N	N	N	N	N	N
More than three sessions per week Y/N <sup>a</sup>	Y/N <sup>17</sup>	Y/N <sup>17</sup>	N	Y	Y <sup>18</sup>	Y <sup>19</sup>	Y <sup>20</sup>
Patients with hepatitis B	N	40/35 <sup>21</sup>	N	23 <sup>22</sup>	N	N	N
Patients with hepatitis C	N	40/35 <sup>21</sup>	N	23 <sup>22</sup>	N	N	N
Patients with HIV	N	40/35 <sup>21</sup>	N	23 <sup>22</sup>	N	N	N
MRSA carriers	N	40/35 <sup>21</sup>	N	N	N	N	N
Diabetes	N	35 <sup>22</sup>	N	N	N	N	N
Age	N	21 if .59	N	N	N	Y <sup>23</sup>	N
Central venous catheter	N	N	N	248 <sup>24</sup>	N	N	N

<sup>16</sup> Reference from Vanholder et al, 2012: *N means no incentive or disincentive; MRSA, methicillin-resistant S. aureus.*

<sup>17</sup> Reference from Vanholder et al, 2012: *Y stands for hospital hemodialysis; N stands for other options.*

<sup>18</sup> Reference from Vanholder et al, 2012: *Any fourth session per week*

<sup>19</sup> Reference from Vanholder et al, 2012: *A fourth session is reimbursed if medically justified*

<sup>20</sup> Reference from Vanholder et al, 2012: *In-home hemodialysis is \$385 for three times per week but \$760 for five to six times per week.*

<sup>21</sup> Reference from Vanholder et al, 2012: *\$40 in self-care and home hemodialysis, and \$35 in peritoneal dialysis.*

<sup>22</sup> Reference from Vanholder et al, 2012: *Only in home hemodialysis and self-care.*

<sup>23</sup> Reference from Vanholder et al, 2012: *Several other adjusters are applied as well (more details in the text).*

<sup>24</sup> Reference from Vanholder et al, 2012: *\$256 if hepatitis B/C or HIV*

## *International costing study on dialysis*

A study was conducted in 2012 entitled 'An economic assessment model for in-centre, conventional home, and more frequent home haemodialysis'. The study used data from Australia, Canada and UK, looking at cost allocation methods and costing study output. (Komenda *et al*, 2012)

The estimated costs for each of the modalities were obtained from other costing studies, many referenced and included in this literature review. The findings are summarised as follows:

- Total costs for each modality were relatively consistent in year 1.
- From year 2 onward, conventional home haemodialysis is less expensive than in-centre haemodialysis.
- The model predicts that, over time and depending on location, home dialysis would save payers between US\$7,612 and US\$12,403 over the first year of in-centre haemodialysis.
- The model predicts that frequent home haemodialysis, with its increased costs of consumables and materials, would cost UK payers US\$4,408 in subsequent years. However, frequent home haemodialysis would save Canadian payers US\$3,411 and Australian payers US\$4,036 in subsequent years compared with first year in-centre haemodialysis costs.

A copy of the cost identified has been included in appendix E.

# 5 Consultation Findings

Consultations with all participating jurisdictions, their nominated site representatives and other relevant stakeholders were undertaken to gather information on the following:

- Identify and discuss any existing costing studies performed in their jurisdiction,
- the process of counting and recording home delivered dialysis activity information,
- the relevant cost drivers and resources consumed, and
- A high level overview of different care pathways and the methodologies used to perform costing.

The consultations were conducted via teleconference, face to face meetings, survey questionnaire submissions or any combination of these methods.

There was consensus across all consultations that the primary cost drivers of home delivered dialysis treatments are: staff salary (including nursing, clinical and support staff), pharmacy cost, pathology costs, consumables/supplies and training for staff and patients.

During consultations for this review, majority of the stakeholders indicated that minimal number of unique studies has been undertaken recently to reasonably estimate the costs of delivering home-based haemodialysis and peritoneal dialysis. A number of recent reports or publications also make reference to these studies which were conducted prior to 2009 and the underlying issues, assumptions, data and the methodology largely remained unchanged.

All jurisdictions, with the exception of Victoria and Australian Capital Territory participated in the review consultations. Key findings from these consultations are described below.

## 5.1 Key findings

### 5.1.1 NSW

#### *Collection of Activity data*

NSW Health noted that the hospitals in NSW commenced capturing home-based dialysis activity only since 1 July 2013. All known HDD patients details and their treatment schedules are recorded in an electronic register and the schedule is updated regularly for exclusions that are reported or identified by hospital staff.

#### *Collection of cost data and cost allocation method*

NSW identified the following cost drivers relevant for this group of patients: consumables and fluids for haemodialysis and peritoneal dialysis patients; staffing cost; pharmaceuticals; transport arrangements; training requirements; and administrative costs. The costs associated with delivering HDD are then identified during the cost allocation process and allocated to the relevant HDD patients based on service event level activity data.

NSW Health commented that the overall data quality, completeness and accuracy of the non-admitted activity data needs to be considerably improved before they can be reliably used to inform the national efficient price.

### 5.1.2 South Australia

#### *Collection of Activity data*

In South Australia the majority of the home-based services are provided for the PD (peritoneal dialysis) patients. The following three South Australian hospitals currently

provide HDD services to their patients: The Queen Elizabeth Hospital; Royal Adelaide Hospital; and Flinders Medical Centre.

SA Health representatives noted that home-based dialysis activity is currently collected and recorded at service event level. However these patient episodes are not costed using service event level activity data.

### *Collection of cost data and cost drivers*

SA Health identified the following cost drivers relevant for this group of patients: nursing costs (physical visits and tele support); depreciation - dialysis machines (including machine parts and cost of replacement); regularity/frequency of home-based dialysis; consumables; medical supplies; pharmaceuticals; and training and education program for patients. The jurisdiction considers home-based haemodialysis and peritoneal dialysis to be less expensive than 'in centre' services.

### *Cost allocation method*

The costs associated with delivering home delivered dialysis services are identified and excluded during the cost allocation process.

A formal study was undertaken in 2000-01 by SA Health to understand the materiality of cost differential between hospital and home delivered services.

## **5.1.3 QLD**

### *Collection of Activity data*

QLD Health responded that home-based dialysis activity is reported only at an aggregate level which is based on expected events per month for an average patient. The current level of completeness, coverage and accuracy for the non-admitted activity dataset is an area of development and requires further work to be used reliably to help inform the NEP.

### *Collection of cost data and cost drivers*

QLD noted that the relevant cost drivers for home therapy services include equipment installation and maintenance costs, supplies and consumables, clinical need of the patient, ongoing clinical support and training to staff and patients.

### *Cost allocation method*

The costs associated with delivering home delivered dialysis services are allocated using aggregate activity data (estimated based on expected events) during the cost allocation process. A virtual patient record is created for allocating HDD costs.

It was highlighted by QLD Health that irrespective of costing methodology, if the total costs are not captured and overhead not reasonably allocated, the costing wouldn't be accurate to set the price weight on.

## **5.1.4 TAS**

### *Collection of Activity data*

Tasmanian Department of Health and Human Services (DHHS) responded that home-based dialysis activity is currently only available as counts of patients. Individual service events of patients receiving these services are currently not collected or recorded; however the jurisdiction indicated that there is a plan to do so in the future.

### *Collection of cost data and cost allocation method*

Home Delivered Dialysis is outsourced to a third party service provider. The costs associated with delivering home delivered dialysis services are identified during the cost allocation process and these costs are excluded from in-scope product reporting.

## **5.1.5 NT**

### ***Collection of Activity data***

NT Health responded that home-based dialysis activity is currently counted at service event level; however this is estimated based on the volume of medication, fluids and consumables issued to HDD patients rather than recording individual service events. The jurisdiction has a very low volume of patient numbers and does not consider counting of these patients or individual service events to be a priority. In Round 17, the cost and activity information for a total of 18 HDD patients was submitted to the NHCDC by NT Health.

### ***Cost drivers***

Primary cost drivers relevant for this group of patients include nursing and clinician costs, patient training, medical and surgical supplies, pharmaceuticals and other consumables costs. The jurisdiction considers home-based haemodialysis and peritoneal dialysis to be less expensive than the services provided in a facility (hospitals, satellite clinics).

### ***Cost allocation method***

The costs associated with delivering HDD services are identified during the cost allocation process and these costs are allocated through application of various allocation statistics to derive cost at a service event level.

No formal studies or analysis have been undertaken by the jurisdiction to understand the materiality of cost differential between hospital and home delivered services for the purpose of funding impacts.

## **5.1.6 Western Australia**

### ***Collection of Activity data***

In their response to the survey, Western Australia did not provide any information about specific counting or collected method related to activity data.

### ***Collection of cost data and cost drivers***

WA responded that the relevant cost drivers for home therapy services include costs of modality training, equipment installation and transition to home, assessment visits and ongoing clinical, consumables and technical support to patients.

The cost of Peritoneal Dialysis is very dependent on clinical outcomes and hospitalisations. Infection complications resulting in additional hospitalisations may offset any upfront savings. This is a key concern and a consideration as the rate of peritonitis and technique failure in WA is reported to be high.

### ***Cost allocation method***

WA has an outsourced model for home delivered services. A private contractor has been engaged to manage all home dialysis therapies in WA for metropolitan and remote home HD and PD under a seven year contract from 2007 to 2014. In their response to the survey, Western Australia did not provide any information about specific cost allocation methods or processes.

## **5.1.7 Commonwealth of Australia**

A high level discussion was undertaken with two members of the Acute Care Division (Public Hospital Sector) to discuss and obtain their views on the current models of counting and pricing home-based dialysis treatments.

The Commonwealth representatives responded that the jurisdictions and IHPA are best placed to determine and implement an appropriate model of counting and recording of the relevant activities. They supported bundling of services in the NEP15 and suggested a one month period could be an appropriate duration for pricing home-based dialysis treatments.

# 6 *Data Analysis*

The purpose of the data analysis component is to inform a price for home delivered dialysis services under the NEP15 pricing model by estimating current costs based on a review of existing costing studies. The following studies were selected for review:

1. NSW Dialysis Costing Study, conducted in 2008 by Health Policy Analysis for the NSW Department of Health (“NSW study”); and
2. Queensland Health Renal Replacement Therapy Costing Study, conducted in 2008 by KPMG for Queensland Health (“Qld study”).

In addition to estimating current costs based on the study results, this analysis includes a review of the costs included (and excluded); the data collection & costing methodology applied; any costing assumptions and limitations; and a summary of the model of care.

## **6.1 *NSW Study***

A study was commissioned by the NSW Department of Health in 2009 to determine the cost of different dialysis modalities in NSW. It was performed by Health Policy Analysis Pty Ltd using 2008 data across 49 sites in NSW.

The purpose of the study was to inform planning for the expected growth of renal dialysis services in NSW, by costing facility-based and home-based dialysis modalities in NSW and reviewing the existing funding model for home-based dialysis.

As part of this review of the study, the Main Report and Appendices of the NSW Dialysis Costing Study were obtained, however the model itself was not able to be obtained. The analysis has focussed only on the elements that relate to the home-based dialysis modality using data that can be obtained directly from the Report and Appendices.

### **6.1.1 *Summary of estimated costs from the 2008 costing study***

At 30 June 2008, NSW services registered 3,103 patients receiving dialysis services which represented one third of the Australian renal dialysis population. Within this group of patients, approximately 46% were receiving their dialysis treatments at home (18% home HD and 28% PD), with the remaining 54% either in satellite units or in-centres. In-centre units are located within a hospital, whereas satellite units are located away from a hospital but remain closely networked to their ‘parent’ in-centre unit.

Table 13 below was extracted from the 2008 costing study and reflects the estimated total expenditure per person per year by dialysis modality for 2007-08. These costs include the following components:

- Employee-related costs (such as nursing, administration, technical, etc.);
- Goods and services (such as pathology, pharmacy, dialysis equipment & consumables, etc.);
- Repairs, maintenance and replacement costs;
- Depreciation; and
- Health professional costs (such as nephrologist visits, allied health support, etc.) and access surgery costs.

Certain costs were estimated and included in the report, but were reported separately and are not included in Table 13, such as:

- Patient out-of-pocket costs;
- Cost of hospital admissions other than those incurred for access surgery; and
- Training costs for home-based modalities.

**Table 13: Estimated total expenditure per person per year, by dialysis modality and region, 2007-08<sup>25</sup>**

<b>Per Person Per Year (\$)</b>	<b>In-Centre</b>	<b>Satellite</b>	<b>Home HD</b>	<b>Home PD</b>
All services	76,559	67,209	47,858	51,420
Metropolitan services	75,102	63,285	47,769	51,548
Rural services	80,414	76,899	48,442	50,766

The estimated costs show that home-based modalities are cheaper than in-centre or satellite services, with HD being the cheapest at \$47,858 per patient per year. A breakdown of the estimated costs of home dialysis per patient per year for 2007-08 is shown in Table 14, with training costs shown separately.

<sup>25</sup> Extract from Table 1, NSW Dialysis Costing Study, 2008



**Table 14: Estimated distribution of expenditures across home-based dialysis modalities 2007-08<sup>26</sup>**

	Home HD	Home HD training	Home PD	Home PD training
<b>Employee Related</b>				
Nursing	995,339	986,438	1,677,522	888,320
Administrative	92,035	105,714	59,569	38,572
Technical	469,414	0	0	0
Hospital/Domestic/Other	0	177,876	0	-12,367
Superannuation	120,672	125,820	163,186	86,784
Workers Compensation	24,134	25,164	32,637	17,357
<i>Subtotal</i>	<i>1,701,594</i>	<i>1,421,012</i>	<i>1,932,914</i>	<i>1,018,666</i>
<b>Goods &amp; Services</b>				
100 Drugs	4,928,420	0	8,435,120	0
Other Prescribed Drugs	2,942,937	0	2,910,755	0
Other Drug Supplies	264,303	0	207,815	0
PPT Payments	1,407,119	0	0	0
Dialysis Fluids/Consumables	3,745,708	0	11,938,762	0
Other Medical & Surgical Supplies	431,363	0	383,570	0
Pathology	610,855	0	920,061	0
Other Special Services	105,859	0	132,714	0
Food	0	19,138	0	66,420
Domestic Services	140,406	0	198,398	0
Goods & Services Other	452,212	0	230,649	0
<i>Subtotal</i>	<i>15,029,181</i>	<i>19,138</i>	<i>25,357,844</i>	<i>66,420</i>
<b>Repairs Maintenance &amp; Replacement</b>				
	298,399	0	226,652	0
<b>Depreciation</b>				
Depreciation Dialysis Equipment	1,057,320	98,880	0	0
Other P&E Depreciation	21,836	25,130	41,150	22,622
Building Depreciation	65,506	75,389	123,449	67,866
<i>Subtotal</i>	<i>1,144,662</i>	<i>199,398</i>	<i>164,599</i>	<i>90,488</i>
<b>Other Estimates</b>				
Nephrologist Consultations	380,127	0	537,658	0
Other Medical Input	77,201	0	142,931	0
Other Specialist Consultations	300,100	0	424,467	0
General Practitioner Consultations	140,047	0	198,084	0
Social Worker Consultations	520,173	0	735,742	0
Dietician Consultations	663,554	0	938,543	0
Other Overheads	928,521	156,311	1,663,064	112,053
Access Surgery	2,266,497	0	7,821,677	0
<i>Subtotal</i>	<i>5,276,220</i>	<i>156,311</i>	<i>12,462,166</i>	<i>112,053</i>
<b>Total</b>	<b>23,450,056</b>	<b>1,795,859</b>	<b>40,144,175</b>	<b>1,287,627</b>
<i>Number of patients</i>	<i>490</i>	<i>N/A</i>	<i>769</i>	<i>N/A</i>
<i>Average expense per patient per year</i>	<i>47,857</i>	<i>N/A</i>	<i>52,203</i>	<i>N/A</i>

<sup>26</sup> Extract from Table 25, NSW Dialysis Costing Study, 2008

## 6.1.2 Estimating current 2014 costs for home dialysis services

The estimated costs from the 2008 NSW costing study were used to estimate current (2013-14) costs through the following process:

1. Indexing the costs using IHPA's indexation methodology applied in the NEP model;
2. Updating costs where more accurate current cost data is readily available;
3. Adjusting the cost profile for any significant changes to the models of care; and
4. Removing costs that are not applicable to the current study.

### 1. Indexation of costs

The 2008 NSW costs were adjusted by applying an indexation factor consistent with that used in calculating the annual National Efficient Price. This approach involved using a growth index based on the increases in weighted separations in acute admitted services over past 6 years, and was provided by IHPA.

The average annual growth rates used are shown in Table 15.

**Table 15: Average annual growth rates for relevant financial years**

Financial year	Average annual growth <sup>27</sup>
2004-05	-
2005-06	4.6%
2006-07	3.9%
2007-08	3.1%
2008-09	5.6%
2009-10	3.6%
2010-11	2.0%
2011-12	2.8%
2012-13	4.1%
2013-14	3.6%

### 2. Updating costs

Some cost categories, rather than being indexed, are more appropriately estimated for current (2013-14) costs using a specific up-to-date cost schedule. These include pharmaceutical costs (costs specified by the Pharmaceutical Benefits scheme) and medical consultation costs (costs specified by the Medicare Benefits schedule).

Due to limitations on the information available in the report, pharmaceutical costs were unable to be updated using the PBS information, as the pharmaceutical protocols originally used to estimate 2007-08 costs were not provided in the report.

Medical consultation costs were updated according to current MBS data where sufficient information on frequencies of consultations was provided in the report. The below table explains this approach in more detail.

<sup>27</sup> The growth indices for 2005-06 to 2007-08 are the Government final consumption expenditure (GFCE) on hospitals and nursing homes from the AIHW report "Health expenditure Australia 2012-13" which is available online –the deflation rates were converted into growth rates with a base year of 2004-05. The growth indices for 2008-09 to 2010-11 are based on the increases in weighted separations in acute admitted over past years. The growth indices for 2011-12 onwards are an estimate of the increases in weighted separations in acute admitted over past years. IHPA does not yet have a firm fix on the indexation between 2011-12 and 2012-13 and these may be revised down.

Medical consultation costs	Updated using current MBS data?	Comments
Nephrologist Consultations	Yes	MBS Item 116 is the main nephrologist consultation
Other Medical Input	No	Includes costs of VMO and supervisory support, not specific consultations
Other Specialist Consultations	No	Insufficient data in report as to frequency & type of consultation provided
General Practitioner Consultations	No	GP visits are excluded from these costing estimates as discussed in item 4 below
Social Worker Consultations	Yes	MBS item 10956 or 80150 (same benefit value applies to both items)
Dietician Consultations	Yes	MBS item 10954

### 3. Adjusting the cost profile to match the current model of care

As discussed in detail in a later section, the current model of care varies significantly and there was insufficient detail provided in either the 2007-08 or the current model of care to determine if any specific changes in the model have occurred. Based on this, no adjustments relating to changes in the model of care were made to the 2007-08 costs.

### 4. Removing non-applicable costs

A number of cost categories were included in the 2008 costing study that have been removed from the 2013-14 cost estimates. These costs were removed because they do not represent costs that are incurred by the hospital that would be funded as part of the dialysis service, or they are excluded from NEP calculations and therefore excluded here to be comparable to NEP. The costs removed are:

- Costs associated with GP appointments. These represent primary care services which are funded separately to dialysis services.
- Costs of access surgery. Similarly, these costs would be funded under the admitted surgical episode.
- Depreciation costs. NEP calculations do not take depreciation into account, so these costs have been removed from the analysis.

Capital expenditure ('capex') costs are also excluded from NEP calculations. However, there is insufficient level of detail in the NSW study costs to identify and remove any capex costs. This limitation is identified this in the Costing Assumptions and Limitations section below.

Secondly, the medical consultation cost category included both costs to the health system, and costs external to the health system. In the report, these were estimated using the 2007-08 MBS data but grossed up to an 'average cost-to-patient'<sup>28</sup>. However, for the purposes of this analysis, the cost to the health system should be limited to the benefit paid and does not include any gap payment made by the

<sup>28</sup> Refer paragraph 2 on page 54 of the Final Report. The indexed costs were divided by 1.46 to find the estimated costs excluding the charge in excess of the benefit.

patient, or the portion of the fee not reimbursed by Medicare. These costs have been adjusted appropriately.

### **Estimated 2013-14 costs**

The four types of changes described above were applied to the 2008 estimated costs to calculate current 2013-14 costs. These changes included applying the indexation to all non-MBS related costs; updating nephrologists and allied health costs based on current MBS schedules; and removing costs which were not deemed applicable for the 2013-14 estimates. The resulting estimates for 2013-14 costs are shown in Table 16.

### **6.1.3 Type of Costs Included (and Excluded)**

As mentioned above, there were six different categories of costs identified in the NSW study. These categories were:

1. Dialysis service costs – including capital costs (dialysis machines, reverse osmosis machines, etc.), staffing costs, costs of goods (e.g. consumables) and overheads
2. Health professional costs – including specialists (e.g. nephrologists) and other health professionals (such as general practitioners and allied health professionals)
3. Pharmaceuticals (prescribed and other)
4. Diagnostic tests (pathology and other)
5. Patient out-of-pocket costs (set-up for dialysis, travel & parking, health professionals, pharmacy & diagnostic test costs). Note that these costs were estimated, but not included in the summary of 2007-08 costs shown in Table 13 and Table 14.
6. Costs associated with hospital admissions (excluding admission for routine dialysis). From this category, costs associated with comorbidity and complications are in scope; pre-dialysis and prep for kidney transplant costs are partially in scope. All other hospital admissions costs are out of scope. Note that these costs were estimated, but not included in the summary of 2007-08 costs shown in Table 13 and Table 14.

The scope of the study included the following renal services: access surgery; patient training; dialysis procedures; certain aspects of ongoing management of kidney disease (e.g. pharmaceuticals, blood and other diagnostic tests; the majority of specialist and other health professional visits, etc.); and consultations with other specialists arising from comorbidities (but not those resulting in admissions to hospital).

Services that were specifically out-of-scope included: acute renal failure; chronic kidney disease not requiring renal replacement therapy; pre-dialysis services other than patient training; kidney transplant and ongoing medical management of transplant patients. In addition, two services were out-of-scope but some estimates were made – complications of kidney disease resulting in admissions to hospital; and consultations with specialists in preparation for kidney transplants.

The study did not distinguish between various types of PD that patients can undergo, or between nocturnal home HD and home HD in general. This is primarily because the majority of the data was not available at this granular level. Secondly, the authors of the study concluded, through their preliminary research, that the difference between costs for these difference types of dialysis would be negligible.

**Table 16: Estimated distribution of expenditures across home-based dialysis modalities 2013-14**

	Cost estimation method	Home HD	Home HD training	Home PD	Home PD training	Total
<b>Employee Related</b>						
Nursing	Indexation	1,231,398	1,220,386	2,075,371	1,098,998	5,626,153
Administrative	Indexation	113,862	130,786	73,697	47,720	366,065
Technical	Indexation	580,742	-	-	-	580,742
Hospital/Domestic/Other	Indexation	-	220,062	-	(15,300)	204,762
Superannuation	Indexation	149,291	155,660	201,888	107,366	614,205
Workers Compensation	Indexation	29,858	31,132	40,377	21,473	122,841
<i>Subtotal</i>		<i>2,105,152</i>	<i>1,758,026</i>	<i>2,391,333</i>	<i>1,260,257</i>	<i>7,514,767</i>
<b>Goods &amp; Services</b>						
S100 Drugs	Indexation	6,097,266	-	10,435,631	-	16,532,897
Other Prescribed Drugs	Indexation	3,640,897	-	3,601,083	-	7,241,980
Other Drug Supplies	Indexation	326,986	-	257,101	-	584,088
PPT Payments	Indexation	1,740,838	-	-	-	1,740,838
Dialysis Fluids/Consumables	Indexation	4,634,057	-	14,770,212	-	19,404,269
Other Medical & Surgical Supplies	Indexation	533,667	-	474,539	-	1,008,206
Pathology	Indexation	755,728	-	1,138,267	-	1,893,995
Other Special Services	Indexation	130,965	-	164,189	-	295,154
Food	Indexation	-	23,677	-	82,172	105,849
Domestic Services	Indexation	173,705	-	245,451	-	419,156
Goods & Services Other	Indexation	559,461	-	285,351	-	844,811
<i>Subtotal</i>		<i>18,593,570</i>	<i>23,677</i>	<i>31,371,824</i>	<i>82,172</i>	<i>50,071,244</i>
<b>Repairs Maintenance &amp; Replacement</b>	Indexation	369,169	-	280,406	-	649,574
<b>Depreciation</b>						
Depreciation Dialysis Equipment	Excluded	-	-	-	-	-
Other P&E Depreciation	Excluded	-	-	-	-	-
Building Depreciation	Excluded	-	-	-	-	-
<i>Subtotal</i>		<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
<b>Other Estimates</b>						
Nephrologist Consultations	Current MBS costs	213,914	-	335,715	-	549,629
Other Medical Input	Indexation	95,510	-	176,829	-	272,339
Other Specialist Consultations	Indexation with adjustment	254,297	-	359,682	-	613,978
General Practitioner Consultations	Excluded	-	-	-	-	-
Social Worker Consultations	Current MBS costs	44,107	-	69,222	-	113,329
Dietician Consultations	Current MBS costs	46,702	-	73,293	-	119,995
Other Overheads	Indexation	1,148,733	193,382	2,057,484	138,628	3,538,227
Access Surgery	Excluded	-	-	-	-	-
<i>Subtotal</i>		<i>1,803,264</i>	<i>193,382</i>	<i>3,072,224</i>	<i>138,628</i>	<i>5,207,499</i>
<b>Total</b>		<b>22,871,154</b>	<b>1,975,085</b>	<b>37,115,787</b>	<b>1,481,058</b>	<b>63,443,084</b>
<i>Number of patients</i>		<i>490</i>	<i>163</i>	<i>769</i>	<i>256</i>	
<b>Average cost per patient per year</b>		<b>46,676</b>	<b>12,092</b>	<b>48,265</b>	<b>5,778</b>	

## 6.1.4 Methodology

The costs estimates were determined in three steps:

1. Collection of costs
2. Collection of activity data
3. Adjustment and allocation of costs

### Collection of costs

Due to the large variety of costs being reported in the study, various data collection methods were used. Table 17 shows the information collected by the source of each cost item, and explains the data collection methodology and cost data collected.

**Table 17: Source of costs & collection methodology in NSW study**

Source of cost	Collection methodology	Cost data obtained
Survey of renal services	Each site participating in the study was asked to complete a survey regarding the characteristics and costs of renal services. Input was typically provided by the Head of Department and relevant staff such as nursing unit managers (NUMs). Follow-up interviews were also conducted to expand and clarify information contained within the survey.	Health service expenditure items relating to renal services. This included questions around price per treatment contracts (PPTs) and provision of the expenditure reports for the relevant financial years.
Patient survey	Dialysis patients were surveyed to adequately capture information about their dialysis experiences, out-of-pocket expenses related to undergoing dialysis, patient characteristics etc.	Patient out-of-pocket expenses such as transport and costs of setting up for home dialysis. The survey also included questions about patient characteristics to allow adjustment for any cost differences as a result of these factors (e.g. place of residence, employment status, frequency of visits to health care professionals).
Blood tests and other diagnostics	Available publicly with advice from pathologists	MBS fees for the relevant diagnostic tests
Pharmacy	Available publicly with advice from medical specialists and pharmacists	PBS fees for pharmaceuticals used
Overhead costs	Overhead costs were estimated using National Hospital Cost Data Collection (NHCDC) reporting provided by NSW Public Hospitals.	Overhead costs

### Collection of activity data

Activity figures were required to correctly divide and allocate costs to dialysis modalities, such as the number of episodes of care per patient (in the period), the number of pathology tests, number of health professional visits, etc. Table 18 sets out the activity measures collected, the data collection methodology and the specific activity data obtained from each source.

**Table 18: Source of activity & collection methodology in NSW study**

<b>Source of activity</b>	<b>Collection methodology</b>	<b>Activity data obtained</b>
NSW Admitted Patient Data Collection (“hospital morbidity data”) ANZData Registry	Obtained extracts of data from the NSW Admitted Patient Data Collection (“hospital morbidity data”) for 2006-07 and 2007-08 Obtained extracts of data for the period 31 December 2005 to 31 December 2007 from Australia and New Zealand Dialysis and Transplant Registry (ANZDATA)	Record of all patients attending a unit for routine dialysis or training as an admitted hospital episode A range of statistics which relate to the outcomes of treatment of those with end stage renal failure, such as the incidence, prevalence and outcome of dialysis and transplant treatment for patients with end stage renal failure.
Survey of services	Each site participating in the study was asked to complete a survey regarding the characteristics and costs of renal services. Input was typically provided by the Head of Department and relevant staff such as nursing unit managers (NUMs). Follow-up interviews were also conducted to expand and clarify information contained within the survey.	<ul style="list-style-type: none"> <li>• service (e.g. number of machines, number of chairs)</li> <li>• patients using the service (e.g. numbers by modality)</li> <li>• staffing</li> <li>• PPTs</li> <li>• Details of each of the modalities (e.g. arrangements for training, number of home visits provided to home HD and PD patients)</li> </ul>
Patient survey	Dialysis patients were surveyed to adequately capture information about their dialysis experiences, out-of-pocket expenses related to undergoing dialysis, patient characteristics etc.	<ul style="list-style-type: none"> <li>• Frequency of visits to health care professionals (nephrologists, other specialists, allied health professionals, GPs, etc.)</li> <li>• Method and frequency of dialysis</li> </ul>
Blood tests and other diagnostics	Protocols for blood tests and other diagnostics were sought from medical staff and NUMs.	Estimated number and frequency of blood and other diagnostic tests for the dialysis modalities
Pharmacy	Typical drug regimens were sought from medical specialists and pharmacists.	Typical drug regimens for the dialysis modalities

### **Adjustment and allocation of costs**

There were various methods used to allocate the costs to the different dialysis modalities, which are discussed below. The main source of costs for the analysis was the expenditure report for the various dialysis units (obtained through the survey of services described above). The following steps were undertaken to allocate costs to each dialysis modality:

#### **A. Map expenditure to a common set of accounts**

Expenses were mapped to a common set of accounts so that expenses from various services could be amalgamated based on the nature of the expense (for later allocation). For direct dialysis costs, the major categories of expense were: employee-

related expenses (predominantly nursing costs); dialysis-specific expenses (such as consumables); drug supplies; other medical and surgical supplies.

## **B. Separate costs related to a particular modality or expense category**

In some cases, the expenditure reports did not clearly separate out expenditures into relevant modalities and adjustments were required. The report noted that for some units expenditure was allocated inconsistently between modalities or expenditure line items throughout the period – e.g. costs relating to consumables may be allocated to one line item for a few months and then allocated to another line item, due to changes in staff or accounting practice or errors - and this may be a limitation of the data.

Using supplementary information obtained through the survey of services and detailed discussions with relevant staff, the dialysis-specific expenses were allocated to the following categories:

1. Dialysis related PPT payment
2. Dialysis fluids/consumables – HD
3. Dialysis fluids/consumables – PD
4. Dialysis fluids/consumables – undifferentiated
5. Dialysis other

Where employee expenses were not split into different expenditure categories, the information provided in the survey of services was used to split out these costs. For example, a portion of the Nurse Unit Managers, Clinical Nurse Educators and Clinic Nurse Consultant's salaries were allocated to the relevant cost centre based on the proportion of time spent supervising and providing support services to the units.

It was noted that superannuation and workers compensation expenses were typically not included in the dialysis cost centre, so these costs were estimated in step D below.

## **C. Reallocate expenses to units where these were incurred centrally**

Certain costs were incurred centrally on behalf of the dialysis unit, and needed to be reallocated, as described below:

- Technical support costs for machines

As the costs for technical support for the machines were centralised, the actual costs were obtained and allocated across units based on the location of machines and/or patient numbers.

- Dialysis fluids, consumables, PPT payments and PD supplies

Where these costs were recognised centrally and not in the relevant dialysis unit's expenditure report, additional information was used to allocate the costs to units where patients received their nursing support.

## **D. Estimates for missing costs**

Estimates for missing costs were made where certain amounts were not provided by the units. In cases where there were significant discrepancies of the reported costs between units, these unexpected costs were excluded from the analysis and re-estimated as described below. These are shown in Table 19.



**Table 19: Estimates for missing costs made in NSW study**

<b>Cost item</b>	<b>Rationale for removal &amp; re-estimation</b>	<b>Estimation methodology</b>	<b>Further adjustment required by PwC?</b>
Food costs	Units were not always charged for food costs provided to patients.	An estimate was obtained from Health Support Services and multiplied by the number of treatments or services provided.	No. Food costs included in the home-dialysis modalities relate to food provided during training sessions and should be included.
Depreciation of home HD machines, RO units and unit owned machines.	Expense item incorrect	Depreciation per year was calculated based on the number of machines identified by the service (including machines used for training), current pricing and a 10 year useful life instead of using the reported in the expenditure report.	No. Machines used at the patient's home and for training are appropriate to include.
Superannuation and workers compensation	Item not included in the expenditure reports	Superannuation and workers compensation were estimated at a rate of 9% and 1.8% respectively, based on the employee expenses.	No. This is relevant where services were provided for home dialysis patients.
Medical staff and VMO costs	Inconsistent costing applied	Estimated based on regular treatment plans (based on the patient surveys) and the weighted average of MBS item fees, adjusted to reflect the average charge in excess of the benefit level, i.e. the 'real' cost of the service, including patient out-of-pocket costs .	Yes. This is relevant where services were provided for home dialysis patients (such as the portion of VMO / medical staff costs which relate to home-based patient training hours at a hospital unit). However the patient out-of-pocket portion has been removed.
Other medical costs	Inconsistent costing applied	Management of dialysis services was estimated at 2 hours per week of renal director salary, which was split across all patients and all modalities.	No. This is relevant as a share of management of dialysis services was allocated to home dialysis patients.
GP and other specialists	External to dialysis unit and not included in expenditure report.	Estimated based on regular treatment plans (based on the patient surveys) using a similar methodology to the 'Medical staff and VMO costs' above.	Yes. Primary care costs were not included in HDD estimates as they are either funded separately or are a patient out-of-pocket expense, therefore can be excluded from this analysis.

<b>Cost item</b>	<b>Rationale for removal &amp; re-estimation</b>	<b>Estimation methodology</b>	<b>Further adjustment required by PwC?</b>
Allied health consultations	May or may not be charged directly to the dialysis unit.	Estimated based on regular treatment plans (based on the patient surveys) and costs obtained from the NHCD for 2006-07.	No. This is relevant where the services were provided to home dialysis patients.
Drug costs	Drug costs (especially section 100 drugs) may or may not be charged directly to the dialysis unit.	A sub-study conducted in consultation with a renal pharmacist was conducted to estimate an average pharmaceutical cost per patient per annum for each modality. The costs were applied to patient numbers to estimate total drug costs.	It is unclear what (if any) portion of these costs are patient out-of-pocket expenses. No adjustments have been made to these costs other than indexation, however note that these might be overstated from the perspective of health system expenditure.
Pathology costs	May or may not be charged directly to the dialysis unit.	A separate analysis of pathology protocol was undertaken and costs per patient per annum were estimated for each modality.	No. This is relevant where the services were provided to home dialysis patients.
Access surgery	Access surgery is an admitted episode and the costs are not included in the dialysis cost centre expenditure report.	Costs of admitted hospital episodes (from hospital morbidity data) where access surgery was performed were estimated and included. Where the episode was not primarily for the purposes of access surgery, but such surgery was also performed, costs were split appropriately.	Yes. Access surgery is an admitted hospital episode and is funded separately so these costs have been excluded from this analysis.
Rates and electricity	Expense item incorrect	Any reported costs for rates & electricity were removed and replaced with an estimated overhead expense (see below).	No
Overhead costs	The majority of overhead costs are not reported in the dialysis cost centre.	Overhead costs were estimated at 11% of employee related costs and good & services, based on an analysis of NHCD data for 2006-07.	No
Transport costs incurred by health services	Not all patient transport expenses are reported in the dialysis cost centre.	No sufficiently robust estimation method could be determined and therefore, if these costs reported directly in the dialysis cost centre they were not estimated or included.	No. Patient transport costs were not included in the analysis.

<b>Cost item</b>	<b>Rationale for removal &amp; re-estimation</b>	<b>Estimation methodology</b>	<b>Further adjustment required by PwC?</b>
Diagnostic imaging services	May or may not be charged directly to the dialysis unit.	Diagnostic imaging unit expenses were removed from the study as a reliable estimate of the data was not available.	N/A
Interpreter services	May or may not be charged directly to the dialysis unit.	No estimates were made of costs of interpreter services due to unavailability of data.	N/A

#### **E. Allocate staffing costs across dialysis modalities based on survey returns**

Staffing costs (predominantly nursing costs) were allocated to each modality based on the survey of services. The fractions were determined on a per unit basis and applied to all reported staff expenditure. The average across all reported units has been included in Table 20 for reference.

**Table 20: Nursing distribution fractions used in NSW study**

<b>Modality</b>	<b>Nursing distribution fraction</b>
Centre	25%
Satellite	61%
Home Training	3%
Home Support	3%
PD training	2%
PD support	3%
Admitted Patients	2%
Support provided to other services	0%
Other Duties	0%
Total	100%

#### **F. Allocate costs using appropriate statistic**

A range of allocation statistics were used to allocated the expenses to each modality. The main statistics were duration (e.g. of training) and number of treatments.

### **6.1.5 Costing Assumptions and Limitations**

Throughout the report, the authors note various assumptions made during the analysis and any limitations on the scope of the project. These assumptions and limitations are described here in order to clarify the details of the analysis.

#### **Limitations in this analysis**

Other than limitations or assumptions made in the costing study itself, the main limitation for this analysis was that the detail behind the costing model was not provided in the report and could not be provided by NSW Health. This limited the extent to which costs could accurately be brought forward to 2013-14 values. For example, no specific costs required adjusting due to changes in the model of care were able to be identified; the pharmaceutical

costs could not be updated against current cost PBS schedules; and no capex costs could be identified and removed from the analysis<sup>29</sup>.

### **Limitations in the NSW study**

1. Due to scope of the project, the patient surveys were only issued in English. The authors recognised that this limited responses to English-speaking patients only, which may or may not be representative of the population of dialysis patients.
2. Reporting of home dialysis patients was inconsistent between the ANZData and the survey of services. It was concluded that different service units might be double-counting the same patients, as patients can be provided services by multiple units. Sensitivity analysis was performed to estimate the impact of this on the costs.
3. Diagnostic imaging services and interpreter services were not included in the costing study due to unavailability of data.
4. Activity measures on the number of treatments provided for home-based dialysis may not have been complete, as most units did not keep statistics on these figures (unless they are covered by a PPT contract).
5. Activity measures on the number of treatments also include patients who temporarily change modalities (e.g. a home-based dialysis patient may be temporarily admitted to hospital and dialysed there for a short period), which may have resulted in double-counting of some patients.

### **Adjustments to data**

Some adjustments were required to data where it was identified that the data may have been inaccurate or incomplete. These are described below:

- In ANZData, the 'centre' reported for home dialysis patients is usually the hospital at which the patient receives nephrology support. However, the nursing support is usually provided through a satellite unit. A range of adjustments were made to ensure home dialysis patients were allocated to the centres at which costs were observed.
- The expenditure reports did not always capture all relevant costs. Using supplementary information obtained through the survey of services and detailed discussions with relevant staff, these costs were estimated as explained above in step D -Estimates for missing costs.

## ***6.1.6 NSW Model of Care***

Information from the 2008 report was extracted to describe the model of care that was used for home-based dialysis at the time of the costing study. The intention is to provide a brief overview of the model of care at the time of the study, to determine if there were any significant changes to the practices which should be incorporated in the 2013-14 cost estimates.

The 2008 report noted that the model of care for home based dialysis varied widely across the state at the time of the study. The main factors underlying this variability were identified as:

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<sup>29</sup> Capital expenditure ('capex') costs are excluded from NEP calculations and so should be excluded from this analysis.

- Variability in:
  - clinical practice and recommended pathways for dialysis patients;
  - service delivery, particularly differences in the arrangements covered under different under price per treatment contracts which were negotiated separately by each Area Health Service;
  - frequency of maintenance of machines (typically not provided under PPT contracts). Some technicians provide more regular services with fewer breakdowns, while others provided less maintenance but had a higher call-out rate for breakdowns;
  - transport availability and reimbursement; and
  - staffing levels and types of services.
- Challenges for rural patients in accessing the same services as urban patients.
- Congestion of satellite services, leading to inappropriate referral of patients to home-based modalities (who may then require different levels of service).

It was also noted that patients using PD modalities will typically require more support (training, visiting nurses and regular nephrologist appointments), however in general the details provided on the model of care did not specify the extent of these differences.

Table 21 shows the model of care in the 2007-08 NSW study. In regards to the current model of care, limited information was available to this analysis for two reasons. Firstly, the majority of detailed information about models of care is available through clinicians rather than financial staff at a hospital, and consultations with clinicians was outside the scope of the current report. Secondly, the model of care for dialysis varies between jurisdictions, LHNs, and clinicians. This was verified through our analysis of the 2008 study and through the high level discussions with finance staff in each jurisdiction.

Based on the above, there have been no significant changes to the model of care from 2008 to the present day<sup>30</sup>. Based on this, no adjustments have been made to the 2007-08 costs which relate to changes in the model of care.

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<sup>30</sup> A summarised form of the model of care was reported in the Literature Review section, which was obtained from the report “A Model for Home Dialysis – Australia” by Kidney Health Australia, and made references to typical practices throughout this report. However, this information cannot be relied on to determine the current NSW model of care for several reasons:

- The latest statistics provided in that report are from 2009, only one year after the NSW costing study and five years prior to this current report;
- The report describes an optimal model of care, not an existing model of care;
- The information is not specific to NSW; and
- The information is a high-level representation of the model of care under each modality, and does not provide specific information about actual patient experiences.

Use of this model to estimate changes in the model of care for NSW would result in assumptions that are no more accurate than the current assumption – that no changes in the model of care have occurred since the 2007-08 costing study.

**Table 21: NSW Model of Care - comparison of 2007-08 to current**

<b>Aspect of Care</b>	<b>NSW Model of Care 2007-08</b>
Pre-dialysis education & training	Training was provided by Sydney Dialysis Centre; Statewide Renal Service Satellite Unit; Wansey Centre (Newcastle) and some other sites. Based on the report, patient training averaged approximately 9 weeks across NSW. No data on the number of training hours or structure of training (e.g. one-on-one, group setting, etc.) was provided in the report.
Access procedures	Analysis of hospital morbidity data suggested that on average, HD patients had 0.67 access procedures per annum, and PD patients had 0.79 per annum. It was noted that this may include some double-counting as some HD patients are patients for whom PD failed.
Dialysis machinery	Home dialysis machines were purchased on a statewide basis by Sydney Dialysis Centre. The average cost for the dialysis machines and RO units was \$20,784 with a useful life of 10 years. It is assumed that home dialysis requires one dialysis machine and one RO unit per patient.
Infrastructure for home and ongoing home costs	Typical home set-up requirements include a recliner, digital scales, storage equipment, and home modifications such as replacing carpet with vinyl and installing plumbing for the dialysis machine. Up-front costs were estimated at \$1,500 per patient. Ongoing costs include increased water and electricity costs. No data was provided on the specifics of these costs, although these are predominantly patient-paid so are out-of-scope for this analysis.
Specialist visits (e.g. nephrologist)	Regular outpatient appointments, usually at a centre close to the home of the patient. Patients reported an average of 6.8 nephrologists per year.
Nursing support	Provided by regular home visits from Sydney Dialysis Centre; Statewide Renal Service Satellite Unit; Wansey Centre (Newcastle) and some other sites. Nursing staff typically provide the nephrologist with a written report following a home visit. No data on the number of visits per patient per annum was provided in the report.
GP visits	Based on the patient survey, GP visits averaged at 9.7 per annum (10.2 for metropolitan areas and 8.3 for rural regions). The patient survey specified that only visits relating to dialysis or kidney disease should be reported.
Other specialists (e.g. for comorbidities)	Based on the patient survey, other specialist visits averaged at 4.2 per annum (4.3 for metropolitan areas and 4.0 for rural regions). The patient survey specified that only visits relating to dialysis or kidney disease should be reported.
Allied health visits	Based on the patient survey, allied health visits averaged at 1.8 for dietician visits and 1.7 for social worker visits per annum. The patient survey specified that only visits relating to dialysis or kidney disease should be reported.
Pharmaceutical protocols	A sub-study was performed to investigate the typical pharmaceutical protocols. The report provided no data on the protocols themselves, only on the estimated cost of a typical protocol (a function of the protocol and PBS data).

Aspect of Care	NSW Model of Care 2007-08
Pathology regimes	The range and frequency of tests was noted to vary between services, and was modelled at a service level rather than state level in the study. Data on the specific pathology regimes can be found in Table 29 of the study.
Delivery of consumables & pharmaceuticals	These may be covered under PPT contracts. No data was provided in the report about the frequency of delivery or the method of receiving consumables for patients where delivery was not covered by a PPT contract.
Transport costs	The major sources of transport costs for home-based dialysis patients are to and from specialist visits or training centres. The frequency of these in the 2007-08 model of care is described above. The report concluded that approximately 15-20% of dialysis patients are using some form of transport which is subsidised by the Area Health Service (e.g. under the isolated patient transport scheme IPTAAS). However patient transport costs are excluded from this analysis.
Technical maintenance	Ongoing maintenance of dialysis machinery is provided by technicians based at Sydney Dialysis Centre and Statewide Renal Service. No data on number of maintenance hours per patient per annum was provided in the report – this was noted to be widely variable.

## **6.2 QLD Study**

Between April 2008 and May 2009 KPMG was contracted by the Queensland Department of Health to undertake a costing review of Renal Replacement Therapies (RRT) on 2007-08 financial year activity data.

The primary purpose of the study was to identify the component costs of dialysis services, by modality, and to identify the cost implications associated with home-based therapies for both patients and Queensland Health. The report also aimed to improve reporting accuracy on dialysis costs and to inform negotiations for public-private partnership arrangements, as well as to examine the appropriateness of casemix activity costs for casemix funding.

The study was performed using both a top down full cost analysis and a limited scope direct cost analysis using patient activity information. The study also identified and separated the costs funded via sources other than Queensland Health, such as patient paid utility costs and S100 funded drug costs.

Sites included in the study were:

- Princess Alexandra Hospital (PAH)
- Royal Brisbane and Women's Hospital (RBWH)
- Townsville (TTH)
- Logan Hospital
- Gympie Hospital

### **6.2.1 Summary of estimated costs from the 2008 costing study**

Cost events included in the study included RRT assessment, surgery work up, patient education and services specific to each modality. The following RRT Modalities were covered under this study:

- In-centre dialysis (both permacath and fistula);
- Satellite dialysis (both permacath and fistula);
- Continuous ambulatory peritoneal dialysis (CAPD);
- Automated peritoneal dialysis (APD);
- Home haemodialysis (HHD); and
- Nocturnal home haemodialysis (NHHD).

The renal services were categorized into:

- Patient assessment, modality assignment and surgical referral;
- Surgery work up;
- Costs specific to each modality;
- Education and support; and
- Outpatient review.

The surgical work up cost includes the clinical involvement in setting the patient up, however it does not include the ward and theatre costs involved in creating the temporary access, vascular fistula creation or peritoneal access. These costs would be included within the admitted surgical episode.



Table 22 and Table 23 below were extracted from the 2008 study and reflect the estimated expenditure per person per year by dialysis modality for 2007-08, for both the cost-modelled approach and the patient level method of costing. These costs include the following components:

- Employee-related costs (such as nursing, administration, technical, etc.);
- Goods and services (such as pathology, pharmacy, dialysis equipment & consumables, etc.);
- Depreciation and repairs, maintenance and replacement costs (for the cost-modelled approach only); and
- Health professional costs (such as nephrologist visits, allied health support, etc.)

Certain costs were estimated and included in the report, but were reported separately and are not included in the tables, such as patient-paid utility costs and \$100 drug costs (which are funded separately).

The cost modelled approach takes a macro perspective and works down from service level to individual patient costing estimates, producing fully absorbed costs as relevant elements of overhead and facility costs are also allocated against service delivery activities. In contrast, the patient-level approach takes a patient perspective and considers all activities directly related to the care of an individual patient receiving RRT and associated services. It is built up from the detailed cost and activity information contained within the process maps produced for each modality at the selected project sites; however it is not 'true' patient costing as it does not track the actual consumption of products against the patient episodes within an operational patient costing system. Furthermore, it does not include elements of overheads and facility costs as these are not tracked on a per-patient basis. This key difference is clear from the results in the tables below, as the patient-level costs are significantly lower than the cost-modelled results. These two approaches are discussed in more detail in section 6.2.4.

**Table 22: Cost-modelled total expenditure per person per year, by dialysis modality and site, 2007-08<sup>31</sup>**

<b>Modality</b>	<b>Gympie</b>	<b>Logan</b>	<b>PAH</b>	<b>RBWH</b>	<b>TTH</b>
In-centre dialysis			51,912	88,627	58,232
Satellite dialysis	48,224	53,443			37,009
Continuous ambulatory peritoneal dialysis (CAPD)			29,364	36,224	29,406
Automated peritoneal dialysis (APD)			38,776	45,664	49,036
Home haemodialysis (HHD)			56,041	32,969	50,553
Nocturnal home haemodialysis (NHHD)			62,495	53,463	74,866

<sup>31</sup> A copy of the table summary on page 5 of the RRT report. More detail is provided in section 3.2

**Table 23: Patient-level expenditure per person per year, by dialysis modality and site, excluding set up and training costs, 2007-08<sup>32</sup>**

<b>Modality</b>	<b>Gympie</b>	<b>Logan</b>	<b>PAH</b>	<b>RBWH</b>	<b>TTH</b>
In-centre dialysis - permacath			31,254	36,263	29,634
In-centre dialysis - fistula			31,683	37,337	27,347
Satellite dialysis - permacath	30,490	19,985			21,613
Satellite dialysis - fistula	33,821	32,656			24,485
Continuous ambulatory peritoneal dialysis (CAPD)			16,287	24,066	18,761
Automated peritoneal dialysis (APD)			25,700	33,569	38,391
Home haemodialysis (HHD)			23,943	21,674	27,483
Nocturnal home haemodialysis (NHHD)			31,108	42,118	51,796

Similarly to the results of the NSW study, in-centre dialysis is the most expensive for QLD sites. The results across the different sites vary considerably, however for sites that perform both in-centre and home-based dialysis, home haemodialysis appears to be cheaper than either in-centre or nocturnal home haemodialysis.

In the Qld study, the cost-modelled approach was only provided at a summary level. Since the current analysis requires access to the detailed cost categories, the patient-level costs have been used throughout the remainder of this analysis.

The ‘extraction tables’ of the patient costing model can be used to understand the costs of providing dialysis in more detail, as these tables display the costs broken down into several categories under the headings of:

- Set up activities: including referral, assessment, surgical access and patient training
- Ongoing treatment

This breakdown of costs is shown in Table 24. The costs shown against the heading of ‘Total-treatment’ reconcile to the summary shown in Table 23 for the sites with home-based dialysis.

### **6.2.2 Estimating current 2014 costs for home dialysis services**

The patient-level estimated costs from the 2008 QLD costing study have been used in the remainder of the analysis, as the detailed breakdown of the cost-modelled approach was not provided in the report. These patient-level costs were used to estimate current (2013-14) costs through the following process:

1. Indexing the costs using IHPA’s indexation methodology applied in the NEP model;
2. Updating costs where more accurate current cost data is readily available;
3. Adjusting the cost profile for any significant changes to the models of care; and
4. Removing costs that are not applicable to the current study.

<sup>32</sup> A copy of the table summary on page 4 of the RRT report. More detail is provided in section 3.2

**Table 24: Estimated distribution of patient-level expenditures across home-based dialysis modalities 2007-08<sup>33,34</sup>**

	PAH	RBWH	TH	Average
<b>Peritoneal Dialysis - CAPD:</b>				
Referral & Initial Assessment	213	376	311	300
Surgery work-up	984	816	227	675
Surgery complications & Revision	220	-	-	73
Education/Training	115	1,709	-	608
PD Training	4,026	-	5,035	3,021
<i>Total Set Up</i>	<i>5,558</i>	<i>2,900</i>	<i>5,573</i>	<i>4,677</i>
Ongoing treatment	1,032	3,441	2,817	2,430
Drug Costs	12,530	3,126	1,632	5,763
Clinical Supplies - deliveries	2,725	17,498	14,313	11,512
<i>Total - Treatment</i>	<i>16,287</i>	<i>24,066</i>	<i>18,761</i>	<i>19,705</i>
<b>Grand total</b>	<b>16,904</b>	<b>24,388</b>	<b>19,381</b>	<b>24,382</b>
<b>Peritoneal Dialysis - APD:</b>				
Education/Training	-	253	-	84
PD Training	306	-	-	102
<i>Total Set Up</i>	<i>306</i>	<i>253</i>	<i>-</i>	<i>186</i>
Ongoing treatment	1,033	3,504	2,817	2,451
Drug Costs	12,530	3,126	1,632	5,763
Clinical Supplies - deliveries	12,137	26,938	33,943	24,339
<i>Total - Treatment</i>	<i>25,700</i>	<i>33,569</i>	<i>38,391</i>	<i>32,553</i>
<b>Grand total</b>	<b>25,802</b>	<b>33,653</b>	<b>38,391</b>	<b>32,740</b>
<b>Home Haemodialysis</b>				
Referral & Initial Assessment	213	252	317	261
Surgery work-up	731	437	562	577
Surgery complications & Revision	132	425	-	186
Education/Training	115	4,612	-	1,576
HHD Training	9,784	-	8,124	5,969
Establishment phase	-	305	-	102
<i>Total Set Up</i>	<i>10,976</i>	<i>6,032</i>	<i>9,003</i>	<i>8,670</i>
Ongoing treatment	6,964	8,128	2,427	5,840
Drug Costs	5,827	3,131	1,632	3,530
Clinical Supplies - deliveries	11,152	10,415	23,424	14,997
<i>Total - Treatment</i>	<i>23,943</i>	<i>21,674</i>	<i>27,483</i>	<i>24,367</i>
<b>Grand total</b>	<b>27,601</b>	<b>23,684</b>	<b>30,484</b>	<b>33,037</b>
<b>Home Haemodialysis - Nocturnal:</b>				
Education/Training	-	538	317	285
Surgery work-up	-	-	562	187
HHD Training	68	-	8,124	2,731
<i>Total Set Up</i>	<i>68</i>	<i>538</i>	<i>9,003</i>	<i>3,203</i>
Ongoing treatment	6,982	8,053	2,427	5,821
Drug Costs	7,398	3,126	1,632	4,052
Clinical Supplies - deliveries	16,728	30,938	47,737	31,801
<i>Total - Treatment</i>	<i>31,108</i>	<i>42,118</i>	<i>51,796</i>	<i>41,674</i>
<b>Grand total</b>	<b>31,130</b>	<b>42,298</b>	<b>54,797</b>	<b>44,877</b>

<sup>33</sup> Summarised from the Patient-level costing Extract tables in the RRT study.

<sup>34</sup> Some of the costs displayed here may differ from those in the original report. During the current analysis, some calculation errors were discovered in the original study, and as far as possible, have been corrected here before proceeding.

## 1. Indexation of costs

The same indexation factors to the 2008 QLD costs have been applied, consistent with the approach used in calculating the annual National Efficient Price. The average annual growth rates used are shown in Table 15.

## 2. Updating costs

As in the NSW approach, some cost categories were intended to be estimated using a specific up-to-date cost schedule rather than applying an indexation model. However the level of detail supplied in the QLD report was insufficient to update costs in this manner so no updating was performed.

## 3. Adjusting the cost profile to match the current model of care

Similarly to the NSW study, and as discussed in detail in a later section, the current model of care varies significantly and there was insufficient detail provided in either the 2007-08 or the current model of care to determine if any specific changes in the model have occurred. Based on this, no adjustments to the 2007-08 costs which relate to changes in the model of care have been made.

## 4. Adding excluded costs and removing any non-applicable costs

It can be assumed that the cost-modelled approach contains the allocated overhead costs for the hospital, such as payroll, engineering and other costs, as well as depreciation. However the patient-level costing approach method excludes many of these overhead costs. Since the analysis is based on the patient-level costs, the overhead percentage was estimated and applied to the patient-level costs to obtain a true cost. In doing this, depreciation was excluded from the estimate of overhead costs in order to be comparable to NEP, as NEP calculations do not take depreciation into account.

Overheads were initially estimated by comparing the cost-modelled costs to the patient-level costs. It is assumed any difference relates to overhead costs. Since the cost-modelled approach could not be split up into training / set up and ongoing treatment cost components, these costs were combined in the patient-level model. An amortisation rate of 33% per annum was estimated for set-up and training costs, based on the estimate of an average 3 year term of dialysis<sup>35</sup>.

As a reasonableness test and to split the overhead percentage between training costs, ongoing costs, and depreciation (which must be excluded) the estimated overhead percentage was benchmarked against an estimate of overhead percentage from the NSW study results discussed above.

Table 25 shows the estimated overhead percentages obtained by comparing the cost-modelled approach to the patient-level costing – the average overhead percentage for HD modalities is 59.7% and for PD modalities is 46.5%. This is significantly higher than the NSW study, which has a total overhead percentage of 29.8% for the training portion of home-based modalities, and 10.0% for all other (ongoing) costs, shown in Table 26.

Since the details behind the Qld cost-modelled approach were not available, it is difficult to be sure that all differences between it and the patient-level approach relate to overheads. Secondly, the overhead percentages cannot be split between training and ongoing costs. Further, the depreciation costs cannot be split out from other overheads (depreciation should be removed in order to be comparable to NEP calculations).

However, it does appear that the Qld sites had significantly higher overhead percentages than the NSW sites.

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<sup>35</sup> "Once on the kidney transplant waiting list, the average waiting time for a transplanted kidney from a deceased donor is around three to four years..." (ANZOD Registry 2011)

Therefore in this analysis that follows, the NSW overhead percentages have been used. These percentages were calculated to exclude depreciation and have been inflated by 50% when estimating overhead costs for Qld, to take into account the apparent higher overhead costs in the Qld jurisdictions. Table 27 shows the result of these adjustments on the Qld home-based modalities cost estimates.

It should be noted that the APD and NHHD modalities are often extensions to the CAPD and HHD modalities, rather than stand-alone modalities. That is, a patient is rarely assigned to APD without having first been on CAPD, and similarly for NHHD and HHD. This explains the discrepancy in set-up costs between CAPD and APD, and between HHD and NHHD – a large portion of the set up and training for APD and NHHD patients has already occurred during the patient's CAPD and HHD term. However since no patient numbers or figures on transfer rates were provided, it is impossible to estimate the impact of this effect.

### **Estimated 2013-14 costs**

The four types of changes described above were applied to the 2007-08 patient-level estimated costs to calculate current 2013-14 costs. These changes include applying the indexation to all costs; and adding or removing costs which were not deemed applicable for the 2013-14 estimates.

The resulting estimates for 2013-14 QLD costs are shown in Table 28.

## ***6.2.3 Type of Costs Included (and Excluded)***

As described above, the cost categories covered in the QLD study were:

- Patient assessment, modality assignment and surgical referral
- Surgery work up
- Costs specific to each modality
- Education and support
- Outpatient review

The surgical work up cost includes the clinical involvement in setting up the patient however it does not include the ward and theatre costs involved in creating the temporary access, vascular fistula creation or peritoneal access. These costs would be included within the admitted surgical episode. No costs for other patient interventions that occur simultaneously with RRT, nor future costs associated with the choice of modality, are included.

Although no specific details of the costs included or excluded in each of these categories was provided in the study, it is assumed that the other cost categories are essentially similar to those described in the NSW study. There is one exception, which is that the cost of \$100 drugs are excluded as these are not funded by Qld Health so were considered out-of-scope.

Additionally, a large portion of patient transport costs are funded under various schemes by Qld Health, however were not included in the scope of the RRT review.

Finally, the QLD patient-level costing method excludes many overhead and grouped costs such as hospital domestic costs; food costs; depreciation and repairs & maintenance costs of equipment.

**Table 25: Estimated overhead percentage by comparison of cost-modelled vs. patient-level results for home-based modalities**

	Patient Level Approach	Cost Model Approach	Overheads Percentage Estimate (%)
Continuous ambulatory peritoneal dialysis (CAPD)	20,224	31,665	56.6
Automated peritoneal dialysis (APD)	32,615	44,492	36.4
<b>Average (PD)</b>	<b>26,420</b>	<b>38,078</b>	<b>46.5</b>
Home haemodialysis (HHD)	27,257	46,521	70.7
Nocturnal home haemodialysis (NHHD)	42,742	63,608	48.8
<b>Average (HD)</b>	<b>34,999</b>	<b>55,065</b>	<b>59.7</b>

**Table 26: Estimated overhead percentages from NSW study, 2007-08 costs, to inform estimation of Qld overheads**

	Depreciation		Other Overheads		Total Overheads		Total Costs
	Aggregate cost (\$)	Percentage (%)	Aggregate cost (\$)	Percentage (%)	Aggregate cost (\$)	Percentage (%)	
Home HD - Ongoing	1,144,662	4.9	1,988,774	8.5	3,133,436	13.4	23,450,057
Home PD - Ongoing	164,599	0.4	2,521,263	6.3	2,685,862	6.7	40,144,175
<b>Average ongoing</b>		<b>2.6</b>		<b>7.4</b>		<b>10.0</b>	
Home HD - Training	199,398	11.1	459,040	25.6	658,438	36.7	1,795,860
Home PD - Training	90,488	7.0	204,678	15.9	295,166	22.9	1,287,627
<b>Average training</b>		<b>9.1</b>		<b>20.7</b>		<b>29.8</b>	

**Table 27: Adjusted 2007-08 expenditure for home-based modalities**

	Set up & training costs			Ongoing annual costs		
	Direct	Estimated Overheads	Total	Direct	Estimated Overheads	Total
Continuous ambulatory peritoneal dialysis (CAPD)	4,677	1,452	6,130	19,705	2,187	21,892
Automated peritoneal dialysis (APD)	186	58	244	32,553	3,613	36,167
Home haemodialysis (HHD)	8,670	2,692	11,362	24,367	2,705	27,071
Nocturnal home haemodialysis (NHHD)	3,203	995	4,198	41,674	4,626	46,300

**Table 28: Estimated expenditure across home-based dialysis modalities 2013-14**

	Set-up & training costs	Ongoing (annual) costs
Continuous ambulatory peritoneal dialysis (CAPD)	7,583	27,084
Automated peritoneal dialysis (APD)	302	44,744
Home haemodialysis (HHD)	14,057	33,492
Nocturnal home haemodialysis (NHHD)	5,193	57,280

## **6.2.4 Methodology**

Two methods were used to estimate the costs of the modalities within the study:

1. Cost centre – cost modelled (top down)
2. Patient level – patient costed (bottom up)

From discussions with Qld Health, it was identified that measurement at the patient level was not performed outside of the in-patient setting. This meant that any micro level costing needed to be done using specific data collection methods. Any top down approaches were also impacted by the lack of classification data and required allocation assumptions that cannot easily be tested.

### **Cost modelled approach**

The cost modelled approach is as follows:

- Takes a macro perspective and works down from service level to individual patient costing estimates;
- Produces fully absorbed costs as some elements of overhead and facility costs are also allocated against service delivery activities; and
- Uses cost centre resource information and models this through application of allocation statistics and other clearly specified assumptions to derive fully absorbed costs at a service rather than patient level.

A standard collection template was developed with one site (PAH) and this was then distributed to each site's contact. The information was gathered from the staff working in the business management roles and was provided at a cost centre/expenditure line level, broken down into the NHCDC cost buckets. Facility overhead allocation information was sourced centrally from Qld Health.

Very little information was provided on the source of data for the top down analysis and no detail was received on the actual calculations used for the analysis. As a result, this analysis was unable to:

- identify the component costs within the final figures provided below;
- test the appropriateness of the costs included; and
- determine an operational cost, exclusive of depreciation or other capital costs.

### **Patient costed approach (actually a patient level model)**

The patient-level cost approach is as follows:

- Takes a patient perspective and considers all activities directly related to the care of an individual patient receiving RRT and associated services;
- Is built up from the detailed information contained within the process maps produced for each modality at the selected project sites; and
- Exhibits a high degree of specificity in terms of the resources used (type and volume).

The patient level model was developed through observation based methods: workshops, interviews, survey and direct measurement. Patient paid costs were identified through the use of a patient survey.

Workshops were performed to review both process and resource item use for each modality. For each "step" (cost driver event) the location, person involved, items used and duration were collected. The frequency of occurrence was also collected (how often, and on what proportion of patients).



This model is comprehensive and detailed; however it is not a true “patient costing” approach, as it does not track the actual consumption of products against the patient episodes within an operational patient costing system. As a result the calculated volumes and costs are not audited against the operational expenditure of the cost centres – it is possible that this may have resulted in errors in the calculations.

## **6.2.5 Costing Assumptions and Limitations**

### **Limitations in this analysis**

Other than limitations or assumptions made in the costing study itself, the main limitation for this analysis was that the detail of the Cost modelled approach was not provided in the report and could not be provided by Qld Health. As a result, the proportion of overhead costs to direct costs could not be specified, and the cost of depreciation could not be separated from the operating costs. The analysis could not identify if any specific costs required excluding (e.g. due to changes in the model of care), or to update any specific costs against current cost schedules (such as PBS or MBS). Further, it could not identify and remove any capex costs from the analysis<sup>36</sup>.

### **Limitations in the patient-level costing approach**

Within the patient-level model, there was a lot of detail on the activities modelled against patients, however the final costs developed were not tested or checked against the actual costs on the general ledger. This weakness results in possible errors where significant costs are either included or excluded from the model<sup>37</sup>. Specific examples noted in this study include:

- Logan Satellite Dialysis – Permacath cost where the cost of ongoing dialysates was missing.
- Logan Satellite Dialysis – Fistula which were inflated by errors in the frequency of what should be infrequent use items, such as disposable face shields and “TipStops”.
- Clinical Supplies – Deliveries varied significantly across modalities and sites. Without detail on the breakdown of the consumables or services provided within this line it cannot be determined if the costs are duplicated within the patient level model.
- Drugs cost at RBWH in-Centre dialysis appears high in comparison to other modalities and sites. As this data was obtained from the top down modelling exercise, it would appear to also include PBS reimbursed drug costs.

## **6.2.6 QLD Model of Care**

The model of care in the 2007-08 Qld study is shown in Table 29. This information was mainly provided within the “Description of the RRT being costed” section of the QLD study being analysed. The intention is to provide a brief overview of the model of care at the time of the study, to determine if there were any significant changes to the practices which should be incorporated in the 2013-14 cost estimates.

In regards to the current model of care, limited information was available to this analysis for two reasons. Firstly, the majority of detailed information about models of care is available through clinicians rather than financial staff at a hospital, and consultations with clinicians was outside the scope of the current report. Secondly, the model of care for dialysis varies

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<sup>36</sup> Capital expenditure (‘capex’) costs are excluded from NEP calculations and so should be excluded from this analysis.

<sup>37</sup> A live patient costing system, such as Transition, would assign actual products utilized by the patients to the patient episodes, and it would only allocate costs available on the GL.

between jurisdictions, LHNs, and clinicians. This was verified through our analysis of the 2008 study and through the high level discussions with finance staff in each jurisdiction.

The following specific information was available:

- Infrastructure for home and ongoing home costs, and delivery of consumables & pharmaceuticals:  
Under the current model of care, hospitals provide the machine, drugs and distilled water - the delivery schedule is dependent on the patient condition.
- Pharmaceutical protocols & pathology regimes:  
This can vary. The consultations and surveys revealed that the stability of the patient would determine the renal protocols.

Based on the above, there have been no significant changes to the model of care from 2008 to the present day. In summary, the model of care varies significantly across LHNs and there was insufficient detail provided in either the 2007-08 or the current model of care to determine if any specific changes in the model have occurred. Based on this, no adjustments to the 2007-08 costs which relate to changes in the model of care have been made.

**Table 29: Qld Model of Care - comparison of 2007-08 to current**

<b>Aspect of Care</b>	<b>QLD Model of Care 2007-08</b>
Pre-dialysis education & training	Training varies greatly between sites. RBWH provides 8 weeks, PAH provides 12 weeks and provides twice the amount of nursing time per patient. North Ward Home Therapies training at Townsville takes twice the nursing time than PAH and 4 times that of RBWH. Townsville provides more training due to the greater distance from in person support and due to the higher indigenous population. Peritoneal Dialysis training follows the same pattern with the differential between Townsville and RBWH being 9 days of nursing time. Additional conversion training to APD of 5 hours was provided during the PD training at Townsville and separate conversion training of 3 days was provided at PAH. Nocturnal training follows a similar path to CAPD to APD conversion training. North Ward combines it with the initial home training whereas PAH and RBWH have separate training that takes 2 nights to complete
Access procedures	Costs specifically related to access surgery costs are excluded from the Qld study as these costs would be funded under the admitted surgical episode.
Dialysis machinery	The cost of home dialysis machines was not included within the scope of the QLD RRT Report
Infrastructure for home and ongoing home costs	Machines, equipment (including scales and blood pressure monitoring) and consumables for home dialysis are ordered via the unit and delivered by the supplier to the home. The cost of configuring homes is included in the direct costs of the services. Ongoing patient paid costs were analysed, but are excluded from the ongoing treatment costs paid for by the sites.
Specialist visits (e.g. nephrologist)	Regular outpatient appointments with a nephrologist were included in the study at a frequency of 6 times per year.

<b>Aspect of Care</b>	<b>QLD Model of Care 2007-08</b>
Nursing support	Ongoing nursing support is provided by Townsville through monthly phone call support and 6 monthly review visits for 240 minutes. At RBWH the home haemodialysis nurse provides home visits every 2 months for 150 minutes, with consultations prior to the nephrology review in outpatients for 30 minutes on the alternating months. PAH provides home visits every 3 months for 105 minutes and monthly phone call support.
GP visits	GP Visits were not included within the scope of the QLD RRT Review.
Other specialists (e.g. for comorbidities)	Only nephrology reviews were included within the costing study, other specialties were excluded.
Allied health visits	Dietetics was provided by PAH and RBWH on initiation and then annually. At Townsville it is provide every 6 months. Social Work consultations were provided annually at PAH and RBWH, but were omitted at Townsville. (This may have been an oversight in the study.) Diabetic education is provided to PD patients only at Townsville. Psychology is also provided only at RBWH for CAPD and HHD patients.
Pharmaceutical protocols	No data was provided about the pharmaceutical protocols modelled in the study.
Pathology regimes	At PAH a battery of FBC, ELFT and COAGS blood tests are taken weekly for the first month, and then every 3 months at the outpatient review. At RBWH and Townsville, they have included the annual pathology tests, but have excluded the review tests, despite having them reviewed at RBWH during the nephrology visit every 2 months. This would appear to be an oversight and it could be assumed that bloods are taken for the outpatient review.
Delivery of consumables & pharmaceuticals	These items were not itemised within the detail of the modalities, but were included in the summarised tables. However there is no detail provided about what is included in these amounts, and they vary from \$2,725 for CAPD at PAH to \$47,700 for Nocturnal HD at Townsville.
Transport costs	The report reviewed transport for all modes of dialysis which concluded that PD and HD average frequency of transport is 6 times per year for review (and also if there are additional consultations for problems that arise). Much of the transport use is subsidised through Qld Health's patient travel subsidy scheme, which is locally administered via District Health Services. The eligibility rules are complex and inconsistently administered, however it appears that much of the HHD travel would be subsidised. These costs are excluded from the ongoing direct treatment costs considered in this analysis, which is comparable with the NSW study.
Technical maintenance	Installation and ongoing maintenance of the dialysis machine and the reverse osmosis machine is provided by Biotechnical Services within the sites. The duration and cost of the services is included in the calculation of the ongoing costs at all sites.

### 6.3 Benchmarking the costs

A comparison of the current costs derived from both costing studies was undertaken to provide an estimate of the national costs of delivering these services. It is worth noting that there are some differences in cost categories between the two studies which should be taken into account when comparing the costs – this is shown in Table 31 and summarised briefly below:

- The NSW study included costs such as GP visits and access surgery which have been excluded when bringing forward the costs estimates to 2013-14.
- The QLD patient-level cost method excludes many overhead and grouped costs such as hospital domestic costs; food costs; depreciation and repairs & maintenance costs of equipment. These have been estimated for inclusion in the figures shown below.
- The QLD top-down cost method appears comparable to the NSW study, with the exception of \$100 drug costs which are excluded. However, it should be noted that very little detail of the costs included in this method was provided in the study.

A third costing study was used to benchmark the accuracy of the costs derived from the NSW and Qld studies. This study was entitled “The organization and funding of the treatment of end-stage renal disease in Australia”, conducted by Tony Harris in 2007 (“Harris study”). The costs in this study have been updated using similar methodology to that described above for the NSW and Qld studies. Specifically, this analysis has:

- Indexed the costs using indexation factors consistent with that used in calculating the annual National Efficient Price. The average annual growth rates used are shown in Table 15.
- Removed costs for health professional visits not associated with dialysis.
- Estimated and removed depreciation costs (using the average percentage depreciation compared to total expenses from the NSW study for ongoing annual costs - these figures are shown in Table 26).

No further breakdown of the estimated costs was provided, so no further adjustments have been made. This also makes it difficult to determine if the costs included in the Harris study are consistent with those included in the NSW and Qld studies – hence these results were only used for benchmarking purposes. Specifically, no depreciation costs or capex costs have been excluded from the Harris study, unlike in the NSW and QLD analysis where this was done to bring the analysis in line with NEP calculations.

Costs are roughly comparable between the NSW and Qld studies. Table 30 compares the costs derived from each study for ongoing (annual) treatment costs and set up and training costs and is based on the reported results in Table 16 for NSW and Table 28 for Qld. In the Qld study, set-up and training costs were provided per person, but in NSW only the total costs were provided. The same assumption has been made here as earlier, that on average, a patient’s treatment lasts 3 years, and have divided the NSW training costs appropriately (assuming a steady level of patient intake) to combine with the ongoing treatment costs.

Based on the analysis described in this report, this analysis concluded that ongoing (per annum) treatment costs are \$42,089 for PD modalities (on average) and \$46,031 for HD modalities (on average). For training and set up costs, the average for PD modalities is \$4,860 and for HD modalities is \$10,859.

In comparison, the analysis of the Harris study described above shows significantly elevated costs, at \$95,431 for PD and \$73,916 for HD. Since the detail behind these costs was unavailable, there is a possibility that either this study included costs that were out-of-scope for the NSW and Qld studies, and/or the model of care has changed significantly since these estimates were developed. This may account for some or all of the discrepancy.

Furthermore, the expenditure in the Harris study is almost wholly based on Victorian public payment rates for dialysis programs – a fundamental assumption here is that the payment

rates are consistent with actual expenditure, which in the context of the current analysis (to inform potential funding) appears to be unsound circular logic. Interestingly, the Harris study found Home HD to be significantly cheaper than PD, which is not supported by the analysis of the NSW and Qld studies.

**Table 30: Comparison of 2013-14 estimated costs for home-based modalities**

Estimated Per Person Per Year (\$)		Home HD	Home PD
<b>2013-14</b>			
Annual ongoing treatment costs	NSW study	46,676	48,265
	QLD study <sup>38</sup>	45,386	35,914
<i>Average</i>		<i>46,031</i>	<i>42,089</i>
Training and set-up costs	NSW study	12,092	5,778
	QLD study <sup>38</sup>	9,625	3,943
<i>Average</i>		<i>10,859</i>	<i>4,860</i>
<b>Total average</b>		<b>56,890</b>	<b>46,950</b>
Harris study		73,916	95,431

<sup>38</sup> The HD results shown here are an average of the HHD and NHHD results reported in Table 28. Similarly, the PD results are an average of the APD and CAPD results.

**Table 31: Comparison of cost categories included / excluded in the NSW and QLD studies**

Cost Category	NSW study	QLD study	
		Top Down	Patient Level
<b>Employee Related</b>			
Nursing	Included	Included	Included
Administrative	Included	Included	Included
Technical	Included	Included	Included
Hospital/Domestic/Other	Included	Included	<i>Excluded</i>
Superannuation	Included	Included	Included
Workers Compensation	Included	Included	Included
<b>Goods &amp; Services</b>			
\$100 Drugs	Included	<i>Excluded</i>	<i>Excluded</i>
Other Prescribed Drugs	Included	Included	Included
Other Drug Supplies	Included	Included	Included
PPT Payments	Included	Included	Included
Dialysis Fluids/Consumables	Included	Included	Included
Other Medical & Surgical Supplies	Included	Included	Included
Pathology	Included	Included	Included
Other Special Services	Included	Included	Included
Food	Included	Included	<i>Excluded</i>
Domestic Services	Included	Included	<i>Excluded</i>
Goods & Services Other	Included	Included	<i>Excluded</i>
<b>Repairs Maintenance &amp; Replacement</b>			
Repairs Maintenance & Replacement	Included	Included	<i>Excluded</i>
<b>Depreciation</b>			
Depreciation Dialysis Equipment	<i>Excluded by PwC</i>	<i>Excluded by PwC</i>	<i>Excluded</i>
Other P&E Depreciation	<i>Excluded by PwC</i>	<i>Excluded by PwC</i>	<i>Excluded</i>
Building Depreciation	<i>Excluded by PwC</i>	<i>Excluded by PwC</i>	<i>Excluded</i>
<b>Other Estimates</b>			
Nephrologist Consultations	Included	Included	Included
Other Medical Input	Included	Included	Included
Other Specialist Consultations	Included	Included	Included
General Practitioner Consultations	<i>Excluded by PwC</i>	<i>Excluded</i>	<i>Excluded</i>
Social Worker Consultations	Included	Included	Included
Dietician Consultations	Included	Included	Included
Other Overheads	Included	Included	<i>Excluded</i>
Access Surgery	<i>Excluded by PwC</i>	<i>Excluded</i>	<i>Excluded</i>
Patient transport costs	<i>Estimated but excluded</i>	<i>Estimated but excluded</i>	<i>Estimated but excluded</i>

## 6.4 Conclusion

This report describes the analysis of two relevant costing studies – from NSW and Qld for 2007-08 costs - to estimate the costs of delivering home-based haemodialysis and peritoneal dialysis. These costs were updated to bring them up to 2013-14 equivalent costs to help inform the NEP15.

The findings from the review of existing costing studies are shown in Table 30 in the previous section. The analysis found that costs are roughly comparable between the NSW and Qld studies. Based on the analysis described in this report, the analysis concluded that ongoing (per annum) treatment costs are \$42,089 for PD modalities (on average) and \$46,031 for HD modalities (on average). For training and set up costs, the average for PD modalities is \$4,860 and for HD modalities is \$10,859.

Table 30 is based on the reported results in Table 16 for NSW and Table 28 for Qld. Estimates for ongoing (annual) costs in these tables ranged from \$27,084 to \$57,280 and that this large range highlights that numerous assumptions & estimates were made during the cost estimation process, both in the original studies and in this current analysis.

As a result it seems reasonable to conclude that all modalities have ongoing (per annum) treatment costs in the neighbourhood of \$45,000, and set up and training costs of approximately \$10,000 as concluded above. However additional study information found in the course of the review also indicated different costings and conclusions (for example, see the comparison to the results of the Harris study described in the previous section).

This analysis confirmed a key point: the frequency of dialysis treatments is difficult to identify for home-based patients. No information obtained in this study pinpointed actual costs per treatment. As a result, the key finding throughout the analysis is that there are significant difficulties in developing a single price funding model for home-based dialysis, and in particular, a price-per-treatment model. The model of care and indeed individual patient experiences, vary greatly. As a result, without further data and analysis, any funding model is likely to introduce the opportunity for varying incentives and gaming. Given these conclusions, a potential next step would be to undertake a study to understand and capture real (current) costs and service delivery models. This analysis suggests that this process would provide more rigorous and accurate cost information for consideration of funding models.

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# *Appendix A*

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# Appendix B

## Literature Review Searches

### Searches on PUBMED

#### a Cost and economic studies

PUBMED was searched for the years 2005 to 2014 using the following search terms:

((costings OR costs OR cost OR economic\* OR finan\*)) AND (((("Renal Dialysis"[Mesh]) OR (hemodialy\* OR dialial\* OR haemodial\*))) AND (home OR homes)). The above search resulted in 260 articles and 34 were relevant

#### b Clinical Practice Guidelines

PUBMED was searched for the years 2005 to 2014 using the following search terms:

((("Guideline" [Publication Type] OR "Guidelines as Topic"[Mesh] OR "Practice Guideline" [Publication Type])) AND ((home) AND (((("Renal Dialysis"[Mesh]) OR "Hemodialysis, Home"[Mesh]) AND (dialysis OR haemodialy\* OR hemodial\*)))

Therapy/Broad[filter]) AND ((haemodialysis OR dialys\* OR hemodial\*) AND (Home OR homes) AND (guideline\* OR clinical practice))

There were two searches undertaken resulting in 65 abstracts for the first search and 17 from the second search. 4 were relevant.

### Searches on ECONOLIT

ECONOLIT was searched using the following search terms: home\* AND ( dialys\* OR haemodials\* OR dialy\*). This resulted in 5 articles and 3 were relevant.

### Searches on NHEED

NHEED was searched using the following search terms: (dialysis OR Haemodialy\* OR hemodial\*) AND home\* This identified 12 abstracts which were all relevant.

### Searches on GOOGLE SCHOLAR

A Google Scholar search using the following search terms 'home AND renal AND dialysis AND risk AND adjustment AND funding AND economics' was sorted by relevance and produced 5,880 hits. From this selection 20 journal articles were selected as relevant

A google scholar search using the following search terms: Home AND renal AND dialysis AND clinical AND pathway there were 17,200 hits since 2010. No new items were selected.

### Searches on INTERNET - Google

Google was searched using the terms Home AND Renal AND Dialysis AND Costs with no time limit. This resulted in 9,610,000 hits and several documents were saved from this search.

# Appendix C

## Annual cost per modality per patient

**Table 32: Annual cost of each dialysis modality per patient (NSW Dialysis Costing Study, indexed to 2008 - 2009 dollars)<sup>39</sup>**

	In centre		Satellite		Home HD		PD	
Estimated health system expenditure/pt/yr AUD 2007-2008	76,881		63,505		47,775		51,640	
Indexed to AUD 2008-2009 <sup>40</sup>	79,072		65,315		49,137		53,112	
Components of costs	In centre		Satellite		Home HD		PD	
	%	\$AUD 2009	%	\$AUD 2009	%	\$AUD 2009	%	\$AUD 2009
<i>Direct dialysis service provision</i>								
Nursing	33%	26,094	24%	15,349	5%	2,457	5%	2,656
Allied health	2%	1,581	3%	1,959	5%	2,457	4%	2,124
Other employee related	3%	2,372	2%	1,306	3%	1,474	0%	0.00
Pharmacy	3%	2,372	6%	3,919	5%	2,457	2%	1,062
Other direct provision costs <sup>41</sup>	27%	21,350	30%	19,594	32%	15,723	36%	19,252
<i>Other costs</i>								
Medical	3%	2,372	3%	1,959	4%	1,965	3%	1,593
Access surgery	6%	4,744	7%	4,572	9%	4,668	19%	10,224
Pharmacy:								
Section 100	13%	10,279	15%	9,471	21%	10,073	21%	11,286
Other prescribed medicines	8%	6,326	9%	5,878	13%	6,388	7%	3,851
Pathology	2%	1,581	2%	1,306	3%	1,474	2%	1,062
<b>Total</b>	<b>100%</b>	<b>79,072</b>	<b>100%</b>	<b>65,315</b>	<b>100%</b>	<b>49,137</b>	<b>100%</b>	<b>53,112</b>
Ongoing out-of-pocket costs to patients		4,172		3,209		2,246		1,913
Other drugs (cinacalcet, sevelamer, lanthanum) <sup>42</sup>		1,511		1,511		1,511		1,511

<sup>39</sup> Extract from "The Economic Impact of End-Stage Kidney Disease in Australia, projections to 2020", Table 6, page 27. ("EIESKDA 2020")

<sup>40</sup> Reference from EIESKDA 2020: *AIHW Total Health price Index for 2007-8 (1.0285) applied to 2008-9:* <http://www.aihw.gov.au/publications/hwe/hwe-46-10954/hea07-08>

<sup>41</sup> Reference from EIESKDA 2020: *Other direct provision costs include PPT payments, dialysis fluids/consumables, depreciation, other goods and services and overheads.*

	<b>In centre</b>	<b>Satellite</b>	<b>Home HD</b>	<b>PD</b>
Transplant work-up costs for those on waiting list <sup>43</sup>	375	375	375	375
<b>Total (all ongoing costs)</b>	<b>85,128</b>	<b>70,409</b>	<b>53,268</b>	<b>56,910</b>
Once-off costs (Training and once-off patient costs)			15,093	3,823

<sup>42</sup> Reference from EIESKDA 2020: Average cost per patient was based on PBS cost data for cinacalcet, sevelamer and lanthanum item numbers from Jan to Dec 2009, apportioned over all dialysis patients

<sup>43</sup> Reference from EIESKDA 2020: Based upon work-up regimen costs from 2006 Kidney Health Australia Report 'The Economic Impact of End-Stage Kidney Disease in Australia', with costs indexed to 2009 values

# Appendix D

## State Reimbursements for home dialysis

Extract from “Financial Support for Home Dialysis Patients in Australia” (by Kidney Health Australia, 2013), page 7 and 8.

### Home Haemodialysis Reimbursements

	Low income or Concession Holder Energy Government (Not dialysis specific)	Life support subsidy – Electricity Government	Low income or concession Holder Water Government (Not dialysis specific)	Dialysis specific water rebate from water suppliers (varies by and within each state)	Specific dialysis payment (health department or hospital payment)	Planned for 2012 Household Assistance medical equipment (carbon price offset)
NSW	\$200*	\$251	Up to 100%*	Free 80-400kl		\$140*
Victoria	17%*	Free 1880kw*	\$277*	Free 168kl*	\$1990 health dept	\$140*
QLD	\$230*	\$314	\$120*	Free 50-400kl		\$140*
SA	\$158*	\$165	\$235*	Free 180kl		\$140*
WA	Up to \$200	\$0	Up to 50%*		\$624-\$780 hospital	\$140*
ACT	\$374	\$121	Up to 88%*	\$1200		\$140*
Tasmania	\$407*	\$114	\$150*	Free Up to 200kl		\$140*
NT	\$430+*	\$0	\$265+*			\$140*

\*specified concession holders only

### Automated Peritoneal Dialysis Reimbursements

	Low income Concession Holder Energy Government (not dialysis specific)	Life support subsidy – Electricity	Specific dialysis payment (health department)	Planned for 2012 Household Assistance medical equipment (carbon price offset)
NSW	\$200*	\$251		\$140*
Victoria	17%*	Free 1880kw*	\$755	\$140*
QLD	\$230*	\$314		\$140*
SA	\$158*	\$165		\$140*
WA	Up to \$200	\$76		\$140*
ACT	\$346*	\$121		\$140*
Tasmania	\$407*	\$114		\$140*
NT	\$430+*	\$0		\$140*

\*specified concession holders only

# Appendix E

## Cost model of in-centre and home haemodialysis

	Canada						Australia						United Kingdom					
	Year 1			Subsequent years			Year 1			Subsequent years			Year 1			Subsequent years		
	ICHHD	CHHD	FHH D	ICHHD	CHHD	FHH D	ICHHD	CHHD	FHH D	ICH D	CHHD	FHHD	ICHHD	CHHD	FHH D	ICHHD	CHHD	FHHD
Total costs	44,801	42,462	51,453	44,461	32,398	41,389	52,614	49,174	57,527	52,274	40,225	48,578	45,374	46,218	57,898	45,034	37,762	49,442
Patient evaluation/recruitment, training costs		6862 <sup>a</sup>	6862 <sup>a</sup>		1864 <sup>a</sup>	1864 <sup>a</sup>		6588 <sup>a</sup>	6588 <sup>a</sup>		2159 <sup>a</sup>	2159 <sup>a</sup>		5285 <sup>a</sup>	5285 <sup>a</sup>		1690 <sup>a</sup>	1690 <sup>a</sup>
Home preparation		2500 <sup>b</sup>	2500 <sup>b</sup>					1954 <sup>c</sup>	1954 <sup>c</sup>					2295 <sup>d</sup>	2295 <sup>d</sup>			
Machine costs	1429 <sup>b</sup>	7200 <sup>b</sup>	7200 <sup>b</sup>	1429 <sup>b</sup>	7200 <sup>b</sup>	7200 <sup>b</sup>	1429 <sup>b</sup>	7200 <sup>b</sup>	7200 <sup>b</sup>	1429 <sup>b</sup>	7200 <sup>b</sup>	7200 <sup>b</sup>	1259 <sup>d</sup>	4398 <sup>d</sup>	4398 <sup>d</sup>	1259 <sup>d</sup>	4398 <sup>d</sup>	4398 <sup>d</sup>
Pump		525 <sup>e</sup>	525 <sup>e</sup>					525 <sup>e</sup>	525 <sup>e</sup>					525 <sup>e</sup>	525 <sup>e</sup>			
Consumables and peripheral costs	5510 <sup>f</sup>	8047 <sup>g</sup>	16,014 <sup>g</sup>	5510 <sup>f</sup>	8047 <sup>g</sup>	16,014 <sup>g</sup>	9966 <sup>c</sup>	9966 <sup>c</sup>	20,367 <sup>c</sup>	9966 <sup>c</sup>	9966 <sup>c</sup>	20,367 <sup>c</sup>	12,290 <sup>d</sup>	12,290 <sup>d</sup>	24,580 <sup>d</sup>	12,290 <sup>d</sup>	12,290 <sup>d</sup>	24,580 <sup>d</sup>
Total allied health-care costs	12,324 <sup>a</sup>	1503 <sup>a</sup>	1503 <sup>a</sup>	12,324 <sup>a</sup>	1503 <sup>a</sup>	1503 <sup>a</sup>	17,467 <sup>c</sup>	4108 <sup>c</sup>	4108 <sup>c</sup>	17,467 <sup>c</sup>	4108 <sup>c</sup>	4108 <sup>c</sup>	10,510 <sup>d</sup>	4920 <sup>d</sup>	4920 <sup>d</sup>	10,510 <sup>d</sup>	4920 <sup>d</sup>	4920 <sup>d</sup>
Medical equipment	390 <sup>b</sup>	2340 <sup>b</sup>	2340 <sup>b</sup>	50 <sup>b</sup>	300 <sup>b</sup>	300 <sup>b</sup>	390 <sup>b</sup>	2340 <sup>b</sup>	2340 <sup>b</sup>	50 <sup>b</sup>	300 <sup>b</sup>	300 <sup>b</sup>	390 <sup>b</sup>	2340 <sup>b</sup>	2340 <sup>b</sup>	50 <sup>b</sup>	300 <sup>b</sup>	300 <sup>b</sup>
Renal medication costs (total)	7312 <sup>h</sup>	5335 <sup>g</sup>	6970 <sup>g</sup>	7312 <sup>h</sup>	5335 <sup>g</sup>	6970 <sup>g</sup>	10,020 <sup>c</sup>	10,020 <sup>c</sup>	10,020 <sup>c</sup>	10,020 <sup>c</sup>	10,020 <sup>c</sup>	10,020 <sup>c</sup>	4,870 <sup>d</sup>	4870 <sup>d</sup>	4870 <sup>d</sup>	4870 <sup>d</sup>	4870 <sup>d</sup>	4870 <sup>d</sup>
Dialysis-related laboratory costs	1071 <sup>f</sup>	1565 <sup>g</sup>	1173 <sup>g</sup>	1071 <sup>f</sup>	1565 <sup>g</sup>	1173 <sup>g</sup>	1071 <sup>f</sup>	1565 <sup>g</sup>	1173 <sup>g</sup>	1071 <sup>f</sup>	1565 <sup>g</sup>	1173 <sup>g</sup>	1071 <sup>f</sup>	1565 <sup>g</sup>	1173 <sup>g</sup>	1071 <sup>f</sup>	1565 <sup>g</sup>	1173 <sup>g</sup>
Costs of in-center runs		1672 <sup>i</sup>	1672 <sup>i</sup>		1672 <sup>i</sup>	1672 <sup>i</sup>		1672 <sup>i</sup>	1672 <sup>i</sup>		1672 <sup>i</sup>	1672 <sup>i</sup>		2761 <sup>d</sup>	2761 <sup>d</sup>		2761 <sup>d</sup>	2761 <sup>d</sup>



Facility costs	10,624 <sup>f</sup>		10,624 <sup>f</sup>			5948 <sup>c</sup>		5948 <sup>c</sup>			8405 <sup>d</sup>		8405 <sup>d</sup>						
Dialysis water and electricity costs		2155 <sup>f</sup>	3592 <sup>f</sup>		2155 <sup>f</sup>	3592 <sup>f</sup>		478 <sup>c</sup>	478 <sup>c</sup>		478 <sup>c</sup>	478 <sup>c</sup>		2155 <sup>f</sup>	3592 <sup>f</sup>		2155 <sup>f</sup>	3592 <sup>f</sup>	
Travel costs to and from dialysis		1613 <sup>j</sup>			1613 <sup>j</sup>			1795 <sup>k</sup>			1795 <sup>k</sup>			2051 <sup>d</sup>	57 <sup>d</sup>	57 <sup>d</sup>	2051 <sup>d</sup>	57 <sup>d</sup>	57 <sup>d</sup>
Hospitalization costs	4529 <sup>l</sup>	2757 <sup>l</sup>	1102 <sup>§</sup>	4529 <sup>l</sup>	2757 <sup>l</sup>	1102 <sup>§</sup>	4529 <sup>l</sup>	2757 <sup>l</sup>	1102 <sup>§</sup>	4529 <sup>l</sup>	2757 <sup>l</sup>	1102 <sup>§</sup>	4529 <sup>l</sup>	2757 <sup>l</sup>	1102 <sup>§</sup>	4529 <sup>l</sup>	2757 <sup>l</sup>	1102 <sup>§</sup>	

Abbreviations: CHHD, conventional home haemodialysis; FHHD, frequent home haemodialysis; ICHD, in-center haemodialysis.

<sup>a</sup>Data on hours from Komenda et al.<sup>35</sup> Costs calculated using country-specific wages.

<sup>b</sup>Estimate based on literature and author experience—amortized over 8 years or annual rental.

<sup>c</sup>See Agar et al.<sup>2</sup>

<sup>d</sup>See Mowatt et al.<sup>22</sup>

<sup>e</sup>Pump cost assumptions based on data for Abbott Lifecare 5000 Pump Infusion System.

<sup>f</sup>See McFarlane et al.<sup>26</sup>

<sup>§</sup>See Kroeker et al.<sup>21</sup>

<sup>h</sup>See Lee et al.<sup>15</sup>

<sup>i</sup>Assumption of 11 in-center runs per year at \$152 per run, which is the Medicare reimbursement rate for such a run.

<sup>j</sup>Assumes Canadian reimbursement rate of \$0.53 per km at 10 km one way for 3 visits per week for 1 year (Canadian Revenue Agency).

<sup>k</sup>Assumes Australian reimbursement rate of \$0.63 per km at 10 km one way for 3 visits per week for 1 year (Australian Taxation Office). <sup>l</sup>See McFarlane et al.<sup>6</sup>

# Appendix F

## Consultation details

### *Consultation attendees and survey respondents*

<b>State</b>	<b>Jurisdiction and hospital representatives</b>
NSW	Julia Heberle, Manager, Funding and Costing, ABF Taskforce, NSW Ministry of Health Susan Dunn, NSW Ministry of Health
SA	Phillip Battista, Senior Manager Funding Models, SA Health David Rawson, Manager Casemix and Clinical Costing System, Royal Adelaide Hospital
QLD	Colin McCrow, Manager ABF Costing, Department of Health
NT	Ian Pollock, Director Activity Based Funding, Department of Health
TAS	Ian Jordan, DHHS Tasmania
WA	Bing Rivera, Manager, National Activity Based Funding Program
Department of Health	Allison Clarke, Acute Care Division, Department of Health Richard Hurley, Acute Care Division, Department of Health

