STATE PLAN FOR RENAL SERVICES 2010-2020

Part One
Overview and Action Plan

Prepared by The George Institute for International Health

Acknowledgements

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Disclaimer

The Plan was commissioned by the DHHS in March 2009.

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Research, analysis, planning and authorship was undertaken by a team of experts working with The George Institute for International Health. The names and affiliations of team members are summarised below:

Professor Alan Cass	The George Institute for International Health
Dr Martin Gallagher	The George Institute for International Health
Ms Gillian Gorham	The George Institute for International Health
Dr Kirsten Howard	The School of Public Health, University of Sydney
Ms Erica Kneipp	The George Institute for International Health
A/Prof Stephen McDonald	The Australian and New Zealand Dialysis and Transplant Registry
Dr Paul Snelling	Royal Prince Alfred Hospital

The analysis and conclusions presented are the responsibility of the authors and subject to the endorsement of the DHHS and Tasmania Government.

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TABLE OF CONTENTS – PART ONE

LIST OF TABLES AND FIGURES

EXECUTIVE SUMMARY

Chronic diseases are the greatest sources of health-related morbidity and mortality in modern economies. Australia is no different, with three quarters of all Australians suffering from at least one chronic health condition, and this group of conditions accounts for some 70 percent of all health expenditures. Chronic kidney disease (CKD) increases in prevalence in ageing populations and is characterised by resource intensive, complex long-term treatments and significant costs to health funding bodies.

Although the number of people identified as receiving treatment for severe end-stage kidney disease is small, health systems nationally and internationally are known to spend as much as 25% of the health budget on patients with chronic and end-stage kidney disease. The Tasmanian experience of this chronic disease epidemic parallels that of the nation as a whole, and planning for the future burden of kidney disease is vital to ameliorate the costs and maximise the benefits of treatment.

The most severe form of kidney disease, end-stage kidney disease (ESKD), requires dialysis or transplantation to prolong life. The number of people with ESKD forms the tip of the chronic kidney disease iceberg but accounts for the majority of spending on renal disease. There is growing evidence that less severe forms of chronic kidney disease are common in Australia but are often unrecognised in the general population. These facts coupled with the ageing population in Tasmania mean that the state will experience continued and significant increases in demand for treatments on top of the 8% annual increases seen over the last decade. For such treatment to be sustainable in Tasmania, treatment modalities must evolve to more affordable models, with a greater focus on prevention, identification and management of CKD.

In Tasmania recent studies have highlighted a significant population of people with CKD who have not been referred to renal services. This report predicts that the number of dialysis patients in Tasmania will expand from the 177 patients seen in 2008 to 253 in 2016, a 43% increase in the next 7 years. Almost all of this expansion will be seen in patients over the age of 65, a group with very high rates of other chronic diseases who are likely to be more difficult and expensive to treat. Transplant patient numbers will also increase by 33%, from 198 in 2008 to 264 in 2016, meaning the total number of patients requiring either dialysis or transplantation will increase from 375 to 517 (38%) in the same time frame. Using national estimates of costs associated with the different forms of treatment, the annual cost of providing this care will increase from $16.3m per annum to $22m in 2018, representing $250m in the decade from 2008 - 2018.

The current mix of treatment modalities for dialysis patients in Tasmania is very dependent upon the more expensive modalities of satellite and in-centre haemodialysis, with lower than national rates of use in the less expensive home-based therapies. Changing this mix of modalities and increasing home-based treatments would deliver savings estimated at $16.2m and would likely be associated with improvements in quality of life. Increases in the rate of renal transplantation (of either 10% or 50%) through improved education and support for live donations will realise significant improvements in quality of life and cost savings. This, coupled with the savings for infrastructure and institutional dialysis, makes a compelling case for investments in home-based therapies and transplantation.

The structure of renal services in Tasmania is unique, reflecting the history and evolution of medical infrastructure in the state. If the Department of Health and Human Services (DHHS) is to oversee a renal service that will deliver solutions to the challenges ahead, it needs to oversee a process characterised by:

- Restructuring
- Reallocation of resources
- Realisation of opportunities

Restructuring

The current structure of two separate renal units managed by Royal Hobart Hospital (RHH) and Launceston General Hospital (LGH), the latter incorporating the North West Renal Unit (NWRU) at Burnie, is inefficient and has been associated with the inequitable allocation of resources. A single renal service should manage renal services for the state with a Director that reports to a governance group comprising members from all areas of the state and the DHHS. The Director and other leaders in the service should be vested with clear reporting responsibilities that include activity against financial expenditure to ensure the best allocation of available resources. The governance group would also be tasked with standardising renal service delivery across the state, based on national benchmarks and evidence-based protocols.

The service would be based on a hub and spoke model with the dual hubs for renal services based at RHH and LGH. The North West Renal Unit will continue to be supported by the LGH with increased linkages with the North West Area Health Service to augment the services it

provides and build renal service capacity across the region. It is recommended that the LGH acute in-centre facility be decanted to a community-based satellite facility as a priority. The size of the facility should be given careful consideration in view of the principles of providing services closer to home. Smaller community-based satellites are advocated however, the ability to predict where future services will be needed within the next 10 years is not possible with the current information. Efforts to rectify data collection and analysis are recommended to enable a more proactive and responsive service development approach.

Reallocation of resources

Elements of the existing dialysis service are inefficient and there are opportunities to realise savings through investing in resources to build a robust home therapies program. The unequal support and funding for more cost-effective treatments should be addressed with service delivery areas charged with achieving clear targets for home-based treatment over the next 4 years.

Existing renal support services are variable in their availability and a single service should seek to have a more even allocation of these resources across the state. This variability is also seen in the ancillary services of vascular access surgery and interventional radiology and a single service is better placed to advocate for greater uniformity across the state.

A standardising of services, promotion of home-based therapies and education and intervention programs for CKD require modest financial outlays in the first year of the service plan, although this will result in significant cost savings in later years.

Realisation of opportunities

Recent DHHS strategies have promised closer working relationships across heath sectors and opportunities are available to integrate renal services more effectively with the primary health sector. Partnerships developed here will see benefits for patient management, improvement in clinical outcomes and a reduction in usage of expensive health services. The staff positions advocated in the service plan (see appendices) will be necessary to facilitate and coordinate this integration through the development of robust education and communications plans.

The recent investments by the Australian Government in staff, to increase organ donation rates, represents an opportunity to increase the transplantation rate in Tasmania and, if well managed, has the potential to deliver significant gains. Opportunities also exist to increase live donor

transplants and a well supported program of transplant education and monitoring of transplant recipients would be necessary to achieve the recommended targets.

A number of junior medical staff are keen to return to Tasmania to work in more senior roles, an opportunity not available to many other renal services. Effective stewardship of new appointments from a single service will build a coherent service for the future challenges. The investment in data collection and quality improvement in the existing services is patchy and is likely to be compromising potential efficiency gains, and opportunities to build upon these deficiencies should be taken.

The key issues described below, frame the Recommendations and Objectives outlined in this report:

1. Recognition of the burden of chronic disease and in particular renal disease facing Tasmania. Relative to other states, the Tasmanian population is ageing rapidly and suffers a higher level of socioeconomic disadvantage, including unhealthy lifestyles.
2. Understanding that the true extent of renal disease in Tasmania is unrecognised, a significant proportion of chronic kidney disease is unmanaged and likely to result in preventable morbidity and mortality within the Tasmanian population.
3. Acknowledgement that the silo structure of current renal service management and provision does not support an efficient, effective and quality driven service and poorly manages the patient across the continuum of care.
4. Resources are required to establish and maintain an effective, responsive and sustainable Tasmanian statewide renal service. However, implementing the plan would result in direct financial benefits and quality improvements for the health department, community and renal patients.

The following Recommendations have been identified as necessary to achieving the goals of the State Plan. They form part of the State Plan for Renal Services and are critical to progressing the full uptake and implementation of the objectives and strategies in the Action Plan.

RECOMMENDATIONS

1. It is recommended that renal services in Tasmania be identified as a statewide service and delivered from the two hubs of RHH and LGH. The North West Renal Unit will continue to be supported by the LGH with increased linkages with the North West Area Health Service to augment the services it provides and build renal service capacity across the region. This includes the provision of regular renal education and mentoring programs for medical staff at this facility and the establishment of additional renal nursing positions.

2. Establish a governance group to oversee the statewide service. A statewide service is essential to ensuring equitable and accessible services and this will only be achieved by equal representation and full participation across the state by relevant fund holders and service decision makers.

3. Establish a Director of Renal Services responsible to the governance group and accountable for ensuring the quality and standard of the statewide service. This position will be allocated administration time of 0.25 – 0.5 FTE to carry out the consultation and duties necessary to successfully fulfil this role.

4. Establish an Implementation Officer to oversee the implementation of the Renal Action Plan, develop performance indicators in consultation with stakeholders and collate, analyse and report relevant data sets to the Director and Governance Group.

5. Establish a satellite service in the northern region and decant the LGH acute in-centre facility as a priority to the satellite unit. Maintain the in-centre facility for acute dialysis only.

6. Seek an alternative site for the acute RHH dialysis facility within the inpatient areas of RHH as a priority. This move is critical to improving efficiencies in work practices and staffing levels, but also to ensure staff and patient safety.

7. Promote and support home-based therapies in the North and North West by establishing discrete programs with dedicated staff and funding that will enable a sustainable service. Pre-determined and approved staff plans, that identify increases in FTE according to patient numbers, will prevent stalling of the program and time consuming submissions for staff and funding.

8. Establish the transplant coordinator role in the north and increase the FTE allocated in the south to promote transplantation and facilitate the education and management of people through the transplantation process. These positions should be tasked with increasing the education and support for live donor transplantations.

9. Fund the CKD/Access RN positions (currently funded by Industry) to facilitate the integration between primary health and tertiary renal services, through education and mentoring of primary health staff, development of shared protocols for the identification, education and management of people with CKD.

10. Establish the multidisciplinary team in each region with adequate staff levels in Dietitian, Social Work and pharmacist support. These allied health positions are essential for the delivery of comprehensive care. A component of their work also includes outreach services to primary health, for the CKD/Access RN and nephrologist, to ensure people are adequately prepared mentally and physically for renal treatment.

11. Ensure patients undertaking self-care therapies are not ‘out of pocket’ as a result of minor infrastructure changes to homes or increased recurrent costs related to essential services. Renal Services should undertake the necessary liaison with councils, power and water authorities to facilitate concessions and provide reimbursements where necessary.

OBJECTIVES AND STRATEGIES

The Recommendations advocated above will enable the Objectives and Strategies of the Action Plan to be delivered. They provide the focus for the State Plan for Renal Services and enable Tasmania to achieve an equitable, sustainable and quality renal service within a short time frame.

Objective 1: Provide a coordinated and responsive approach to service delivery

Strategies

- Establish a suitable coordination structure that addresses service planning, decision-making, implementation and an accountability framework for renal services across Tasmania.
- Standardise audit mechanisms governing the delivery of clinical practice across Tasmania.
- Identify areas that require structural change, operational change and resource support and incorporate these actions into the implementation plan.

Objective 2: Integrate renal services across the continuum of care

Strategies

- Promote importance of continuity of client care through establishing and maintaining links (shared protocols, education frameworks) between levels of care.
- Improve primary health care staff awareness of education about CKD.
- Develop comprehensive and robust communication plans across health care sectors, organisations and regions.

Objective 3: Develop a sustainable and equitable statewide renal service

Strategies

- Develop recruitment and training strategy to ensure workforce replacement is sufficient to address challenges of staff attrition and growth in renal services.
- Standardise renal services in line with national benchmarks and provide equitable resources across renal services.
- Identify and address barriers to provision of self-care and home dialysis therapies and attaining kidney transplants.

Objective 4: Maintain an efficient and effective service

Strategies

- Establish a statewide reporting framework for all unit activity including known CKD statistics from primary health care.
- Provide the necessary resources to support clinicians and service planners to develop and maintain a responsive and effective service.
- Develop Performance Indicators that are evidence-based and meaningful to Tasmania.

DIRECT RESOURCE COSTS

Table 1 explores the direct costs associated with restructuring and resourcing renal services to enable it to deliver equitable and accessible services. The refocus towards integrated care, across sectors and particularly with primary health, is likely to see an increase in the number of people accessing renal replacement therapy.

Table 1: Comparison of unchanged and restructured service costs

	Current Situation Year 0	Years 1-3	Years 4 – 6	Years 7 - 10	Total growth and expenditure over 10 years
Patient numbers	**194**	**264**	**277**	**315**	**121 patients**
Expenditure per year of unchanged service structure					
Funding required	$10,037,767	$11,504,014	$13,141,162	$14,484,028	**$131,871,630**
Renal services remain inequitable, institutional-based rather than home-based focussed and full utilisation of in-centre and satellite stations required to manage growth					
Expenditure of Restructured Service					
Funding required	$11,262,197				
Resources and direction	Governance, monitoring and standardisation of renal programs				
Funding required	$12,701,933				
Resources	Health sector integration and home based therapies focus. Increases in operational costs for growth only				
Funding required	$14,124,517				
Resources	Increased access, coordinated equitable services with institutional capacity, Increases in operational resources for growth and minor home therapies support.				**$128,390,458**

Table 1 identifies direct costs associated with renal service delivery only and does not include infrastructure, overheads or costs related to overnight admissions, ancillary services or primary health expenditure. It demonstrates that there are efficiencies to be made and that by restructuring and resourcing appropriately in the initial phase, the service will be positioned to manage the change in focus towards self-care therapies and the increase in patient numbers.

The base-line costing data used to develop Table 1 was provided by DHHS in the Renal Unit Capacity and Workforce Surveys as supplied by Unit Managers and Financial Budgets and Expenditure Reports provided by Business Managers of RHH and LGH. Significant gaps in the financial data provided, and apparent differences in what was counted within a range of cost classifications across sites, affect the reliability of this modelling as a true reflection of actual costs. The derivation of this costing, in two parts — i) A Final Renal Staff Plan and Recommendations (see appendices) and ii) A Final Renal Unit Proposed Budget — was discussed with DHHS.

The methods used to derive cost estimates in Table 1 differ from those used in the health economic modelling described in Part Three of the Renal Plan. The health economic modelling used published Australian data regarding dialysis costs; ANZDATA and expert-informed estimates of medication utilisation, frequency of hospitalisation for complications of dialysis therapy and frequency of specialist review; and National Health Care Costing data to create a high-level model to explore the costs and benefits of significantly shifting renal practice towards home-based care. This high-level modelling discounted future costs and benefits 5% per annum.

The cost estimates provided in Table 1 are based on 2008 costs provided by the RHH and LGH renal units regarding key staff and consumable costs for providing renal services. The costings provided by the two units are not based on directly comparable methodologies and no discounting was applied to future spending. However, using current Tasmanian estimates of resources required to provide renal services, a detailed analysis outlines the implications of continuing service provision according to current models compared to implementing the recommendations, objectives and strategies outlined in this report.

As expected, these two approaches based upon different data inputs and methodologies, derive substantially different estimates of the total costs of providing renal services and the absolute benefit of shifting practice. Nevertheless, both approaches suggest two key common findings:

1. The growing demand for renal services will necessitate a significant increase in expenditure; and
2. Implementing the strategies outlined in the Renal Plan would realise significant improvements in efficiency and effectiveness of service delivery.

ABOUT THE STATE PLAN FOR RENAL SERVICES

Tasmania, in line with other Australian states and territories, has recognised the need for effective prevention, detection and management strategies for CKD.

An ageing population, high levels of chronic disease and evidence that a considerable proportion of the population has unrecognised and untreated renal disease has prompted Tasmania to develop a Statewide Renal Plan. Recently completed statewide strategies acknowledge this burden of chronic disease –Tasmania's Health Plan 2007[1] and Clinical Services Plan: Update 2008[2] – and identify the need to develop coordinated renal services across the state.

In late 2008, the Department of Health and Human Services (DHHS) sponsored a Renal Services Forum for key stakeholders to discuss the features and objectives of a high quality renal service and the benefits of developing a statewide renal plan. Participants included DHHS officers, consumer representatives, hospital managers, renal physicians and nurses from across the state. The outcome of the forum was a recommendation to engage a consultant to develop a state plan.

The George Institute for International Health was contracted to develop the State Plan for Renal Services.

The Tasmanian State Plan for Renal Services 2010 – 2020 suggests new service delivery models that will ensure sustainability while providing a coordinated, interdepartmental framework that should integrate seamlessly with DHHS Strategic Directions and Tasmania's Health Plan. The Plan has three parts.

Part One: The Tasmanian State Plan for Renal Services 2010 –2020

Part One provides an overview of the findings and puts forward objectives and strategies in an action plan, designed to establish an equitable, quality and responsive service for all Tasmanians.

Part Two: Challenges for the Department and Future Projections

Part Two explores the current situation in Tasmania, with a focus on how renal services integrate with other services and health sectors, compares service delivery models and health status, and discusses future predictions of need.

Part Three: Economic Modelling Report: Modelling the Current and Future Costs and Benefits of Renal Replacement Therapy in Tasmania

Part Three explores the potential impact of changing the current renal health service delivery patterns within Tasmania and the resulting costs and health benefits to 2020.

SCOPE, METHODOLOGY AND GOVERNANCE

The Tasmanian State Plan for Renal Services (TPRS) has been developed to inform the Department of Health and Human Services (DHHS) and Tasmanian Government. The Plan recommends a best practice course of action to deliver a high-quality and equitable service for all Tasmanians while addressing the predicted future demand for CKD and ESKD care and therapies.

The TPRS was developed with consideration of two key Tasmanian documents: DHHS Strategic Directions 09-12[3] and Tasmanian Health Plan 2007[4].

The TPRS accords with the Vision expressed in the DHHS Strategic Directions document: *High quality, safe services for the people of Tasmania when they need them, so they can live well and live longer.*

The objectives of the DHHS Strategic Directions 09-12 are reflected in the TPRS:

1. Supporting individuals, families and communities to have more control over what matters to them.
2. Promoting health and well-being and intervening early when needed.
3. Developing responsive, accessible and sustainable services.
4. Creating collaborative partnerships to support the development of healthier communities.
5. Shaping our workforce to be capable of meeting changing needs and future requirements.

In addition the service delivery principles outlined in the Tasmanian Health Plan 2007 and subsequent Clinical Plan, Update 2008 prescribe how health services in Tasmania will be delivered and underpin the TPRS.

Health services will be:

- As close as possible to where people live, if services can be delivered safely effectively and at an acceptable cost
- Appropriate to community needs
- Client and family focused
- Integrated through effective service coordination and partnerships between providers and
- Designed for sustainability.

The Health Plan makes particular mention of the need to embed sustainability measures within any services arising from the public hospitals. These measures include ensuring:

- Sufficient patient volume to maintain skill and competence of health care professionals
- Staffing structures can withstand temporary shortages without excessive cost or burden
- Access to quality equipment and facilities and appropriate access to necessary clinical and non-clinical support services
- Costs are reasonable and able to be managed within available resources and competing demands and
- Transparent and predictable funding allocations

There are a number of other key Tasmanian documents that inform and support the TPRS. These include:

- Clinical Services Plan: Update 2008
- Working in Health Promoting Ways: A Strategic Framework for Tasmania 2009-2011
- Development of a Chronic Disease Strategy for Tasmania: Background Paper
- Caring through Partnerships: Community Sector Strategic Plan
- E-Health and e-Communities

While this Plan concentrates on one clinical service – renal health – it acknowledges that CKD and ESKD are products of an increasing global incidence in chronic disease. Many of the prevention and early intervention strategies for cardiovascular disease, hypertension and diabetes can significantly slow the progress of kidney disease and associated health complications. Therefore, synergy with broader statewide chronic disease agendas and strategies is essential.

For the purposes of the TPRS, the renal health continuum spans:

- CKD identification, early intervention, education and management including referral patterns
- ESKD education and management including self-care therapy options in Haemodialysis (HD) and Peritoneal Dialysis modalities
- Kidney transplantation and management
- Palliative Care

The methodology used to develop the TPRS included the following components:

- Reviewing state and DHHS Strategies, Frameworks and Service Plans along with regional Clinical Plans and Business Cases
- Review of national and international renal strategies and polices relating to CKD and ESKD management
- Analysing interstate renal programs, initiatives and evidenced-based practices
- Evaluating quality, capacity and service linkages including primary sector integration of current services through analysis of activity data, workforce and service capacity mapping and regional and state plans to determine gaps and duplications
- Analysing workforce supply, sustainability measures and benchmarking comparisons.
- Reviewing and critically analysing Tasmanian patient demographics, incidence and prevalence rates and projections
- Determining service ability to implement best practice models, quality assurance measures and monitoring and evaluating cycles within current resources

- Predicting future demand and evaluating effects of changes to service delivery from current patterns
- Developing recommendations for future service delivery and resources required in order to realise efficiency and financial gains
- Determining opportunities for private provider collaboration to increase system capacity and improve service options
- Key stakeholder consultation to identify opportunities, barriers and solutions to improving service coordination and capacity
- Development of a Strategic Action Plan (2010-2020) designed to improve the statewide delivery of renal services and patient outcomes

The TPRS considers mechanisms to improve early detection and management; enhance multi-disciplinary care integration; implement optimal service delivery models including a shift to home-based and self-care therapies; develop sector linkages across the continuum of care necessary to ensure sustainability; and improve patient choice and maximise health outcomes. Key stakeholders were consulted in the development of the TPRS, which meets best practice and national benchmarks, to ensure the viability of Tasmanian Renal Services throughout the next decade.

The objectives of the Strategic Directions 2009 - 2012 and the principles for Tasmania's Health Plan have been outlined in Table 1 and 2 and align with implementation principles for the TPRS.

The purpose of this table is to illustrate the 'fit' of a statewide renal service within current Tasmanian Strategies and Frameworks, highlighting how the TPRS implementation will be supported and facilitated by other key Tasmanian documents.

Table 2: Alignment between TPRS and DHHS Strategic Directions and Service Delivery Principles

Objectives and Delivery Principles	Renal Services Implementation
Principle: *As close as possible to where people live, if services can be delivered safely effectively and at an acceptable cost* Objective 1: *Supporting individuals, families and communities to have more control over what matters to them.* Objective 2: *Promoting health and well-being and intervening early when needed*.	Greater focus on early detection, education and outreach services to • Promote informed decision-making around treatment options • promote and support home based therapies • promote and facilitate uptake of transplantation • support outreach services.
Principle: *Appropriate to community needs* Objective 1: *Supporting individuals, families and communities to have more control over what matters to them.* Objective 2: *Promoting health and well-being and intervening early when needed.*	Creative service delivery strategies to ensure renal services are: • delivered to national standards • provided equitably across the state • decentralised utilising outreach services, community centres and rural hospitals • incorporate non-health facilities and private/public partnerships.
Principle: *Client and family focused* Objective 1: *Supporting individuals, families and communities to have more control over what matters to them.* Objective 2: *Promoting health and well-being and intervening early when needed.*	Informed decision-making by patients and families through: • earlier identification and management of renal disease • access to a multi-disciplinary team and support clinical services • promotion of holistic management of the patient and family rather than a treatment focussed approach.
Principle: *Integrated through effective service coordination and partnerships between providers* Objective 1: *Supporting individuals, families and communities to have more control over what matters to them.* Objectives 4: *Creating collaborative partnerships to support the development of healthier communities.*	Integrate renal services across the health sectors through: • partnerships with primary health services and other tertiary services (surgical and radiology). • development of comprehensive communication strategies • establishment of shared management and education protocols • pro-active and pre-emptive management of clinical conditions
Principle: *Designed for sustainability* Objectives 3: *Developing responsive, accessible and sustainable services*	Establishment of a cross departmental governance structure to • ensure the service is integrated across health sectors • oversee implementation, monitor and evaluate financial and activity data • promote pro-active, responsive and accountable service.

Table 3: Alignment between TPRS and DHHS Strategic Directions and Service Sustainability Principles

Objectives and Service Sustainability Principles	Renal Services Implementation
Principle: *Sufficient patient volume to maintain skill and competence of health care professionals* Objective 3: *Developing responsive, accessible and sustainable services.* Objective 4: *Creating collaborative partnerships to support the development of healthier communities*. Objective 5: *Shaping our workforce to be capable of meeting changing needs and future requirements*.	Establish state wide service to • ensure equitable service provision across state • standardise protocols to promote policy driven service rather than individual based • develop cross organisational procedures for timely access to services not available on site.
Principle: *Staffing structures can withstand temporary shortages without excessive cost or burden* Objective 5: *Shaping our workforce to be capable of meeting changing needs and future requirements*.	Promote the development of new renal roles and services by: • establishing a renal recruitment and training program • ensuring workforce replacement keeps abreast of clinical demand and staff attrition due to retirement. • promoting flexible staffing models eg ENs, dialysis technician and nurse practitioners • promoting home-based therapies (lower staff to patient ratios).
Principle: *Access to quality equipment and facilities and appropriate access to necessary clinical and non-clinical support services.* Objective 3: *Developing responsive, accessible and sustainable services.* Objective 4: *Creating collaborative partnerships to support the development of healthier communities.*	Resource service areas so staff can focus on their core duties with: • non-clinical support eg clerical, patient assistants, business managers • operational support eg infrastructure, information technology equipment and vehicles. • exploration of private/public partnerships and contracted services for satellite services
Principle: *Costs are reasonable and able to be managed within available resources and competing demands.* Objective 3: *Developing responsive, accessible and sustainable services.* Objective 4: *Creating collaborative partnerships to support the development of healthier communities.*	Reduce renal expenditure and promote cost efficiencies by: • promoting early identification and management of people with renal disease to stream line the patient journey • decentralising satellite services away from tertiary facilities • increasing uptake of self-care therapies and transplantation
Principle: *Transparent and predictable funding allocations* Objective 3: *Developing responsive, accessible and sustainable services.*	Provide clinicians and service delivery areas with • equitable and predictable funding allocations • an understanding of budget allocation methods • access to accurate monthly expenditure reports.

FUTURE DIRECTIONS AND PRIORITIES

The following Objectives and Strategies form the basis of the Tasmanian State Plan for Renal Services (TPRS). The TPRS addresses renal health service delivery with consideration of how integration will occur in keeping with other key Tasmanian health documents. The Objectives of the TPRS align with the DHHS Strategic Directions and are underpinned by the principles prescribed in Tasmania's Health Plan, aiming for a patient focussed, coordinated, responsive and accountable service.

The implementation of a statewide service is viewed as necessary to eliminate the inequities in current service delivery. A statewide service is predicated on a governance structure that will provide a pathway for accountability, a transparent funding framework and oversee the quality assurance processes necessary to establish and maintain an accessible, equitable and quality service that is responsive to patient needs. This will include standardisation of procedures, protocols and programs governing service delivery across Tasmania as well as the development of a reporting framework into which activity monitoring and clinical and performance indicators from all renal services will be fed.

The structure for a Statewide Service will include a hub and spoke model with specialist renal services based at RHH and LGH. This includes

- nephrologists
- CKD education, management and referral
- base for the multidisciplinary team consisting of CKD educator, social worker, dietitian and pharmacist
- transplantation education, work-up and post operative management
- acute dialysis and renal investigative services
- collocation of other specialist services such as vascular and interventional radiology.

The maintenance haemodialysis and home therapies training and support will be delivered off-campus and in line with the principles of the Tasmanian Health Plan, will promote services closer to home.

The North West Renal Unit at Burnie should continue to be supported from the LGH service hub. The establishment of new renal nursing positions and increased linkages between the North, North West Area Health Services and a statewide renal service, will build renal service capacity across the North West and increase the treatment options for people within this region. Small satellite services – particularly self-care rooms – established in community hospitals or Integrated Care Centres may be supported in the future.

The ability to predict where services will be required in the future will always be problematic but more so in Tasmania where there are data quality issues in the service areas regarding patient numbers with advanced CKD (Stages 4 and 5). The lack of sound data precludes the ability to meaningfully predict demand for dialysis services by community or geographical area.

These data quality issues include lack of completeness of population coverage (especially for the North-West and North), the requirement that a patient be referred to a nephrology service and then onto the CKD educators to be captured within the data collection; and the fact that approximately 1 in 4 new ESKD patients are still referred late – that is first seen by the nephrology service within 3 months of commencing treatment.

The establishment of appropriate referral processes and data bases to assist with the management and analysis of patient numbers is crucial to forward planning and strongly recommended.

Governance Structure

The Governance structure of the statewide service (see Appendices) would include the following:

Overarching Renal Governance Group

- CEO's of Area Health Services, DHHS representative, Director of Renal Services. Responsible for championing strategic direction, service development and service planning, funding stream and monitoring of performance indicators.

Director of Renal Services

- Responsible and accountable for statewide service to achieve high quality, equitable and accessible service.

Implementation Officer and Secretariat

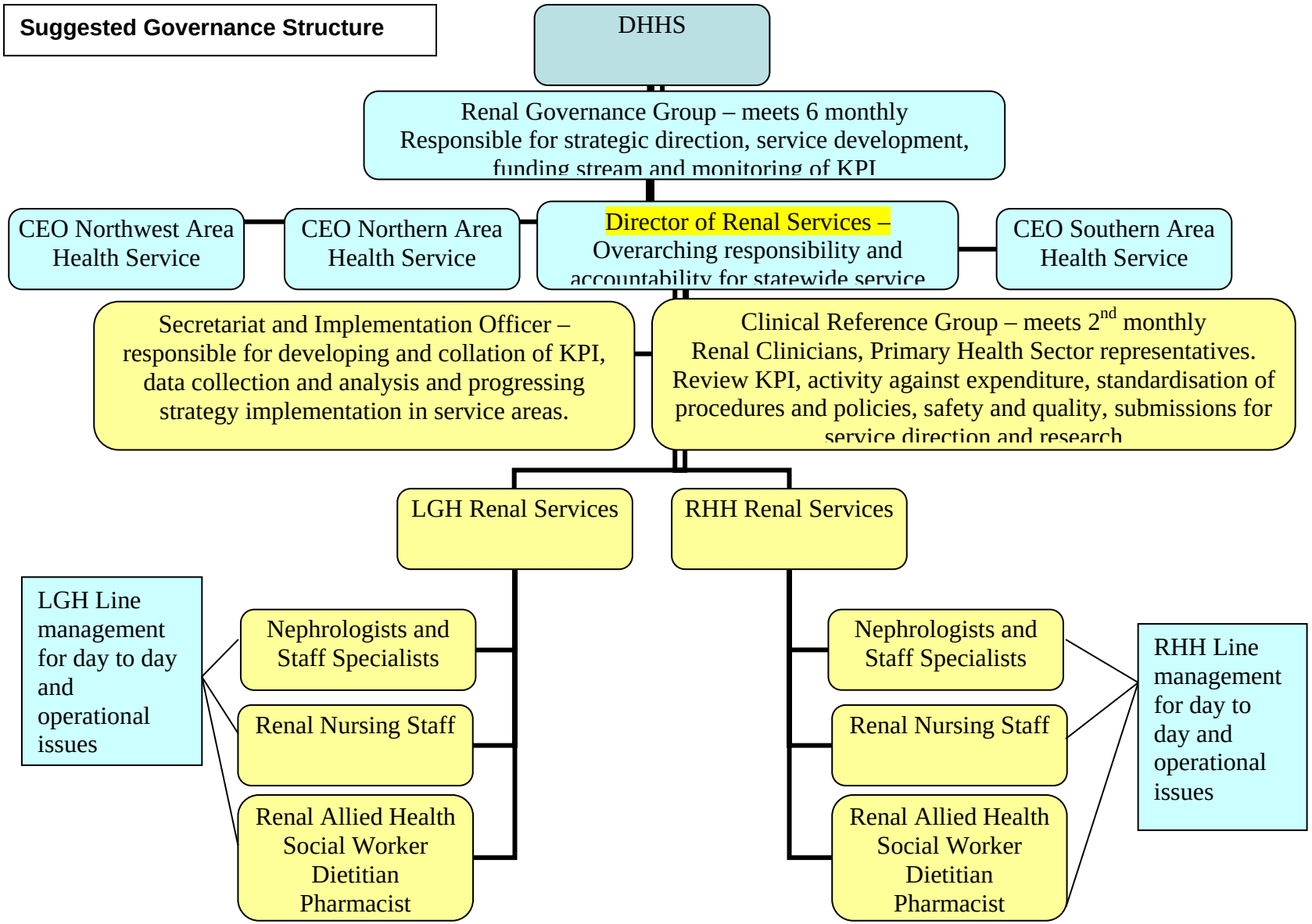
- Assist Director achieve consensus across services in standardising procedures, policies and performance indicators. Provide a key role in implementation of renal strategy, collection and analysis of all activity and financial data. Develop statewide tenders, submissions and proposals and provide Secretariat for Clinical Reference Group and Renal Governance Group.

Clinical Reference Group

- Made up of senior clinical representatives from each hub and satellite service, primary health sector representatives and other stakeholder representatives as required.

A diagram of the suggested governance structure for renal services has been included. For the full justification of a statewide service, governance structure and suggested performance and clinical indicators see the Appendices.

Suggested Governance Structure



Improving Accessibility

Renal services cover the continuum of care and the very nature of the disease requires coordination and integration with services across health sectors and disciplines. Robust communication plans, shared protocols and management strategies will assist with service integration, identifying gaps and duplication in service delivery. A governance structure as recommended here will facilitate integration with health services, particularly with ancillary services such as surgery and radiology, and across sectors into primary health and palliative care.

The establishment of the multidisciplinary outreach team will also be integral to facilitating the networking and integration required to better support the patient across the continuum of care.

Haemodialysis is an expensive and resource intense therapy. Avenues to support and encourage patients in self-care treatment options, including transplantation, that offer better patient outcomes, quality of life and decreased health care costs, should be a priority. A shift in patient modalities and management strategies is advocated to reduce the demand for expensive institutional dialysis and increase opportunities for patients and their families to make informed choices about their health care treatments.

In order to determine the impact on costs and health outcomes of changes in the clinical management of ESKD, current costs and benefits must be defined and estimated. A number of analyses have been conducted to examine the effect of changing patterns of RRT modality on costs and health outcomes in Tasmania. Specific questions address the effect of increasing transplant rates, and the effect of different proportions of patients receiving alternative dialysis modalities, such as home haemodialysis and peritoneal dialysis.

Resourcing

A staff plan and budget has been developed based on current knowledge of service cost and activity. The staff plan and budget was then extrapolated out to 10 years (broken into three time frames) providing costs and resource requirements based on the ‘Do Nothing’ strategy versus implementation of recommendations.

These analyses clearly identify the benefits for patients and the service which are achievable with quite modest resource outlays in the first year. This initial outlay sets up the service for coming years with minimal further resource requirements despite the growth in patient numbers.

Conversely, the ‘Do Nothing’ scenario will result in significant additional capital and staff requirements to manage the growth in the more expensive tertiary dialysis services.

Part Three of this document has taken the perspective of the health care funder and has modelled the health sector costs of providing RRT on the basis of the best available data. These take into account personnel, interventional, pharmaceutical, diagnostic, infrastructure, maintenance and consumable item costs. The cost of management of comorbidities such as diabetes mellitus, ischaemic heart disease and cancer have not been modelled, as these costs and their contribution to the costs of ESKD are not readily identifiable. It is likely that costs associated with lost earnings and productivity, and other out of pocket costs of patients and families such as the cost of carers, travel and over-the-counter medications are very large. Due to a lack of available data, it has not been possible to quantify these costs in this document.

Cost models were undertaken for both incidence and prevalence projections and demonstrate the cost-effectiveness of shifting treatment modalities to self-care therapies. Increasing

transplant rates by just 10% demonstrated incremental cost savings and is likely to result in improvements in quality of life.

The resources described within the TPRS are integral to the success of the implementation and achieving the efficiency and financial gains promised. The cost of self-care and home based therapies including transplantation are far less than providing institutional dialysis. However these programs will not be sustainable without the dedicated resources to ensure quality training and support for patients in the community. Similarly, the provision of an outreach multidisciplinary service promotes early identification and management of people with renal disease, facilitates informed decision making and limits unplanned and expensive usage of health services. The combined resources form a quality service that meets the community's need of improved access and decentralised service delivery and in so doing decrease costs to the patient, community and health service.

The objectives and ensuing strategies should guide Tasmania's Renal Services to the year 2020.

OBJECTIVE ONE

Provide a coordinated and responsive approach to service delivery

Health services in Tasmania are provided according to the three DHHS Areas – Southern, Northern and North-West Area Health Services. The population is fairly evenly divided between the two referral hospitals with LGH providing the majority of renal services for the people living in the North and North West Areas of the state. Approximately 50% of Tasmania's population are in the Southern Area Health Service, with the majority residing in Hobart and the surrounds. The population in the north is more dispersed and spreads out from Launceston to the coastal regions between Burnie and Devonport.

Renal Services are identified in the Clinical Services Plan as a Regional Service rather than a Statewide Service, with LGH responsible for the Northern Area Health Service and the provision of outreach services to the North West Area Health Service. Specialist services not provided by LGH, such as acute vascular surgery and interventional radiology, are provided on a referral basis by RHH. In some instances, renal patients at LGH have been referred to interstate facilities for specialist treatments (other than transplantation) based on patient and specialist preference. Transplantation does not occur in Tasmania and the Royal Melbourne Hospital (RMH) in Victoria, in collaboration with DHHS, provides transplantation services for Tasmanians at RMH including a visiting transplant assessment team to both RHH and LGH.

Renal Services delivered from RHH and LGH operate independently of each other. Services are not coordinated in terms of resource management, patient flow, funding structures or approved program activity, with monitoring and quality assurance processes varying markedly between the two areas. In addition both areas rely upon external funding for specific positions not funded by DHHS. There is an obvious inequity between services funded and supported from each hospital and LGH, which has responsibility for outreach services to the widely dispersed northwest of the state, has the lesser resources. Fluctuations in service activity or resource availability at LGH have a significant impact on services delivered and supported in Burnie.

Providing stand alone specialist services, from RHH and LGH, in a relatively small jurisdiction is false economy. The lack of ability to provide equitable access to services, and the inability to mobilise resources as needed, results in the contraction of renal services into the tertiary facilities and thus high cost and resource intense treatments.

The Statewide Plan for Renal Services recognises that Tasmania would benefit from a statewide approach to service development and management, to ensure equity of access and service quality for all Tasmanians.

A true statewide service is predicated on a governance structure that has broad stakeholder input and representation and financial and planning influence. The governance structure should be accountable for reviewing activity and financial data and key quality indicators from all service areas, ensuring the data is fed into DHHS planning and budgetary cycles. Inequitable service provision, shortfalls in resources and variations in quality of service across the state would be readily discernible and addressed in a proactive manner.

A Director of Renal Services, accountable to the governance group with representation from all regions, should be charged with ensuring services are equitable, supported by standardised procedures and that key data sets can be utilised to monitor service performance. The Director should report regularly to the governance group upon delivery of these objectives. It is unlikely that such a restructuring of renal services can be delivered without the development of a Statewide Renal Service.

Objective 1: Provide a coordinated and responsive approach to service delivery

Strategies	Action	Responsibility	Time Frame
a). Establish a suitable coordination structure that addresses service planning, decision-making, implementation and an accountability framework for renal services across Tasmania	1. Establish a Governance Structure (Renal Leadership Group) inclusive of clinical, management and policy stakeholders from Acute and Primary Health Sectors.	Renal Leadership Group	12 months
	2. Establish clear and agreed lines of accountability and responsibility for service standards at all levels		12 months
	3. Confirm new structure with Director of Renal Services		12 months
	4. Establish annual service planning cycles based on sound activity data and projections.		12 months
	5. Utilise planning and budgetary cycles to ensure infrastructure necessary for renal programs is planned for and provided as capacity dictates.		1-2 years
	6. Establish minimum service standards guidelines and resources applicable across disciplines and specialist services such as surgery and radiology.		1-2 years
	7. Identify gaps in service delivery in order to share resources and prevent duplication of programs between partners and stakeholders.		1-2 years
b). Standardise audit mechanisms governing the delivery of clinical practice across Tasmania	1. Identify activity and clinical reporting to be undertaken by each renal area and within each unit	Renal Leadership Group and Senior Renal Clinicians	12 months
	2. Standardise procedures and protocols for renal clinical services across Tasmania.		1-2 years
	3. Develop Performance and Clinical Indicators linked to evidence-based practice and national guidelines		12 months
	4. Establish a reporting and action framework for the monitoring and evaluation of all service data that promotes early intervention if targets are not met.		1-2 years
c). Identify areas that require structural change, operational change and resource support and incorporate these actions into the implementation plan	1. In collaboration with Hospital administrations and relevant work areas assess renal units space, utilisation practices and activity against occupational and safety standards, infection control and available best practice standards.	Renal Leadership Group	1-2 years
	2. Assist with the development of action plans for each area, setting priorities to be incorporated into each hospital and unit business plan		3-5 years
	3. Facilitate the development of costings for each recommendation providing suitable and adequate justifications, for approval by DHHS.		3-5 years

OBJECTIVE TWO

Integrate Renal Services across the continuum of care

Tasmania has an ageing, socioeconomically disadvantaged population with growing health needs and evidence of significant levels of undiagnosed chronic kidney disease. The divergence between estimates of the number of people with CKD and the uptake of dialysis services suggests that many Tasmanians with CKD are dying prematurely of heart disease or making choices not to access renal replacement.

The State Plan for Renal Services recognises the need for renal services in Tasmania to have better integration and communication across the health sectors to improve the detection and community-based management of people with CKD. This necessitates the development of partnerships with Primary Health (GPs, Practice Nurses, community health centres) and secondary services to promote opportunistic screening, early identification, management and referral guidelines to improve clinical outcomes and promote a seamless service.

Kidney disease is often accompanied by other chronic conditions such as diabetes, hypertension and cardiovascular disease, which can be precursors to, or co-morbid conditions associated with, kidney disease. Opportunistic screening of high-risk groups to detect risk factors for and early manifestations of chronic disease is recommended. Such high-risk groups would include people over 50, people with diabetes and hypertension, people who are obese, people who smoke and Aboriginal and Torres Strait Islander Australians.

An effective primary care sector is the key to successful detection and management of CKD. Evidence of the broader health and financial benefits of opportunistic screening and early identification has led to the development of primary health screening guidelines and automatic pathology reporting of estimated glomerular filtration rates (eGFR) based on creatinine levels.

Full uptake and implementation of screening guidelines has not happened consistently across Australia and many jurisdictions have recognised the need for tertiary renal services to support health practitioners in the primary health area through targeted education, resources and communication strategies. The strategies acknowledge that there are multiple opportunities for identification and management of renal disease that, while not reversing the condition, can delay progression to ESKD and prevent premature death from cardiovascular disease.

Strategies include formalising networks between primary care and renal services, establishing mentoring and education programs, bringing primary health staff into outreach clinics and renal services staff into primary care, using telehealth, e-health and electronic shared health records (ESHR), case conferencing and shared patient management plans. In many jurisdictions, these strategies have been facilitated by the establishment of outreach multidisciplinary renal teams that include a nephrologist, chronic kidney disease nurse, social worker and dietitian. Kidney Health Australia (KHA) has dedicated educational programs for GPs and educational material for patients designed to assist them manage their own care.

In terms of service needs, renal disease crosses the continuum of care from primary to tertiary services including palliation and requires a multi and cross-disciplinary approach to management. Early renal disease education in the primary health sector enables a patient and their family to make informed decisions about RRT options. Early education and appropriate referrals to allied health can prepare patients and their families for the changes ahead and can result in substantial improvements in health outcomes.

Early referral assures a planned progression along the continuum of care, enables linkages to appropriate support services and ensures other tertiary services such as surgery and radiology

are accessed in a timely manner. Patients commencing treatment with an established vascular access utilise less acute services particularly in the length and cost of hospitalisation and have improved morbidity and mortality rates.

Evidence also suggests that timely patient and family education can empower patients to choose self-care options including transplantation rather than accepting facility based haemodialysis as the default choice.

A CKD nurse provides substantial support to a nephrologist in terms of facilitating the education of staff within the primary health sector, implementing and monitoring management plans and educating patients. The position is pivotal in integrating services across sectors and ensuring timely referrals to dietary, social support and surgical services. Many jurisdictions in Australia have recognised the importance of the CKD nurse position and have followed North American and Canadian initiatives to develop the nursing position to a Nurse Practitioner to play an integrated but more independent role in the monitoring and management of people with early CKD[5].

Objective Two recognises that early identification of CKD is simple and cost effective and multiple entry points for improved patient management exist along the continuum of care. It acknowledges the importance of providing early information, education and support to people with chronic disease so that people can retain or regain control of their health care decisions. A whole of service approach with appropriate support and assistance to health professionals in a variety of settings, is necessary and underlines the importance of the multidisciplinary team in facilitating this care across the continuum. This will necessitate the establishment of comprehensive communication strategies, shared protocols and sound working relationships based on cross agency and interdepartmental collaboration and coordination.

Objective 2: Integrate renal services across the continuum of care

Strategies	Action	Responsibility	Time Frame
a). Promote importance of continuity of client care through establishing and maintaining links (shared protocols, education frameworks) between levels of care.	1. Encourage GPs and GP practices to utilise case conferencing, case management and other Medicare reimbursable items to increase identification and improve management of people with CKD.	Senior Clinicians	1-2 years
	2. Coordinate and liaise with GPs and GP Networks in the design and usage of CKD management and referral guidelines		1-2 years
	3. Design multidisciplinary Management Plans to include specific referrals to Social Worker, Dietitian, Surgeon, Access Nurse and Transplant Nurse.		1-2 years
	4. Ensure management plans support informed decision-making regarding treatment options including transplantation and palliative care.		1-2 years
	5. Monitor and ensure referrals are made in a timely manner to facilitate smooth transition to renal treatment services through development of Performance Indicators.		1-2 years
	6. Establish outreach multidisciplinary clinics to Integrated Care Centres, Tier One and Tier Two facilities to decentralise CKD monitoring and improve links with primary health.		1-2 years
b). Improve primary health care staff awareness of education about CKD.	1. Support the establishment of CKD Nurses Practitioners in each region to promote and assist with early education and management of CKD.	Renal Leadership Group and Senior Clinicians	1-2 years
	2. Provide early and frequent access to the multidisciplinary team to support patient and families make informed choices regarding treatment options including transplantation and palliative care.		1-2 years
	3. Establish regular education sessions for GP Practices and CHC staff through linkages with Kidney Check Australia Task Force (KCAT), CKD practitioner and CKD workshops.		1-2 years
	4. Work collaboratively and productively with stakeholders to develop, share and utilise resources to promote good health, early identification and management of chronic diseases.		1-2 years
	5. Promote and support Chronic Disease Strategy and Working in Health Promoting Ways Framework into the primary health sector.		1-2 years
c). Develop comprehensive and robust communication plans across health care sectors, organisations and regions.	1. Identify the format, usage and location of chronic disease registers and recall systems in primary health and GP practices and ability to feed into a single register across Tasmania.	Renal Leadership Group and Senior Clinicians	1-2 years
	2. Develop mechanisms for sharing information between health sectors and disciplines regarding patient information and management protocols.		3-5 years

OBJECTIVE THREE

Develop a sustainable and equitable statewide renal service

Objective Three aligns with the Clinical Services Plan and reinforces the measure of fair and equitable service delivery. Renal programs are not funded consistently across Tasmania or to national benchmarks. Service delivery in some areas is costly and inefficient. A restructuring of the service is warranted to ensure service delivery is patient focussed, effective, efficient and is able to maintain a high-quality service despite fluctuating demands in activity.

Externally Funded Programs

The renal industry in Australia (primarily pharmaceutical companies) has supported many renal services in the states and territories by funding staff and programs within renal units, with the intent to improve the coordination of patient care. Some of these positions, notably the Chronic Kidney Disease nurse and the Access Nurse, have proved highly effective in their roles demonstrating improved health and financial outcomes with a decrease in the utilisation of tertiary services. There are part-time examples of these positions in Tasmania, with the part-time CKD RN at RHH and the part-time Access RN based at LGH. The role of the Access RN includes monitoring all CKD and established dialysis patients to facilitate timely access to surgical services and collate quality data on infection rates, access failure rates and invasive and non-invasive interventions. The position works closely with the nephrologists, surgeons and patients to coordinate access planning and theatre scheduling and in some states, this includes facilitating and coordinating the decentralisation of surgical procedures to rural inpatient facilities.

However, such industry funding was designed as ‘seed’ funding with the intention being to demonstrate the benefits of the position in the initial phase and thereby justify the ongoing funding from the public sector. There is sufficient clinical need and evidence regarding effectiveness of the service to warrant a full time combined (CKD/Access RN) position for each region. The positions would focus on coordinating the integration of renal services across sectors, ensure education and management protocols are implemented and monitored and that patients are referred in a timely manner to the necessary clinical and support services. The benefits include financial and health outcomes and relate to:

- a decrease in late referral of renal patients which will improve morbidity and mortality outcomes,
- Earlier referral to clinical (dietitian, self-care therapies and surgical) and support (social worker, palliation and psychologist) services to promote mental and physical preparedness for treatment
- An increase in the number of people starting dialysis with a permanent dialysis access, associated with improved morbidity and mortality outcomes,
- An increase in the uptake of transplantation, home therapies and advanced care planning,
- Improved monitoring of established patient’s dialysis access to pre-empt issues requiring hospitalisation, and
- Decentralisation of clinics to increase attendance and reduce patient travel times and out of pocket costs.

Multidisciplinary Renal Team

The renal multidisciplinary team, consisting of a nephrologist, CKD RN, Social Worker and Dietitian, are pivotal to improving the coordination of the patient journey across the continuum of care and facilitating the integration of renal services across the health sectors. The role, including their influence on patient management and outcomes, of Allied Health workers in the multidisciplinary team (Social Worker and Dietitian) is often underestimated.

Social Workers offer invaluable support to patients and families in preparing them mentally and emotionally for treatment. Patients and families struggle with decisions and arrangements relating to changes in income support, maintaining employment while adhering to treatment regimes and determining transport or residential arrangements in order to be closer to treatment. Social Workers are trained to provide counselling, assist patients and families with Advanced Care Planning and make linkages to appropriate support programs and services including palliation.

The Renal Dietitian's role is to provide advice, education, recipes and even cooking lessons to assist patients and their families make the substantive changes required in dietary intake. The role of dedicated renal Allied Health personnel is recognised nationally and internationally and evidence-based guidelines and staffing benchmarks exist.

Self-care Programs

The TPRS advocates decentralising services and providing the necessary support to improve the uptake of self-care therapies. This will enable people to access services as close to home as possible and where they have the most support. Self-care therapies require lower infrastructure and staffing ratios than institutional or satellite dialysis.

Peritoneal dialysis training can be accomplished in the home and while it is possible to also do this for home HD, the minor infrastructure changes necessary in the patient's home require a level of certainty regarding the success of the training program and the commitment from the patient. Therefore a dedicated self-care training facility that more closely reflects the patient's home situation is required. Many jurisdictions move their training off campus or to the periphery of satellite services to promote a sense of wellness and independent nature of the treatment regime.

Self-care therapies have better health and quality of life outcomes for patients and are significantly less expensive to deliver. Ensuring costs incurred by patients choosing these therapies are minimal will promote this as a viable form of treatment. Infrastructure changes to patients' homes, such as minor works for plumbing and electrical upgrades, should be borne by the department as the long term savings far outweigh the minor costs of this work. In addition various forms of reimbursement should be considered as haemodialysis machines utilise considerable amounts of water and electricity. In some states reimbursements and discounts on outlays in essential services are provided by the relevant authority, while in other jurisdictions, the renal service may offer reimbursement based on a calculation of usage.

Sustainability of these programs includes adequate staffing ratios to ensure patients are supported and monitored once they are at home. It is imperative that the benefits of delivering a well supported self-care program are recognised as the cost of managing the same number of patients within a satellite service are far greater and include higher staff requirements, operational outlay and capital infrastructure. Staff plans should cater for growth and allow automatic increases in staffing levels as patient numbers increase. This will enable services to

continue unhindered. A recommended staff plan for self-care home haemodialysis and peritoneal dialysis has been developed and discussed with the DHHS..

Increasing Transplantation Rates

Transplantation has the best outcomes of all RRT and increasing the number of people receiving a kidney from either a live or deceased donor is a priority. Organ Donor Coordinators have been established in several jurisdictions and a National plan to establish clinical directors and nursing organ donor coordinators in each state and Territory is currently being rolled out. Tasmania has already recruited to these positions. Organ Donor Coordinators provide a key role in the clinical setting offering education and support to families and liaising closely with clinicians to identify potential donors. They can have substantial influence on the rate of organ donations and South Australia attributes their high organ donor rate to the impact of their Coordinator.

Donor coordinators are not attached to clinical services as a certain degree of separation needs to exist to ensure impartiality. However, dialysis and pre-dialysis patients and their families still require education to understand the assessment process for transplantation and support to negotiate the interstate transfer procedures for transplantation and post-operative management. Increasing the number of live donations and improving transplant outcomes is facilitated by earlier education and referral for assessment. Longer waiting times on dialysis are associated with poorer morbidity outcomes.

The financial benefits of shifting the uptake of renal treatments from institutional dialysis to self-care therapies and transplantation will be substantial. Cost savings will be realised in reduced recurrent costs and elimination of capital expenditure.

Operational Support

A considerable amount of time and effort in any dialysis service is devoted to data capture, machine preparation, coordination of support services and in the case of the home therapies, travel. Without adequate clerical and non-clinical support, nursing staff are obligated to take on these roles which then impacts on their available time to deliver clinical services. The lack of operational support such as vehicles, places a high reliance on staff to use their own resources to manage service delivery. Adequate operational support in clinical areas must be provided if clinicians are to safely and efficiently manage workflow and quality assurance processes within their allocated staffing ratios.

Effective Workforce

In recognition of the current workforce demographics that includes an older workforce, largely part-time and consisting of only registered nurses, a staff recruitment and training plan is recommended. The plan requires immediate implementation and should focus on diversifying staff profiles to include nurse practitioners, enrolled nurses and dialysis technicians. Renal nursing is broader than the technical aspects of providing haemodialysis treatment and competent skilled staff require the theoretical knowledge to support their practice. Training programs must include access to education that results in tertiary renal qualifications and the support to complete the study. An accredited renal qualification is available for Enrolled Nurses (ENs) through Vocational Education Training (VET). ENs have been identified as a group that can offer significant support to renal services across all health sectors and the training includes aspects related to screening and intervention, supporting self-care dialysis patients in the community and providing PD treatments in nursing homes and hostels. Many units across

Australia employ ENs in satellite dialysis units. Nurse Unit Managers will require support to deliver professional development and training programs and guide the change management process

Staff Plans

The service models and staffing profiles suggested here are intended to support the changes proposed to increase integration of renal services, improve coordination of patient care across sectors, decentralise services and expand the home therapies programs. The cost efficiencies and improved outcomes proposed cannot be delivered within current resources and at a minimum, services must be delivered equitably across the state. A standardising of service delivery programs, and benchmarked to national standards across Tasmania, is necessary to ensure a flexible and sustainable service.

Staff plans and budgets prepared for this report demonstrate increased capacity, accessibility and potential for improved quality of service with a very modest initial outlay.

Infrastructure requirements

Appropriate infrastructure is required to ensure that services can be delivered efficiently and effectively. Current acute inpatient provision at both RHH and LGH is costly and resource intense. RHH has a 5 bed acute inpatient unit in an ambulatory area of the hospital. Activity in this area is low to medium and the unit is not open every shift or every day. However, in anticipation of requirements and in view of the location of the facility, two or more staff are allocated. Moving the RHH 5 bed unit to an inpatient area, which is staffed 24 hrs a day, will allow efficient staff ratios when treatments are carried out in this facility. An inpatient location with immediate access to assistance for a patient or staff emergency will enable a reduction in staffing levels.

The LGH dialysis facility is located within the hospital. The dialysis unit is too small for the volume of patients being treated and does not meet the occupational and safety guidelines for an acute dialysis facility. The majority of patients attending this unit are stable and attend for maintenance dialysis. Nearly one third have some level of self-care. Only five have been identified as acute or unstable. The establishment of a satellite facility off campus and the decanting of this unit is a priority. If room permits, provision should be made to establish the self-care training programs for HD and PD in the new satellite centre. The LGH in-hospital dialysis facility, with a reduction to five stations, would become a more effective acute dialysis facility and would enable the safe manoeuvring of beds and staff around the beds, in an emergency. The in-hospital unit should be staffed on an as needs basis.

Public Private Partnerships

The establishment and delivery of satellite services and even home therapies programs by dialysis companies contracted to the public sector, is a model of service delivery that is gaining support across Australia. The three main dialysis companies in Australia have historically provided the machinery and consumables to enable the public sector to deliver dialysis treatments. Dialysis provider contracts have changed in the recent past, from purchasing machines and requiring a capital outlay, to a lease arrangement inclusive of maintenance and consumables. Invoicing is based on a set price per dialysis treatment and reimbursed according to the number of treatments completed per month. This form of contract has generally been received favourably by Health Departments as it allows service providers access to the latest

technology without capital funds; has known recurrent costs for the life of the contract; eliminates maintenance (including technical staff) and capital replacement programs and the requirement to divest obsolete technology. Further, more comprehensive contracts potentially remove the need for the development and management of multiple, costly and time consuming tenders for the gamut of consumables and machinery.

In recent years, the contracts on offer have expanded to include a variety of models that may or may not include construction or refurbishment of a facility for dialysis, staffing and management of public patients under the direction of publicly funded Nephrologists. Contracts are based on a price per treatment so the total outlay including capital is amortised over the period of the contract. Jurisdictions that have entered into this form of contracted service have noted that the dialysis companies are able to establish and deliver the service for a competitive price.

The exploration of a public private contracted service for future satellite services is worthy of further investigation. However, the importance of a well written contract cannot be underestimated and guidance should be sought from jurisdictions that have undergone this process.

Objective 3: Develop a sustainable and equitable statewide renal service

Strategies	Action	Responsibility	Time Frame
a). Develop recruitment and training strategy to ensure workforce replacement is sufficient to address challenges of staff attrition and growth in renal services.	1. Ensure all staff receive quality training from appropriately qualified Educators and within nationally recognised programs. 2. Implement supported rotations between facilities to ensure all staff have the opportunity to up-skill on a regular basis. 3. Promote and implement training for Enrolled Nurses and Dialysis Technicians in renal utilising nationally recognised VET. 4. Promote the Nurse Practitioner model and support attainment of qualifications across the service.	Renal Leadership Group and Senior Clinicians	1-2 years 1-2 years 1-2 years 3-5 years
b) Standardise renal services in line with national benchmarks and provide equitable resources across renal services.	1. Endorse the concept of multidisciplinary outreach teams and support the development of identified positions to promote integration of services. 2. Determine staff to patient ratios for Allied Health through national and international benchmarking and liaising with professional organisations. 3. Determine operational support necessary for stand alone units to provide effective and efficient service delivery eg access to vehicles, courier services, assistance with facility management 4. Identify duties that can be effectively and efficiently redirected to non-clinical staff such as clerical duties, data entry and machine cleaning. 5. Ensure infrastructure and facilities meet Health Facility Planning Guidelines. 6. Evaluate through Expression of Interest (EOI) the benefits and risks of a range of contracted satellite services that include establishment and management models.	Renal Leadership Group and Senior Clinicians	1-2 years 1-2 years 1-2 years 1-2 years 3-5 years 3-5 years
c) Identify and address barriers to provision of self-care and home dialysis therapies and attaining kidney transplants.	1. Provide access to Transplant coordinator to discuss transplant workup and living organ donation. 2. Establish appropriate self-care education and training programs, including dedicated facility, staff and suitable resources. 3. Develop educational strategies to raise awareness of potential benefits and harms and correct dubious perceptions of PD, APD, home HD and transplantation. 4. Consider onsite training for individuals to reduce travel and training time. 5. Ensure adequate support to maintain patients at home eg liaison with local CHC staff, GP practice, power and water authority, council regarding waste removal, essential services reimbursement where necessary, respite and regular contact and onsite visits from renal services.	Senior Clinicians and CEO Area Health Services	1-2 years 1-2 years 1-2 years 1-2 years 1-2 years

OBJECTIVE FOUR

Maintain an efficient and effective service

The development of information systems that support the capture, coordination and analysis of administrative and clinical data will enable health service planners to determine the future needs of renal services in Tasmania. An understanding of precursors, risk factors and the level of burden of moderate to severe CKD is essential to projecting future need and planning service development. This, together with timely and accurate capture of key indicators of renal service quality and efficiency is essential to the provision of renal services in Tasmania into the future.

A national data base for the capture of activity and information relating to patients receiving renal replacement therapy in Australia and New Zealand (ANZDATA) exists but this does not extend to pre-dialysis patients. General Practice networks and community health centres in Tasmania utilise a variety of patient recall and management systems for chronic disease. The systems are not integrated and do not readily allow the comprehensive collation of information relating to levels of chronic disease and in particular kidney disease. While it is unlikely that an integrated system that interfaces across health sectors will be implemented in the foreseeable future, it is possible for the coordination and capture of the relevant information to occur. This requires the establishment of partnerships with the GP network and community health centres to collaborate on the funnelling of pertinent information to renal services via the CKD RN. The establishment of a single data base will facilitate a more accurate determination of projections, promote targeted education and interventions and ensure earlier referrals and management of people with renal disease. The implementation of E-Health in Tasmania should be supported and monitored to assess progress and determine the ability of the system to meet the services need for shared electronic records.

Information management systems currently available to renal services do not readily provide quality data. Service areas and senior renal clinicians do not have access to their financial data including derivation of budgets, final allocation or monthly expenditure. They are unable to evaluate the cost of service provision or make adjustments to programs to create efficiencies. Further, it would appear that DHHS also has difficulty in determining expenditure by renal services as funds are derived from a number of sources and details of expenditure attributed to individual classifications within renal cost centres are not available. In order to promote a responsible and accountable service, clinicians require an understanding of budget development and skills to monitor and evaluate expenditure against activity. Access to accurate cost centre budget and expenditure reports relating to renal activity is necessary.

The collection of demographic, activity and quality patient information in each unit varies and the only standardised information relates to the number of treatments undertaken each month for invoicing purposes. Collection and collation of timely data is necessary for service planning, patient management and quality assurance purposes. Data sets and indicators developed should reflect national benchmarks and be standardised across all units to ensure equitable and quality service provision. Most jurisdictions in Australia have investigated the very same issues and a number of data bases and programs are available ‘off the shelf’ while some areas have developed their own data sets and reporting frameworks. A comprehensive investigation of what is available nationally, with cognisance of Tasmania’s IT capabilities, is warranted.

Objective 4: Maintain an Efficient and Effective Service

Strategies	**Action**	**Responsibility**	**Time Frame**
Establish a statewide reporting framework for all unit activity including known CKD statistics from primary health area.	1. Determine the needs of the service in terms of data collection, management and reporting mechanisms. 2. Establish an audit, review, action-planning cycle to assist the Governance Group plan for current and future service delivery. 3. Ensure performance and activity indicators are fed into a Governance structure that has accountability for service quality and equity across Tasmania. 4. Negotiate and develop agreements with relevant groups regarding data flow, ownership and issues such as patient consent. 5. Establish a communication plan for stakeholders.	Renal Leadership Group, CEO Area Health Service and Senior Clinicians	1-2 years 1-2 years 1-2 years 1-2 years 1-2 years
Provide the necessary resources to support clinicians and service planners to develop and maintain a responsive and effective service	1. Identify and develop the main data components and IT functions necessary for effective clinical care delivery and service planning. 2. Develop a comprehensive renal management database that is integrated across the care continuum to assist service providers with client management. 3. Promote and support research into renal service delivery issues and cost-effectiveness of care. 4. Negotiate to continue funding of current externally funded research positions within renal services.	Renal Leadership Group	1-2 years 3-5 years 1-2 years 3-5 years
Develop Performance Indicators that are evidence based and meaningful to Tasmania	1. Establish benchmarks and performance indicators for service delivery areas including activity against expenditure and clinical outcomes for quality monitoring and assessment. 2. Establish monitoring and evaluation cycles for performance and activity indicators for all components of renal services to promote early intervention if targets are not being met. 3. Provide renal unit managers with monthly budget and expenditure reports and the necessary education to ensure understanding of program funding.	Renal Leadership Group, CEO Area Health Service and Senior Clinicians	1-2 years 1-2 years 1-2 years

IMPLEMENTATION, EVALUATION AND RISK

This TPRS provides the strategic and operational directions for future renal service delivery reform and investment with the aim of improving health outcomes. The focus is on improving and standardising renal care across the continuum while providing an accessible and timely service for all Tasmanians. The desired outcome is a responsive and flexible service that can be sustained despite fluctuations in workforce availability and patient activity. The objective-linked strategies within the Action Plan identify responsibilities, resources and monitoring requirements that will support quality systems.

Tasmania would be best served by a statewide service rather than regional services. Smaller services have less capacity to absorb fluctuations in activity and staffing levels and changes magnify shortfalls in support structures and resources. Resources should be allocated to standardise service delivery and ensure an appropriate governance structure to deliver resources where they are most needed. Greater cost efficiencies will be achieved through a statewide, pro-active service that has strong and accountable governance.

The success of a Statewide Renal Service will be dependent on the manner in which a governance or renal leadership group engages with the service. The TPRS will require a champion to oversee implementation and ensure that the objectives and strategies remain current and reflect the changing health service needs of the community. The Governance Group should perform this role.

Responsible partners in implementing the TPRS are defined as follows:

- Renal Governance Group – CEO Area Health Services, Director Renal Service, DHHS representative
- Renal Clinicians
- DHHS – Policy and Financial Branch representatives
- Royal Hobart Hospital (RHH)
- Launceston General Hospital (LGH)
- Burnie Hospital
- Representatives of the GP Network

Progress in implementing the TPRS should be reported yearly, overseen by the Governance Group and dovetailed into the Clinical Services Plan: Update 2008 Implementation Plan and Reporting Framework[6].

At a minimum the reporting would utilise service activity data correlated against expenditure and performance indicators based on national evidence-based practice guidelines. Strategy achievements can be assessed against nominated timelines, capacity reports, workforce profiles and patient satisfaction surveys. The success of the TPRS will be measured by the responsiveness of the service and the ability to manage patient flow and fluctuations through proactive monitoring and analysis of data. Outcomes will include a smoother patient journey, reduced patient morbidity and mortality associated with unplanned admissions and lack of treatment preparation, reduced service expenditure and reduced capital and infrastructure requirements.

The following table (Table 3) outlines the potential risks, their level of importance or impact and strategies for minimising risk to the successful implementation of the TPRS.

Table 4: Risk and Minimisation Strategies

Risk	Level	Minimisation strategies
Failure to obtain endorsement	Moderate	Reluctance to endorse may relate to financial impact of plan. Seek engagement and support through Departmental briefings to ensure there is a clear understanding of financial costs and benefits of proposed plan.
Lack of DHHS Exec engagement and ongoing input	High	Establishment of Governance Group would ensure continued DHHS engagement and sustainability of plan.
Lack of clinical ownership, engagement and resistance to change	Low	Ensure active clinical engagement through frequent briefings and awareness sessions regarding implementation plan and expected outcomes.
Patient and carer indifference or resistance to strategic change	Low to Moderate	Promote engagement and support of Plan through regular Unit briefings and clearly outlined benefits for patients and carer.
Workforce recruitment and retention incompatibilities with service expansion.	Low	Plan workforce changes in incremental steps utilising change management strategies, creating workforce data bases and ensuring regular feedback and briefing sessions at unit level to minimise misinformation.
Difficultly reconfiguring current services consistent with strategies.	Low	Ensure all avenues are considered and rejection of any possible strategies is justifiable. Explore how other jurisdictions have achieved outcomes.
No or limited additional recurrent funding.	Low to Moderate	Ensure DHHS is cognisant of cost of current and future renal service with no changes. Stage implementation to maximise cost savings in early stages of plan.
Lack of suitable infrastructure or capital funding	Moderate to High	Seek alternatives such as minimising amount of capital required by using existing structures (medical and non-medical facilities) and entering into expanded contracted dialysis services.
Mismatch in timing between capacity expansion and demand.	High	Utilise capacity in other services to manage increased demand as a short term measure. Increase staff in preparation for new service but utilise to manage additional activity in home and community based services or in additional dialysis shifts eg night-duty
Inability to capture accurate data to support monitoring and strategic refinement.	High	Ensure DHHS aware of inefficiencies created and perpetuated through poor data collection and IT interface systems. Demonstrate the benefits of ability to monitor and analyse activity and financial data.

Risk Legend: **Low**: Unlikely scenario **Moderate**: Potential for scenario to occur

High: Strong likelihood that scenario will occur

APPENDICES

Case for Statewide Service and Governance Group

The Tasmanian Department of Health and Human Services provides all Renal Services in Tasmania, which are funded and delivered under the auspices of the Southern Area Health Service and Northern Area Health Service. There are no private dialysis facilities in Tasmania.

Current Service Delivery

Renal Services delivered from the Southern Area Health Service through Royal Hobart Hospital (RHH) and the Northern Area Health Service through Launceston General Hospital (LGH) operate independently of each other. Both centres offer, albeit to varying degrees, acute and maintenance dialysis services, access to the transplantation program and training and support of the home dialysis therapies. Currently renal programs are not staffed and funded consistently across Tasmania, and there is significant variation in the nature, quality and extent of services in each region. In addition both areas rely upon external funding for specific positions not funded by DHHS.

LGH, has responsibility for outreach services to the north and widely dispersed northwest of the state, yet has the lesser resources in terms of patient programs and specialised clinical positions including nephrologists. Fluctuations in service activity or resource availability at LGH have a significant impact on services delivered and supported in Burnie at the North West

Renal Unit (NWRU).

Further, the billing and admission procedures for same day dialysis vary across the state and have an impact on funding streams and frequency of patient reviews. RHH identifies and bills treatments as outpatients episodes with approximately 40% admitted as private patients. LGH and NWRU admit all patients for dialysis treatment as public inpatients. This policy provides an additional funding source for both RHH and the St Johns Satellite Unit although skews hospital activity data related to dialysis admissions.

With differences between the services in admission and billing procedures, as well as obvious differences in terms of nephrologist availability (from being on-site through to being several hours drive away), there is substantial variation in the frequency of specialist and other medical review. Recent specialist staffing shortfalls at LGH has exacerbated this variability and has the potential to impact on the quality of care and oversight offered to renal patients in the north and north west.

The silo structure of funding and service delivery models in renal services negatively impact on the coordination of resources, patient flow and program activity. Clinicians have little understanding of the budgetary process or access to their expenditure reports, which does not promote accountability or efficient service delivery.

Providing discreet stand alone specialist services, from RHH and LGH, in a relatively small jurisdiction is false economy. The lack of ability to coordinate and mobilise resources as needed to provide equitable access, results in the contraction of renal services into the tertiary facilities and thus high cost and resource intense treatments.

Recommendation for a Statewide Service

The implementation of a statewide service is viewed as necessary to eliminate the inequities in current service delivery. A statewide service is predicated on a governance structure that will provide a pathway for accountability, a transparent funding framework and oversee the quality assurance processes necessary to establish and maintain an accessible, equitable and quality service that is responsive to patient needs. This will include standardisation of procedures, protocols and programs governing service delivery across Tasmania, the development of a framework and data management systems for activity reporting and monitoring of clinical and performance indicators from all renal services.

Renal Services are identified in the Tasmanian Health Plan: Clinical Services Plan Update 2008 as a Regional Service with LGH responsible for the Northern Area Health Service and the provision of outreach services to the North West Area Health Service. RHH is responsible for the Southern Area Health Service. Renal Services were also initially identified as one of the Clinical Networks and then later downgraded to a Renal Forum. Both Clinical Networks and Forums were established to provide professional support to clinicians and specialists and have little service authority or power to change strategic direction or provide a coordinated service delivery response.

The Operational Framework and Protocols for Statewide, Single Site and Regional Services notes that:

"Statewide services can be delivered from a single site or multiple sites with outreach services and have a significant coordinating role, formal responsibility and accountability to the system as well as to their host hospital for their performance".

Proposed Structure

Renal Services will continue to be delivered by RHH and LGH. The two hospitals will provide the hub for specialist renal services that includes the base for the:

- nephrologists,
- CKD education, management and referral,
- multidisciplinary team consisting of CKD educator, social worker, dietitian and pharmacist,
- transplantation education, work up and post operative management
- acute dialysis and renal investigative services
- collocation of other specialist services such as vascular and interventional radiology.

Maintenance haemodialysis and home therapies training and support will be delivered off campus and in line with the principles of the Tasmanian Health Plan, will promote services closer to home.

The patient volume and geographical layout of health services in Tasmania strongly suggests that the North West region should continue to be supported by the LGH renal service hub. Increased linkages, communication and coordination of service delivery by a Statewide Renal Service will improve access to renal services across the North West. Additional renal nursing positions are advocated for, with particular emphasis on the need in the North West area. These positions will augment current service delivery and improve access for patients across the North

West. Small satellite services – particularly self-care rooms - established in community hospitals or Integrated Care Centres are more likely and could be supported in the future.

The structure for a Statewide Service will include:

Overarching Renal Governance Group

- CEO's of Area Health Services, DHHF representative, Director of Renal Services
- Meets 6 monthly
- Responsible for championing strategic direction, service development and service planning, funding stream and monitoring of performance indicators.

Director of Renal Services

- Nominated staff Nephrologist with 0.25 to 0.5 FTE allocated for administration duties
- Responsible and accountable for statewide service to achieve high quality, equitable and accessible service
- Responsible for the delivery of KPI by all service areas.

Secretariat and Implementation Officer

- Full time position to work closely with Director of Renal Services
- Responsible for the development of standardised performance indicators, implementation into each service area and reporting into single framework
- Collection and analysis of all activity and financial data
- Development of statewide tenders, submissions and proposals
- Assist Director achieve consensus across services and health sectors with the development of standardised procedures and policies that facilitate the integration of services
- Secretariat for Clinical Reference Group and Renal Governance Group

Clinical Reference group

- Made up of senior clinical representatives from each hub and satellite service, primary health sector representatives and other stakeholder representatives as required
- Meets monthly to second monthly – teleconference
- Responsible for reviewing activity against expenditure, performance indicators, identifying procedures and policies requiring development and standardisation, monitoring and acting on safety and quality issues, submissions for service direction, resources and research.

Description of proposed services

Renal Services delivered from each hub will encompass:

- Chronic kidney disease education and support of Primary health clinicians in the early identification, management and referral to nephrology services of people with chronic kidney disease
- Education and support for people with advanced CKD transitioning to ESKD through the multidisciplinary team – nephrologist, CKD RN, Social Worker, Dietitian and surgical team

- Acute renal management – acute dialysis, surgical interventions for new and established access, complications of treatment (infection etc)
- Education, preparation and support for pre-emptive, living and cadaveric transplants
- Maintenance haemodialysis in off campus facilities
- Training and support for home therapies in haemodialysis and peritoneal dialysis

Clinical Indications, disease, conditions for treatment

Kidney disease is a chronic condition often associated with other chronic conditions such as diabetes, heart disease and hypertension. Collaboration with other services and management frameworks in the care of people with CKD and ESKD is likely to realise clinical, financial and efficiency benefits. A single service approach to this collaboration will reduce duplication of services and systems.

Treatment options include haemodialysis either at home or in satellite facilities, peritoneal dialysis usually at home or supported at home and transplantation.

International and national best practice evidence

Recent initiatives nationally have recognised the need to have a coordinated and whole of service approach to renal disease management to better understand the future need and delay progression to end stage and dialysis. The burdensome nature of treatment regimes has led many jurisdictions to seek ways to provide more accessible and equitable services for renal patients while the high cost of treatment has necessitated a more quality driven, evidence-based and accountable service. This includes mechanisms to monitor and evaluate service activity, compare and benchmark performance and clinical indicators across their jurisdictions and nationally and develop transparent and responsive funding streams.

Evidence of clinical and cost effectiveness

A statewide service with relevant activity and indicator reporting promotes a planned and coordinated service delivery model and pre-empts the development of services in isolation. The relatively smaller jurisdiction of Tasmania and the proximity of the electorate to policy makers has the potential to fast track service development before there has been sufficient analysis of service needs, capacity and necessary support services. A statewide service with the appropriate reporting and governance structure can pre-empt crisis management of service development and delivery and enable a planned and responsive approach to service needs.

Estimation of likely level of demand

Predicting the future need for renal services across Australia is challenging due to the lack of complete and reliable data regarding the number and location of people with CKD who are likely to require services in the near future. In Tasmania, several research studies, plus information from pathology providers, indicate that there are significant numbers of people in the community with renal disease who have not been referred to a nephrologist and therefore are not captured within current service planning processes.

Currently there are 375 people receiving renal replacement therapy in Tasmania and this is expected to rise to 517 by 2016. This does not consider a change in referral patterns from the primary health sector. With better integration with the primary health sector and improved support and education of GPs and community health staff, it is envisaged that there will be an increase in the identification and referral of people with CKD to renal services. This will have a significant impact on the demand for renal replacement therapy.

Reporting Requirements

The following data collection would be embedded in the service and align with Statewide reporting requirements. It would be recommended that activity data is collated and reported to a single point monthly, enabling timely assessment of activity and capacity across the service. Financial data such as expenditure per unit should be provided to the service areas and correlated against the activity it funds. This would require separation of the cost codes relating to home therapies, maintenance dialysis, transplantation and chronic disease management. This also promotes accountability amongst the clinicians who manage these portfolios to effectively and efficiently utilise the allocated resources to provide a quality service for their patients.

Although an annual report is required for the Department, more frequent reporting to the Director and individual hospitals is advocated. This promotes performance reporting as routine and part of service delivery, it enables early identification of quality or service delivery issues and interventions where and when necessary. More frequent reporting is also easier to collate and manage.

Data collection and management can be accomplished with simple excel spreadsheets and does not require interconnected or complicated data bases. However, administration support will be necessary to collate and produce reports for the statewide service in an understandable and accessible format.

Financial, activity and performance indicators might include:

Activity

- Number of known people with CKD Stages 4 and 5
- Stock and flow each month — number of new patients commencing treatment and number of deaths
- Total number of new transplants by donor type
- Total number of renal patients at each site and for each modality
- Total number of haemodialysis treatments from each site
- Percentage of dialysis patients receiving a home based therapy
- Percentage of total patients with a transplant

Financial

- Monthly expenditure per unit per program
- Identification of budget against activity variance

Performance indicators

CKD

- Percentage of stage 4 and 5 CKD patients with a completed Advanced Care Plan

- Percentage of stage 4 and 5 CKD clients who have received education regarding options for renal replacement therapy including transplantation
- Percentage of stage 5 CKD patients with a dialysis access

ESKD

- Percentage of new dialysis patients who received education 3 months or more before starting treatment
- Percentage of new dialysis patients starting with a permanent access
- Percent of dialysis patients utilising a temporary access
- Number of hospital admissions immediately post dialysis – aggregated 3 monthly
- Number of ambulance retrievals from satellite centres – aggregated 3 monthly

Clinical Indicators

- Percent of dialysis patients with a urea clearance above 65%
- Percent of dialysis patients with clinical indicators such as Hb, iron, calcium, albumin within CARI Guidelines
- Infection rates per hundred patient months for:
    - Peritoneal dialysis catheters
    - Fistulas
    - Temporary central catheters
- Patient survival on dialysis – reported by ANZDATA

Other indicators are possible but collecting more is not necessarily better. The chosen indicators, frequency of reporting and method for data capture must be agreed upon by all clinical areas and fed to a single point. The analysis of the data should be fed back to the service areas at the regular Clinical Reference group meetings.

The following flow chart describes the recommended structure for a statewide renal service including the governance mechanisms. This recommended structure aligns and adheres to the Frameworks described in the Operational Framework and Protocols for Statewide, Single Site and Regional Services.

These Frameworks have also been reproduced here to illustrate the renal services proposed alignment with this policy.

The Service Capability Framework has been modified to demonstrate the justification for a statewide renal service. The Characteristics of a Statewide Service have not been reproduced here but fit with how the governance structure and management of the service would integrate.

Statewide Renal Service Structure

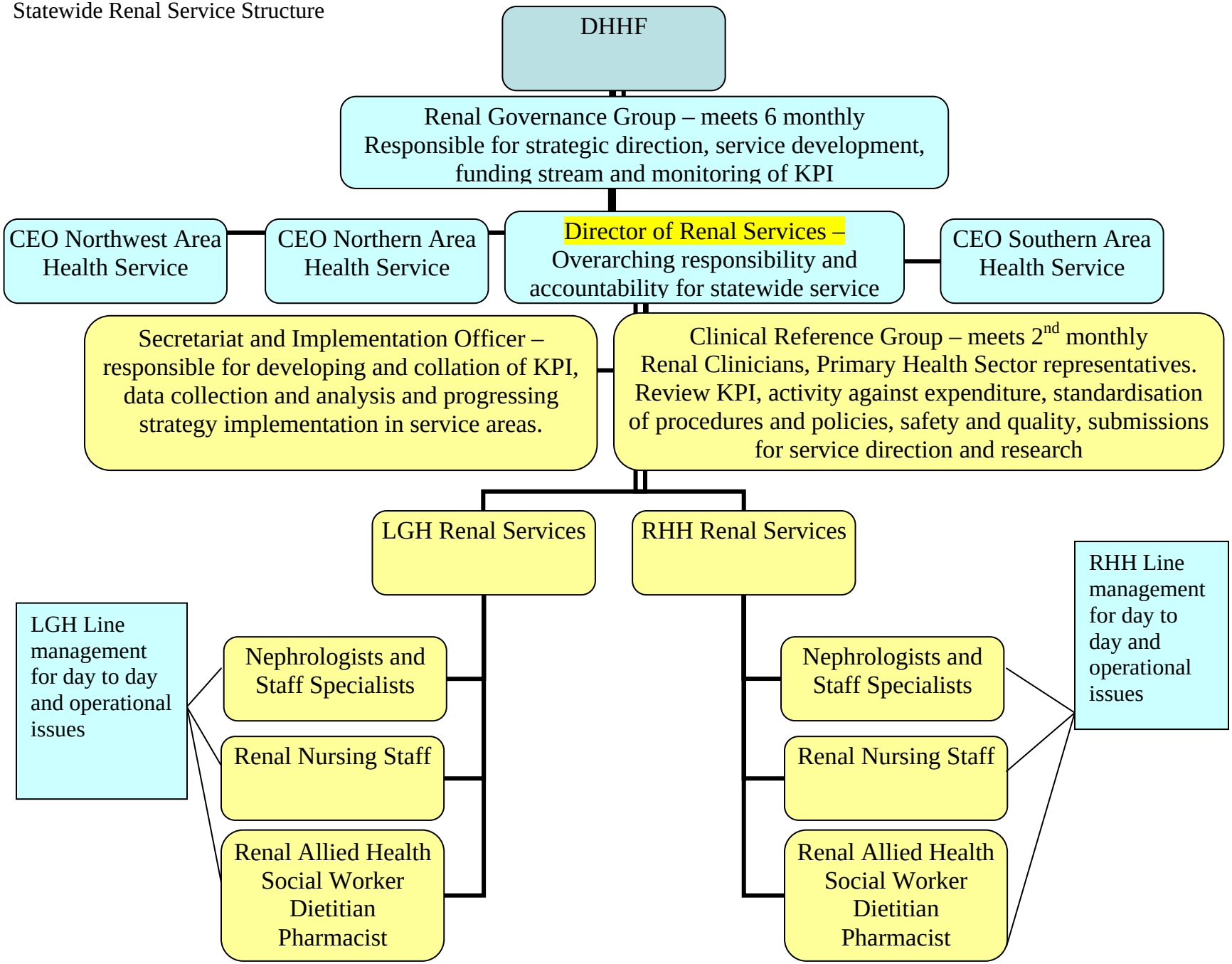
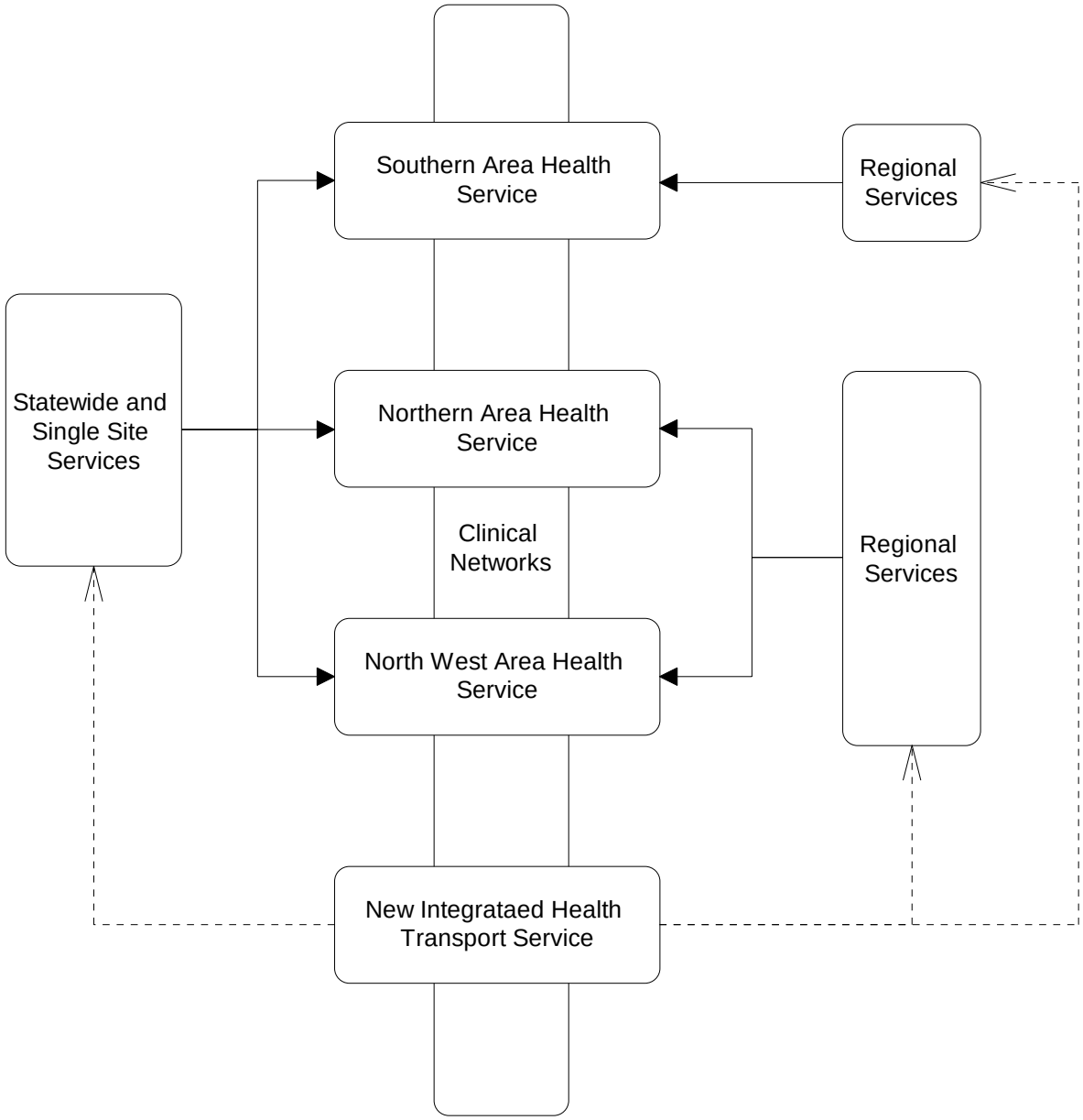


Table 1: Service Capability Framework[1] - Modified for Renal Services

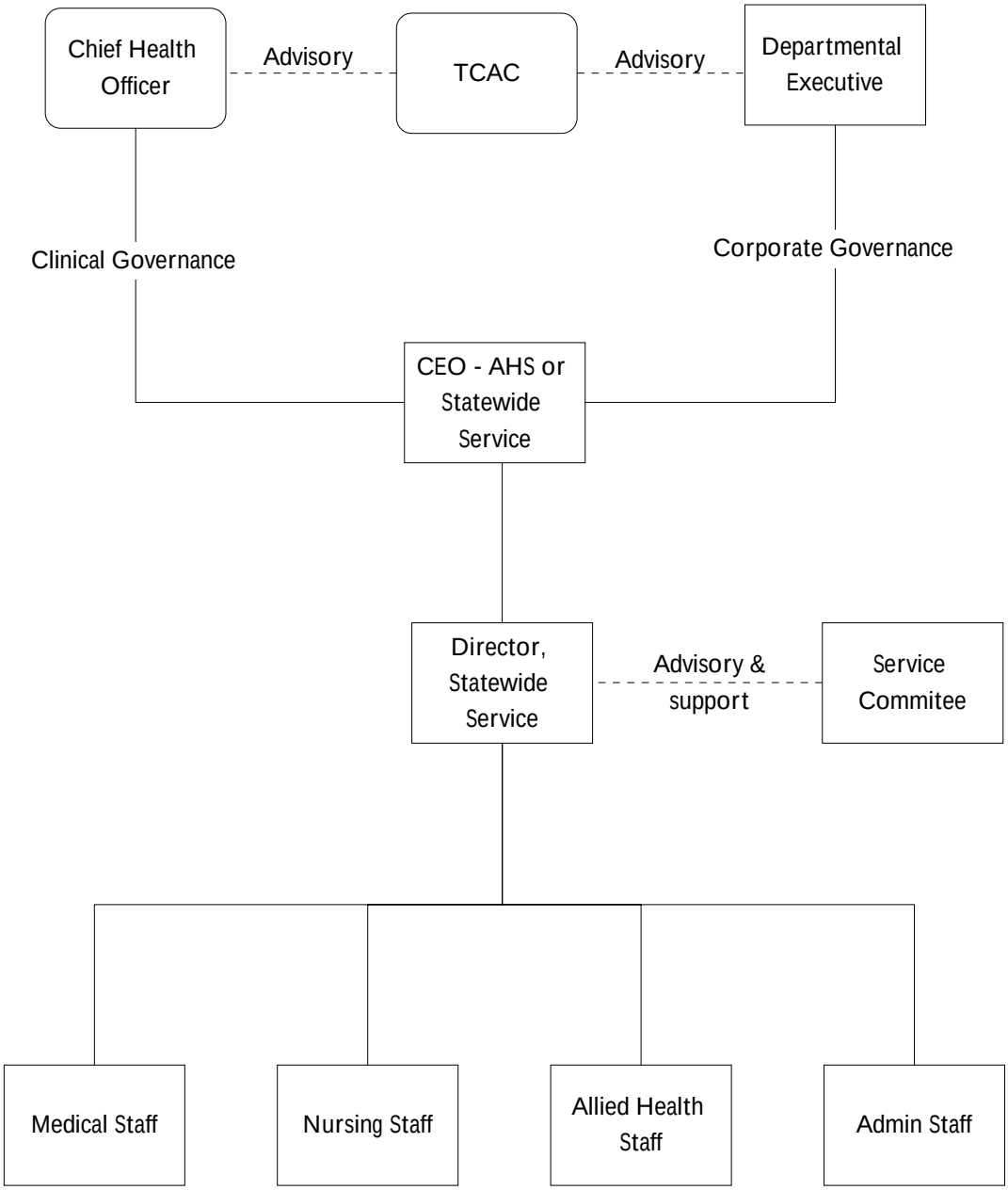
Characteristic	Statewide service, dual site	Justification for Renal Services
Service Base	Both LGH and RHH providing services locally and via outreach to patients from all regions	Renal disease covers the continuum of care with a chronic disease component in the primary health sector, acute care service in the tertiary sector and secondary services that although funded by tertiary can be delivered in a community setting.
Outreach	Funded to provide services at both LGH and RHH. May also be funded to provide services via outreach to patients from the North West. Generally outreach to the North West would be from LGH	Outreach for renal services necessitates the inclusion of the primary health sector – support for GP services through education, shared protocols and case management of renal patients. Chronic Kidney Disease clinics held at ICCs smooth the patient journey.
Complexity	High	Components of renal care are complex and poor input and management can lead to poor outcomes.
Infrastructure and support requirements	May require expensive technology (but not very high cost) and/or collocated specialist support services	Management of haemodialysis requires significant technical capital equipment, high volume of consumables and specifically designed infrastructure. Delays in accessing some specialist services such as vascular surgery and interventional radiology impact on quality outcomes. Developing pathways and agreed protocols with specialist services are necessary to improving timely care.
Volume/quality relationship	May have a demonstrated volume/quality relationship which justifies concentration of services on 2 sites	The ability to decentralise renal services is paramount to offering an accessible and quality service for patients across Tasmania. This decentralisation needs to happen in a planned and coordinated manner and a statewide service is necessary to ensure services are funded and delivered to where they are most needed.
Throughput	Sufficient to support at least 3 practitioners at each of LGH and RHH if frequent out-of-hours recall	Patient numbers for people receiving renal replacement therapy and those with an advanced level of chronic kidney disease are sufficient to warrant three nephrologists at RHH and LGH
Management	Responsibility of the designated host site – single point of management control for the State (either LGH or RHH)	While day to day operational management will remain with the parent hospital (hub) for each satellite service (spoke), overall service direction must be consistent with the state-wide governing structure.
Accountability for service accessibility	Led by the management site with engagement of and accountability to all	The governance structure would include a reporting and approval framework to the CEOs of Area Health Services through the Director

[1] Source: *Clinical Services Plan; Update (2008)* , Department of Health and Human Services, Tasmania

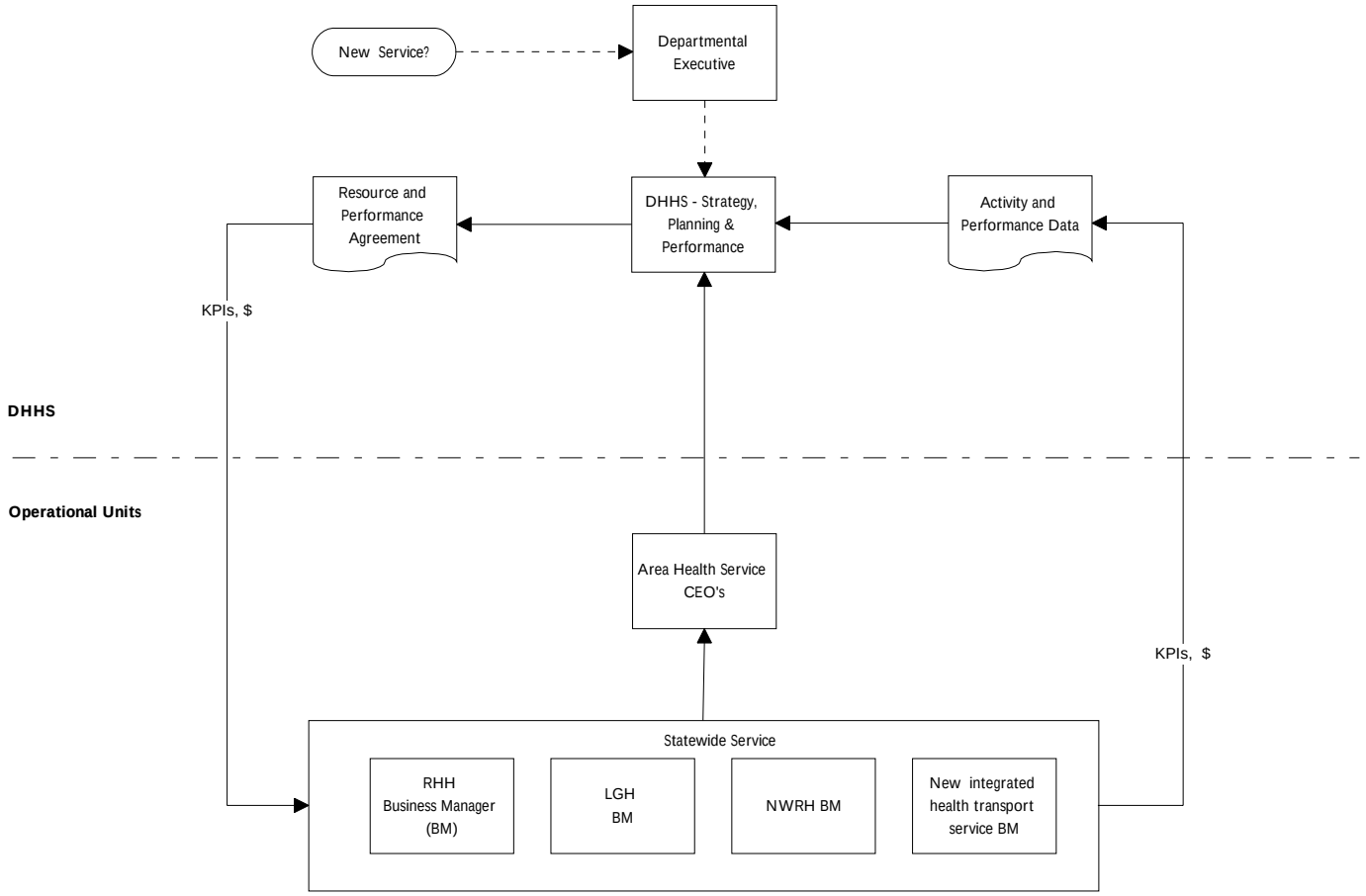
Characteristic	Statewide service, dual site	Justification for Renal Services
and quality (clinical governance)	regions	who has responsibility for reporting on activity from all sites.
Networking arrangements	Single Tasmanian service, may be networked interstate or part of a broader Tasmanian clinical network	A single service promotes coordinated networking across the state and across all health sectors. It reduces opportunities for duplication of services and systems and enables efficiency gains based on volume of activity – such as whole of state tenders and negotiating interstate clinical services.



Service Delivery Model for Statewide, Single Site and Regional Services



Proposed Generic Structure for Management of Statewide and Single-Site Services



Proposed Statewide Service Administration

Final Consultation and Stakeholder Feedback

The final consultation regarding the submitted Draft State Plan for Renal Services was held on July 9th, 2009 in Hobart. Representatives from the Tasmanian Department of Health and Human Services (DHHS), stakeholders and consumers attended the meeting.

Participants included:

- 18 clinical representatives from the renal service across Tasmania
- 4 consumer representatives, (from LGH and NWRU)
- 2 stakeholders (Kidney Health Australia)
- 4 representatives from DHHS including the Secretary David Roberts and Director Sonj Hall
- 2 LGH senior administrators

Attendees were provided with the Executive Summary and action plan prior to attending the meeting and copies were also made available on the day

Participants were welcomed by Sonj Hall who gave an introduction and a brief history to the renal plan development. The Secretary, Mr David Roberts provided an overview of the Strategic Direction of the DHHS and urged participants to consider the main themes of the renal plan in light of the five strategic directions identified for DHHS.

Professor Alan Cass from the George Institute provided an overview of the renal plan including

- Profile of renal services in Tasmania including patient demographics, working environment and renal structure and capacity
- Comparisons with national data
- Incidences and prevalence rates and projections for the next 10 years
- Basis for cost modelling
- Estimated cost projections for Dialysis and Transplantation usage
- Principles and objectives of proposed State Renal Plan
- Opportunities for cost savings.

The floor was then opened for questions.

Several questions addressed how the economic costings were derived, the practicality of realising cost savings and subsequent quarantining of monies for renal services. Other questions relating to how home dialysis patients could be better supported to reduce out of pocket costs were also canvassed.

Participants were divided into five working groups and asked to consider and debate the following topics. The groups were asked to identify the barriers and enablers and submit three to five key strategies for implementation. The topics were:

1. Integration with primary care in better identification and management of CKD
2. Barriers and enablers to home based care and transplantation
3. Accountable and equitable resourcing of services
4. Patient pathways – preparation for dialysis, patient involvement in treatment choices, exploring palliative care options
5. Addressing workforce issues.

The following responses were provided:

1. Integration with primary care in better identification and management of CKD
    b. Engagement of community including communication with all stakeholders through
        i. A variety of media (advertising, pamphlets, school programs) with broad health messages and resources that address literacy issues and complex nature of CKD
        ii. Engagement of GP's and practice nurses through the three GP Divisions
        iii. Engagement with community health centres and Integrated Care Centres
        iv. Provide incentives for GPs to utilise CKD management protocols – access to appropriate education and medicare item numbers
    c. Equitable access to services, education, information and training
    d. Care reform – across the care continuum and health sectors utilising sentinel events to change practices
    e. E-Health integration – inclusive of all stakeholders

2. Barriers and enablers to home based care and transplantation
    a. Early education of home-based care issues
        i. Access to CKD Nurse and information on treatment options
        ii. Access to other consumers for advice and information on their experiences – consider paying for advice
        iii. Early access to education and training
    b. Immediate and appropriate staffing and funding of home therapies programs
        i. Prioritise staffing for home therapies
        ii. Provide staff with necessary skills to train patients and carers
        iii. Provide physical spaces for training and support and fund program appropriately
        iv. Provide sufficient phone and on site home support
    c. Lack of carer
        i. Provide financial incentives for people to undertake home therapies that will enable a decrease in work hours to cope with carer and or treatment responsibilities.
    d. Increase transplantation rates through
        i. Community education in community groups
        ii. Financial incentives for donor recipients eg reimbursement of loss of income during medical and surgical treatment

3. Accountable and equitable resourcing of services – the group felt this strategy was key to implementation of all other strategies and that this structure should be in place within 12 months.
    a. Appropriate governance structure
        i. Statewide Director Renal Services
        ii. Establish joint clinical advisory group – multi-professional group inclusive of clinicians, policy and consumer representatives
        iii. Equitable representation from all departments
        iv. Director responsible for policy development and equitable resourcing across state
        v. Requires access to central funding for statewide services
    b. State wide KPI and QI framework
        i. determined by renal clinical service
        ii. Standardise collection and reporting
    c. Establishment of good data collection system
        i. Not necessarily a stand alone data-base
        ii. System of standardising data collection and reporting so that each unit reports against same performance indicators at same time.

4. Patient pathways – preparation for dialysis, patient involvement in treatment choices, exploring palliative care options
    a. Increased education of GPs and primary health providers to improve timely referral to nephrology services.
        i. Increase community awareness and support primary health sector with resources to improve management of CKD
        ii. Provide opportunities for group education to include family and consumers to improve communication.
    b. Provide more structured pathway through CKD management plan
        i. Educate patients early to contribute to self-management and empowering patients
        ii. Improve timing of palliative care information and access to palliation
        iii. Provide early access to multidisciplinary team

5. Addressing workforce issues
    a. Focus on home therapies to decrease workforce needs
    b. Recruit to address ageing workforce
        i. Accept student placements
        ii. Investigate diversifying workforce with EN and possibly technicians
    c. Professional development
        i. Upskill staff
        ii. Professional training according to level and role definition
        iii. Establish renal educators for all units
        iv. Aim for development of nurse practitioner role
    d. Recruit to specialist positions
        i. Nephrologist
        ii. Transplant coordinator
        iii. CKD Nurses
        iv. Allied health

Staff Plan and Resources

North West Renal Unit Burnie

Option 1 Do Nothing

The NWRU is currently staffed to a capacity of 30 haemodialysis patients. The unit runs on minimal staff and is efficient with the resources available. It is managed and operated by registered nurses with no support staff for non clinical duties. Although staff support and encourage self-care, the additional resources required to train, establish and manage the patients at home are not available.

The Do Nothing option will result in increased demand for haemodialysis positions at the NWRU and which will require the opening of an additional shift and an increase in the units RN FTE. It is anticipated that a third shift will be required within 1-2 years if patients cannot be supported with home therapies and the unit will be at capacity within 6 years. An additional 5.85 FTE RN plus clerical and support staff will be utilised. Capital and recurrent funding for an additional satellite service will be required prior to 2019.

Option 2 - Resource and support service to manage home therapies

The NWRU is staffed and operating with minimal lee way. The unit is functioning in an efficient manner within the resources that it has been allocated but would be far more effective with additional clinical and support staff and operational resources. There is a high reliance on RN to carry out all aspects of service delivery and an acceptance by both staff and management that staff will use their own time and resources to deliver care. The additional staff and resources being advocated here will assist and support the change management process necessary to increase home therapies and therefore service capacity, establish Enrolled Nurses within the staffing structure.

Resource	Time Frame and Impact	Justification
1.9 FTE Home Therapies CN	Immediate and to 3 years	Increase the PD program by 0.84 FTE to enable appropriate levels of support for patients trained in self-management. This will increase the home therapies capacity and eliminate the need for additional dialysis shifts. Time Frame and Impact - immediate and to three years.
1.19 FTE Home haemodialysis CN	Immediate and to 10years	Establish a dedicated position for Home HHD. This program is currently being delivered from within the unit's resources and is therefore unable to provide the necessary support to home patients without impacting on services within the satellite unit or the utilisation of staff personal resources. The increase in patients accessing home therapies will reduce pressure on the satellite service to expand and will absorb fewer human resources in the long term. Time Frame and Impact - immediate and to three years.
0.53 FTE Clinical Educator	Immediate and to 10 years	The establishment of a Clinical educator would provide much needed support for nursing staff and will be necessary and essential in the change management process required to efficiently and smoothly implement Enrolled Nurses within the staffing structure. Clinical educators will ensure the workforce remains skilled and develops the necessary links and processes to support the development of Nurse Practitioners.
0.63 FTE PCA 1 FTE Ward Clerk	Immediate and to 10 years	Patient support staff (PCA) and Ward clerks are necessary to reduce the amount of non clinical work undertaken by nursing staff that then takes them away from clinical care. In addition accurate and timely data collection around activity, reconciliation of expenditure and collection of performance indicators are necessary for a quality service that can be benchmarked nationally.
0.5 FTE CKD Nurse	Immediate and to 10 years	The establishment of a CKD nurse position would improve the quality of care and increase efficiencies with the patient journey. The benefits of both the CKD position is recognised Australia wide. Improvements in early referral and education have already been demonstrated with the externally funded CKD position in Hobart.
1 car for the Home therapy program	Immediate and to three years	Operational support such as access to cars for the PD and HHD programs would save considerable time and resources currently expended by nursing staff and (in the main) in their own time. The invoicing for this time and the claiming for the use of their own cars should be encouraged and supported.
Allied Health Support	Immediate and to 7 years	Allied Health Support such as Social Worker, Dietitian and Pharmacist are considered integral to the delivery of renal services and positions funded to LGH should provide support to the NWRU with the SW and Dietitan visiting weekly and the pharmacist visiting fortnightly.

Launceston General Hospital

Option 1 - Do Nothing

The LGH Renal Unit is currently at capacity and staffed according to an acute incentre ratio of 1:1 for acute dialysis and 1:3 for the stable patients. The majority of patients attending the unit are low dependency and sub acute with at least 25% of the patients able to undertake some aspects of their treatment. The unit is positioned within the clinical areas of the hospital and has access to emergency teams if necessary. The unit is managed and operated with registered nurses with support staff of 1 FTE ward clerk and 1.63 FTE for patient support (PCA) and non clinical duties.

The unit is not configured to manage the volume of patients attending for dialysis treatments which also impacts on the ability of the staff to provide safe acute dialysis. Patient flow, confidentiality and day to day management are severely compromised by the number of patients attending the facility. There is minimal storage area, patient assessment and clinical review areas double as offices and self-care training is attended in offices or when machines are not being utilised for dialysis of dependent patients. The unit is at capacity and cannot safely accept any more patients.

The 'Do nothing option' will compound an inefficient and less than effective service where the quality of care delivered to patients is severely compromised. Self-care therapies are not adequately staffed or supported with the necessary services in order to ensure sustainability.

Option 2 - Resource and support service for demand and growth

A satellite unit is proposed for the Launceston area. It is recommended that the majority of the LGH patients be decanted to the new unit and the LGH unit be retained purely for acute dialysis requirements. This will result in a far more efficient staffing plan that can be directed from the Satellite unit. The new facility will not require an additional level of senior staff such as NUM and CNS as these can be transferred from the current unit. Non clinical support can also be transferred to the new facility and with the addition of a vehicle based at the satellite service, adequate support can be offered to the acute centre as required.

The number of available stations in the new unit should be given consideration as to the best configuration that will enhance patient outcomes. Large units require less capital to establish but are more difficult to manage and coordinate the volume of patient movements. They provide a less personal treatment experience and often give a sense of production line care. Clinical outcomes have shown to be better in small units where patients can develop a rapport with staff, supervision of clinical care is higher and there is a sense of family between staff and patients. As patients are required to attend treatment three times a week indefinietely, this is an important aspect of care. Units of between 8 and 12 stations are considered the most effecitive and efficient.
Additional clinical staff in the way of HHD RN, CKD/Access RN, and Tx Coordinator is being advocated to assist with primary health sector and patient education and communication, thereby facilitating the transition of patients along the continuum of care. Staff to provide education, training and support of patients undertaking self-care therpaies will be necessary to assist the change management process necessary to increase home therapies and therefore service capacity. An Educator position is considered essential given the need to establish Enrolled Nurses within the staffing structure and support professional development towards the Nurse Practitioner model.

Resource	Time Frame and Impact	Justification
1.19 FTE Home Therapies CN	Immediate and to 3 years	Establish the Home HD program with 1.19 FTE. This will provide the necessary support for current home dialysis patients and increase home therapies capacity by 11 and eliminate the need for additional dialysis stations.
1.0 FTE CKD/Access CN	Immediate and to 10years	The establishment of a CKD/Access position would improve the quality of care and increase efficiencies with the patient journey enabling earlier education, referral for and creation of access and closer monitoring of access problems within the unit. The benefits of both the CKD and Access positions are recognised Australia wide. Improvements in early referral and education have already been demonstrated with the externally funded CKD position in Hobart, while the externally funded Access position has also made clear improvements in the insertion and management of fistulas.
0.53 FTE Clinical Educator	Immediate and to 10 years	The establishment of a Clinical educator would provide much needed support for nursing staff and will be necessary and essential in the change management process required to efficiently and smoothly implement Enrolled Nurses within the staffing structure. Clinical educators will ensure the workforce remains skilled and develops the necessary links and processes to support the development of Nurse Practitioners.

Resource	Time Frame and Impact	Justification
0.63 FTE Tx Coordinator	Immediate and to 10 years	The success of a strategy to increase the number of people receiving and retaining a transplant in Tasmania will be dependent on patients and families receiving early education and support through the assessment, acceptance and post transplantation phases. Particularly if more people are to consider a living donor transplant as a treatment option, then it is not feasible to assume that this education and support can be provided by the nephrologist alone. The establishment of a Transplant Coordinator for the northern region would provide much needed support for patients and their families and reduce the responsibility of dialysis staff to ensure transplant education, work up and pre transplant care is appropriately delivered. As patients are transferred interstate for the operation and remain there for the following 6 -8 weeks it is important that they receive adequate education and make the necessary links through the appropriate channels for clinical, social and emotional support. Patients and family members will be better prepared and supported upon their return.
1.87 FTE Allied Health Staff	Immediate and to 10 years	Allied Health Support such as Social Worker, Dietitian and Pharmacist are considered integral to the delivery of renal services and dedicated renal positions exist in the majority of interstate units of comparable size. International benchmarks are also available for Social Worker, Dietitian and Pharmacy positions within renal services. These positions should provide support to the NWRU with the SW and Dietitan visiting weekly and the pharmacist visiting fortnightly.
0.77 FTE PCA 1.2 FTE Cleaner	Immediate and to 10 years	Patient support staff (PCA) and cleaning services will be required in the stand alone facility to reduce the amount of non clinical work undertaken by nursing staff that then takes them away from clinical care. In addition accurate and timely data collection around activity, reconciliation of expenditure and collection of performance indicators are necessary for a quality service that can be benchmarked nationally.
1 car for the Home therpay program	Immediate and to three years	Operational support such as access to cars for the PD and HHD programs would save considerable time and resources currently expended by nursing staff and (in the main) in their own time. The invoicing for this time and the claiming for the use of their own cars should be encouraged and supported.

Royal Hobart Hospital - Acute Nephrology and Nephrology South

Option 1 - Do Nothing

Renal services in Hobart are administered by Royal Hobart Hospital and primarily delivered from the St Johns Park Renal Unit New Town.. The renal service in Hobart is well resourced, with dedicated programs and staff for self-care therapies including home haemodialysis, peritoneal dialysis and transplantation. The service has access to part-time Allied Health positions including Social Worker, Dietitian and pharmacist. There is also a part-time externally funded CKD nurse and a full time research officer.

St Johns Park manages and allocates staff to the acute incentre facility at RHH. The unit is inappropriately situated in the ambulatory ward of the hospital which is not operational outside of business hours. The unit is rostered staff Monday to Friday mornings and Monday, Wednesday Friday afternoons in anticipation of dialysis needs. However the unit may not be operational each day. In addition due to the isolation of this unit, staff levels are much higher than warranted to ensure patient and staff safety.

The 'Do nothing option' is counter productive in this situation. The current service configuration is expensive and ineffective and if left untouched will continue to absorb significant resources. There are opportunities for efficiency gains which may not be readily apparent to staff working at the coal-face.

Option 2 - Reconfigure resources and services to promote efficiencies and meet growth in demand

As noted the Renal Service from RHH is well resourced but the allocation of resources appears to be inefficient and ineffective. In particular the management and staffing of the acute incentre facility is an area where considerable gains can be made in terms of staff resources. This would require the relocation of the facility to a ward area where there is 24 hour access to staff at hand. This would enable a significant reduction in routine staffing allocation and the ability to staff according to need, with meal breaks and other support provided from the daily roster at St Johns.

Based on information provided by the service area, there is capacity within the staff plan at St Johns to fund the CKD position to full time, increase the FTE of the transplant position and manage significant growth in patient numbers over the next 7 years. A reconfiguring of the patient roster to increase the morning shifts to 16 stations and reduce the afternoon shift correspondingly would enable more efficient use of the staff to patient ratio of 1:4. The home therapies programs have adequate allocated FTE although there appears to be some instability in the positions which has impacted on growth in and support of patients choosing this option. Further the St Johns Unit is well resourced with support staff and services and it is not envisaged that an increase in these resources will be required within the next 5 years.

It is recommended that the Allied Health staff be increased to assist with the management of established and pending patients. The Social Worker currently at 0.5FTE and the Dietitan at 0.4 FTE should be increased to full time positions and it is envisaged that this FTE would be sufficient for the foreseeable future.

Resource	Time Frame and Impact	Justification
1.0 FTE CKD/Access CN	Immediate and to 10years	An externally funded part-time CKD position exists at RHH however the funding expires early 2010. The establishment of a CKD/Access position would improve the quality of care and increase efficiencies with the patient journey enabling earlier education, referral for and creation of access and closer monitoring of access problems within the unit. The position is also instrumental in liaising with primary health sector to facilitate education around early identification and management of people with kidney disease. St Johns staff plan indicates there are sufficient FTE to fund a full time position from DHHS.
0.63 FTE Tx Coordinator (increase from 0.4 FTE)	Immediate and to 10 years	RHH already has a part-time Transplant Coordinator at 0.4 FTE however if more people are to consider a living donor transplant as a treatment option, then it is not feasible to assume that this education can be provided by the nephrologist alone. The increase in the FTE of the RHH Transplant Coordinator to 0.63 FTE will enable more opportunities for patient education of pre dialysis and established patients around transplant workup and post transplant care. This will also reduce the responsibility on dialysis staff to prepare and support transplant patients. As patients are transferred interstate for the operation and remain there for the following 6 -8 weeks it is important that they receive adequate education and make the necessary links through the appropriate channels for clinical, social and emotional support. St Johns Park staff plan indicates there is sufficient FTE to increase this position.
1.27 FTE Allied Health Staff (on top of 1.13 FTE)	Immediate and to 10 years	Allied Health Support such as Social Worker, Dietitian and Pharmacist are considered integral to the delivery of renal services and dedicated renal positions exist in the majority of interstate units of comparable size. International benchmarks are also available for Social Worker, Dietitian and Pharmacy positions within renal services. It is proposed that the Social Worker and Dietitian positions be increased to full time and the pharmacist be increased by 0.2 FTE.

STATE PLAN FOR RENAL SERVICES 2010-2020

Part Two
Challenges for the Department and Future Projections

Prepared by The George Institute for International Health

TABLE OF CONTENTS – PART TWO

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LIST OF TABLES AND FIGURES

POLICY AND PLANNING CONTEXT

TASMANIA

In May 2007, the Tasmanian Government released the *Tasmania's Health Plan* – a blueprint for future health system reform.[7] This Plan acknowledges the dramatic increase in chronic disease, ageing population trends, increasing healthcare costs and workforce sustainability issues. A *Clinical Services Plan* and a *Primary Health Services Plan* underpin the Health Plan.[8,9] All plans are consistent with DHHS Strategic Directions 09-12 and whole-of-Government agenda entitled *Tasmania Together 2020* and build upon the 2004 Richardson Report (*The Tasmanian Hospital System Reforms for the 21st Century*).[10,11]

Tasmania's Health Plan proposes a new four tier service model to facilitate the restructuring and integrate services across the continuum. Opportunities exist for renal services to establish efficiency and financial gains through the proposed sector integration which will be accomplished through the establishment of:

- **Primary Health Partnerships** that link services owned and/or funded by multiple Government or industry interests.
- **Integrated Care Centres** (ICCs) that provide non-emergency services including a broad range of non-admitted primary, secondary and tertiary services, short stay elective services and specialist subacute services.
- Reformed **Community-Based Health Services** to increase local capacity to detect chronic disease and promote self-management, expand home-based services (i.e., post-discharge and specialist community nursing) and support healthy lifestyles changes.
- Multi-disciplinary and statewide **Clinical Service Networks** responsible for developing shared protocols that reduce inefficiencies, address duplication where it exists and monitoring safety and quality in practice.

An increased demand for good community-based care is inevitable, given the ageing population and the growing number of people with chronic disease and the four Tier model will position Tasmania to better cope with the predicted demand.[12]

The model has been mapped against proposed renal services and Table 4 illustrates how the integration of renal service will occur across the health continuum.

Table 1: Renal Service Mapping Against 4 Tier Service Model

TIER	DESCRIPTION	RENAL SERVICE INTEGRATION
Tier 1	Sites provide core primary health and community care services within a local community with an increasing emphasis on community and home-based care and the provision of these services through an integrated team approach.	Outreach services from tertiary facilities will support and educate primary health staff in the early identification and management of people with CKD and those on home-based therapies.
Tier 2	Sites operate rural inpatient services (sub-acute beds) in addition to their primary health and community care services.	Self-care therapies will be housed on site for people unable to have treatments in their own home. Review clinics offered to people with CKD and home therapies from site to reduce travel requirements.
Tier 3	Sites provide extended primary health services with significant outreach across the network and a strong representation of acute services including integrated care centres developed in association with acute health services.	Home therapies training and support delivered from sites, establishment of satellite services for maintenance dialysis, offering of renal access surgery and management of non-acute access infections.
Tier 4	Sites provide acute care services not normally provided under primary health services, including same-day procedures requiring inpatient back-up in order to be safely and effectively delivered.	Acute renal services including investigational and interventional radiology, surgery and acute dialysis

The *Clinical Services Plan* contains a *Service Capability Framework* that defines renal medicine as a regional referral service operating out of Royal Hobart Hospital (RHH) and Launceston General Hospital (LGH**)** with a requirement for outreach services from LGH to the North West only. Both sites act as hubs servicing patients in the southern and northern regions respectively. The catchment area population for RHH is approximately 235,330 while LGH (which includes the catchment areas of Burnie and Mersey Hospitals) is 241,163.[13]

Renal medicine was identified as a Clinical Service Network reporting to the statewide Clinical Advisory Committee, but this was subsequently amended to being a Renal Forum. The intention of Clinical Service Networks is to provide professional and clinical support and ensure a level of quality within disciplines across all sites. Clinical Networks, without DHHS Policy or hospital management representation, are not able to make decisions on resourcing or service direction.

Substantial growth in demand is predicted for renal dialysis services. The proposed management strategy within the Tasmanian Health Plan is:

- A continuing focus on home-based services where possible.
- Provision of acute dialysis services within the new RHH in both inpatient and acute ambulatory locations. *This has since been rescinded with a decision not to proceed with the new RHH and a possible future location for the acute dialysis service at RHH is unclear*.
- Continuation of maintenance dialysis from the Nephrology South Renal Unit at St John's Park with consideration for more satellite chairs at proposed ICCs such as Glenorchy.
- Development of a community-based satellite service for the Launceston community, utilising funds from the proposed ICC.

- Continuation of satellite services at the Parkside North West Renal Unit (NWRU) and development of a satellite service at Mersey on an outreach basis from the LGH. Expected patient numbers 17 and 16 respectively by 2016. Whilst a satellite unit at the Mersey is not advocated for at this point in time, small satellite services – particularly self-care rooms - established in community hospitals or Integrated Care Centres may be supported in the future.

RENAL SERVICES ACROSS AUSTRALIA

Since 2000, Western Australia (WA) has introduced the concept of corporatised satellite units (also known as Private Public Partnerships (PPPs) operated by private providers, predominately dialysis suppliers, under the clinical governance of tertiary hubs. The State has also developed partnerships with Aboriginal Community Controlled Health Organisations (ACCHOs) to deliver on-site satellite and self-care dialysis in regional and remote centres. More recently WA has outsourced home and community dialysis training, set-up and technical support under a statewide PPP. This move has consolidated previous Home Therapy Units that operated out of three tertiary hospitals. WA is currently working towards a goal of 40% home or community-based self-care dialysis, from the current base of less than 25%. As part of this strategy the Government is exploring mechanisms for developing regionalised self-care training and support programs.

The *Northern Territory Renal Services Strategy* (2005) recognises the importance of collaboration, negotiation and the development of partnerships with communities and local services, including housing and education in delivering effective renal services.[14] The Northern Territory (NT) has identified priority areas which include the need to improve prevention, detection and management of CKD; increase Aboriginal and Torres Strait Islander participation, provide treatment closer to home and develop a coordinated approach across the care continuum. It emphasises the need to develop a sustainable service and the importance of multidisciplinary care, patient focused treatment and flexible staffing models. Included in the strategies is the establishment of a governance framework (Renal Clinical Reference Group) which guides service development by monitoring and evaluating activity, expenditure and performance indicators. The NT has also entered PPP (termed ‘contracted services”) for satellite services to reduce risks associated with capital expenditure, budget overruns and staffing shortfalls. Clinical governance remains with the department

The *Queensland Statewide Renal Health Services Plan* (2008-2017) addresses the mismatch between current and future demand and renal replacement therapy (RRT) service capability.[15] This Plan is the first of its kind in Australia to apply robust predictive activity and economic modelling to determine the costs and benefits associated with changing RRT usage patterns. A shift towards an increase in self-care dialysis options and transplantation opportunities is recommended to address patient access issues, improve quality of life and obtain cost efficiencies. Queensland has adopted a 50% goal for new patient home and community-based HD and PD across the State, which it is estimated will result in savings of $40 million over the term of the Plan. The importance of multi-disciplinary teams, service coordination and continuity of care are identified as key features of successful CKD and ESKD management. The service is now governed by a Renal Clinical Network that provides strategic leadership and consults with Area-specific networks.

New South Wales (NSW) Health has developed a *Renal Dialysis Plan to 2011* (January 2007) that contains principles for managing people with CKD and specific targets to be achieved through Area Renal Service Plans.[16] NSW acknowledges that in an environment of increasing demand for dialysis and finite resources it is imperative to find ways to optimise the provision of care. The NSW Plan sets modality benchmarks of 50% home-based (30% PD and 20% home

HD) and 50% facility-based HD (20% in-centre and 30% satellite). A renal Minimum Data Set (MDS) and Key Performance Indicators (KPIs) have been implemented to measure progress towards achieving the Plan. Governance is provided by a Renal Services Network with reference to a Rural Renal Clinical Advisory Group.

Victoria released its *Renal Dialysis: A Revised Service Model for Victoria* in 2005.[17] This report was commissioned to assess the suitability of the current service delivery model and define future service configuration. Use of a hub and spoke model was reaffirmed as an appropriate means of service delivery with requirements for better role definition and consistent clinical protocols and KPIs. The report found considerable variations between providers and modality mixes and recommended the use of incentives to encourage self-care dialysis in an effort to decrease health infrastructure investment. Spending on renal dialysis in 2008/09 is estimated to be over $110 million using a two tier funding model that includes a capitation grant paid to hub hospitals and variable case mix payments to providers. Annual activity targets are set and include a statewide growth allocation. The service is governed by a statewide Maintenance Dialysis Advisory Committee.

In South Australia, the Renal Clinical Network has a series of draft recommendations under consideration by the Health Department. These recommendations focus on ways to increase home therapies (transplantation and dialysis), improve access to service in non-metropolitan regions and meet predicted future dialysis needs.

A number of Australian-wide initiatives are also relevant:

- *Report by the Remote Area Renal Services Sub Committee of the Australian Health Reform Agenda Working Group* (2004)[18] – Recommended the adoption of principles to provide dialysis treatment as close to home as possible taking into consideration the unique needs and disadvantaged circumstances of remote communities.
- *Australian Health Ministers Advisory Council Statement on Remote Area Renal Services* (2004)[19] – Acknowledged the challenges facing remote living ESKD patients and agreed to a series of principles and strategies to address disparity in access.
- *National Service Guidelines for the Management of Dialysis and Transplantation in Remote Australia* (2006)[20] – Australian Health Reform Agenda collaboration with the aim of improving access, choice and reducing inequities by proposing standardised serviced development and operational guidelines.
- *National CKD Strategy* (2006)[21] – Developed by Kidney Health Australia (KHA) this strategy seeks to reduce the burden of CKD through the facilitation of evidence-based and holistic services that address prevention, early detection and best practice management for people with CKD and their families/carers across the continuum of care. The Strategy is a high-level reference for policy-makers, funders, providers and service planners.

The decision by Tasmania to develop this Plan is timely and DHHS can benefit from the recent work of other jurisdictions to address similar service issues related to capability, capacity, quality and patient access.

RENAL SERVICES — INTERNATIONAL

On the international stage, numerous alliances have been established to increase the importance of kidney health education and early CKD intervention. The same delivery, patient access and cost containment issues experienced in Australia are being faced in other countries. Policy development increasingly prioritises whole-of-care-continuum management, multi-

disciplinary teams, workforce retention and models of self-care. Many of the strategic solutions in the TPRS are consistent with policy and planning initiatives elsewhere.

The United Kingdom *National Service Framework for Renal Services* (published in two parts 2004 and 2005) establishes service standards and markers of good practice across the care continuum within the National Health Service.[22] These high level policy directions are designed to manage service demand, increase equity of access and improve treatment choice and quality of dialysis and transplant services. It is the responsibility of local integrated renal networks to develop strategies based on these standards. Patient transport, timely access surgery, workforce re-design and care plans that support provider partnerships, patient choice and end of life care are identified as areas for improvement.

The Wales Assembly Government recently released a *Policy Statement and National Services Framework Designed to Tackle Renal Disease in Wales* (2007).[23] Wales has taken a holistic and integrated approach to renal disease across the care continuum from prevention to palliation that optimises care and accessibility through the use of Multi-Disciplinary Renal Teams. Given resource scarcity, the Welsh are moving away from focusing entirely on RRT towards reducing the complications of CKD.

In South Eastern Ontario, Canada, efforts have concentrated on rejuvenating the capacity of primary health care to address the precursors to CKD. Work to improve access to dialysis is concentrated on increasing the uptake and maintenance of home modalities through multi-disciplinary support teams and expanding the scope of pre-dialysis services. Ontario is currently decentralising its health service into 14 Local Health Integrated Networks that will facilitate local care support. South Eastern Ontario is one of few networks that have identified CKD as a priority under the integration.

In the USA, the *National Kidney Disease Education Program and the Kidney Disease Initiative* sponsored by the Centre for Disease Control is spearheading public health strategies to increase awareness about the seriousness of CKD and the importance of prevention, early diagnosis and management.

The USA has had four decades of experience with combining public funding and private health care management to address dialysis demand. Some evidence suggests that for-profit dialysis providers in the US provide inferior care at inflated prices but the context is so different from that seen in Australia, in terms of insurance arrangements, funding and governance models, to draw comparisons with the Australian experience is of dubious utility.[24] Australia has had limited engagement of private dialysis provider beyond that of a price per treatment (ppt) arrangement for equipment and supplies. The Australian Capital Territory (ACT), WA, NSW and NT have entered into PPPs. Other jurisdictions, such as Queensland, have established service level agreements with private hospitals to dialyse public patients. The noticeable difference between the two national approaches is the predominance of public sector clinical direction and patient management in Australia. To date private provider accreditation and benchmark records in Australia have been exemplary.

In developing the state plan for renal services, local, national and international initiatives were considered. Current service structure, capacity, links and activity were analysed with the aim of providing evidence to assist with forward planning initiatives and identify enablers and barriers to service restructuring. The renal services plan also explored future projections and undertook economic modelling on a number of service delivery scenarios, to demonstrate the efficiency and financial gains achievable for the health sector.

KIDNEY DISEASE

THE KIDNEYS

The kidneys, shaped like kidney beans and about the size of a fist, are located on either side of the spine under the lower ribs. Their main task is to remove waste products and excess fluids from the body through urine. They also ensure that the blood supply to tissues has a proper balance of water, minerals (sodium, potassium, phosphate, calcium and magnesium) and other substances required to maintain body functions. The kidneys produce important hormones that help control blood pressure and stimulate the bone marrow to produce red blood cells. They produce the active form of Vitamin D required to absorb calcium from foods and importantly maintain healthy bones.

CHRONIC KIDNEY DISEASE

CKD is a progressive deterioration of the filtration ability of the kidney, and can lead to end-stage kidney disease where the kidneys are no longer able to function. Renal replacement therapies (RRT), such as dialysis or transplantation, are then required to sustain life. CKD may occur over a number of years and with early identification and management, the disease can be slowed and progression to end stage significantly delayed or prevented. The main causes of kidney disease are diabetes, glomerulonephritis (a painless inflammation of the kidneys) and hypertension. However, CKD is often termed a 'silent disease' as it can reach near terminal stages before an individual experiences significant symptoms.

The level of kidney dysfunction can be determined by assessing the creatinine concentration in a blood sample, although this may not move out of the normal range until nearly 50% of a person's kidney function is lost. An earlier determination of kidney dysfunction is available through estimated glomerular filtration rate (eGFR), a calculation of the person's kidney function utilising the Modification of Diet in Renal Disease (MDRD) formula. An eGFR is determined using the creatinine, sex and age of the person and is expressed as a mls/minute result, which is standardised for body size (body surface area). A result of at least 90mls/min is considered normal function and less than 60mls/min is evidence of significant kidney disease. The meaning of values between 60-90 mls/min is not clear and most guidelines do not recommend acting upon such values. Most clinical practice guidelines recommend that people with eGFR of less than 30mls/minute should be referred to a nephrology service. The stages of CKD are identified in Table 5.

Table 2: Five Stages of Chronic Kidney Disease[25]

Stage	Description	GFR (mL/min/1.73m^2)
1	Kidney damage with normal or ↑GFR	≥ 90
2	Kidney damage with mild ↓ GFR	60-89
3	Moderate ↓ GFR	30-59
4	Severe ↓ GFR	15-29
5	End Stage Kidney Disease	< 15 (or dialysis)

Source: Kidney Disease Outcomes Quality Initiative (K/DOQI)

The ANZDATA Registry provides an annual comprehensive national data collection of people with ESKD treated by dialysis or a kidney transplant. We lack, however, a comprehensive national data collection monitoring the incidence, prevalence, morbidity and mortality associated with CKD. There is a strong suggestion that the number of people with CKD is critically underestimated. The reasons for this include:

- the silent nature of the disease;
- the high risk that people with CKD will die from cardiac disease before they require dialysis;
- poor understanding by the primary health sector of early signs of kidney disease;
- lack of pubic awareness and education regarding healthy lifestyles and regular checkups for CKD precursors;
- low rates of opportunistic screening and consequent loss of opportunities for early intervention.

A better understanding of CKD prevalence has been reached in recent years as a result of automatic eGFR reporting by pathology services and the Australian Diabetes, Obesity and Lifestyle (AUSDIAB) Study. Automatic reporting of eGFR for every creatinine blood sample arose from a recommendation from the Australian Creatinine Consensus Working Group, which included a broad range of Australian and New Zealand clinicians, researchers and nephrologists. This strategy was intended to opportunistically identify people with CKD, who might not previously have been identified as having kidney disease and ensure they received appropriate management.

The AusDiab study[26], is a national population-based study to investigate the prevalence and incidence of diabetes and its complications including heart disease and kidney disease. A baseline cross-sectional survey of Australian adults was conducted in 1999-2000 and the 5 year follow-up conducted in 2004-2005. Plans to carry out the third phase (2009-2010) are now under way.

The findings from the AUSDIAB study identified the health burden that Australia faced as a result of the increase in diabetes, kidney disease, cardiovascular disease and obesity. Important findings included:

- Every year 1% of adults develop albuminuria (an early risk factor for the development of ESKD, cardiovascular disease and mortality)
- High blood pressure increases the risk of CKD and albuminuria three fold
- Each year 1% of adults develop CKD
- People with CKD are predisposed to developing premature cardiovascular disease with an increased risk of death due to heart attack or stroke.

Opportunities for intervention to reduce avoidable morbidity and mortality exist at each CKD stage across the renal health continuum (Table 6). With early identification, greater opportunities are available for best practice management with the potential to delay or prevent progression to ESKD and the requirement for dialysis.

Table 3: Renal Health Continuum[27]

High Risk Groups	**Early CKD** Stages 1/2	**Mild - Moderate CKD** Stage 3	**Advanced CKD** Stage 4	**Established ESKD** Stage 5
Health Promotion, Protection and Prevention				
	Early Detection, Intervention and Active Management			
			Secondary Prevention, Pre-Dialysis Education and Access Surgery	
				Dialysis, Transplantation and Palliation

Source: Reworked from Queensland Statewide Health Services Plan (2007-12)

Screening for early signs of kidney damage is inexpensive and simple. It involves a urine dipstick for albumin and blood and measuring blood pressure, which lends itself well to opportunistic screening. As CKD and ESKD are often diseases of socio-economic disadvantage, people in rural and remote areas are more likely to be affected where there are high levels of unemployment, low education attainment and low income.[28]

Many of the risk factors associated with CKD are modifiable and can be managed through changes in lifestyle behaviours and medication. Simple health messages, early identification through opportunistic screening, intervention and management can have a significant impact on health outcomes, quality of life and the subsequent economic impact on the health care system.

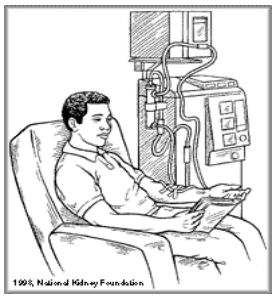
END STAGE KIDNEY DISEASE

ESKD is the most severe form of CKD and occurs when there is complete or near complete loss of kidney function. If left untreated, a build up of waste products in the body, leads to seizures or coma and ultimately death. Once ESKD has been reached people require Renal Replacement Therapy (RRT) - dialysis or transplantation - to stay alive.

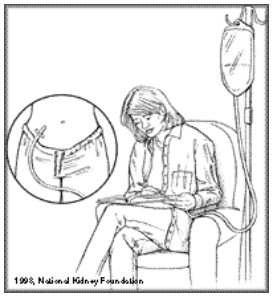
DIALYSIS

Dialysis is a life-saving procedure that partially replaces the work of failed kidneys. Dialysis does not cure ESKD nor alleviate all ESKD symptoms. There are two principal types of dialysis and there is no definitive evidence that one form of dialysis is superior to the other in terms of patient mortality or quality of life.

- **Haemodialysis** (**HD**) is the process where a machine pumps a patient's blood through an artificial kidney to remove excess toxins and fluid before returning the blood to the patient. HD is provided in a tertiary hospital or satellite (low-care) setting for acute and dependent patients, but it can be successfully delivered in a patient's home or nearby community facility for independent patients or with assistance from a committed carer or network of carers. Home-based nocturnal HD is an emerging dialysis modality.



- **Peritoneal Dialysis** (**PD**) typically is a home based treatment and performs the blood cleansing and waste removal by utilising the body's own peritoneal membrane as a filter. Continuous Ambulatory PD (CAPD) has traditionally been the most frequently used form of PD and is performed at least four times a day. Automated PD (APD) works in the same manner except the fluid is cycled through the abdomen overnight by a machine. APD offers some lifestyle advantages compared to CAPD and usage rates in Australia are now higher than CAPD. .



The location of haemodialysis depends on individual patient acuity and preferences. Acute and unstable patients often dialyse in tertiary units, also referred to as "in-centre units". Sub-acute and relatively stable patients are in the main, referred to a satellite dialysis centre. Satellite units are non-tertiary centres located either on the campus of a tertiary hospital or within a community setting. Satellite units were traditionally reserved for very stable patients who were partially if not fully independent in their care. However, with the growing demand for services and an ageing renal population, satellite units across Australia now accept patients with a range of co-morbidities and levels of dependence.

PD is traditionally used for the very young and the very old due to the less technical nature of the treatment. However with the advent of Automated Peritoneal Dialysis (APD) and the freedom this form of treatment provides for workers and those that travel, APD uptake has increased considerably in the last 10 years.

SELF-CARE

Self-care HD implies the patient is able to undertake all aspects of the treatment independently. Self-care or more specifically home HD, can occur in the patient's home or a designated community facility where a machine and supplies are stored for use by one or more persons. Home HD traditionally required the support of a trained carer however an increasing number of people are returning to their homes and communities without this additional support. PD, provided as CAPD or APD, is usually undertaken within a patients home either with the support of a carer or independently.

TRANSPLANTATION

In general, transplantation is the best form of renal replacement therapy because it conveys a better quality of life, superior patient survival and lower cost. The success rates of kidney

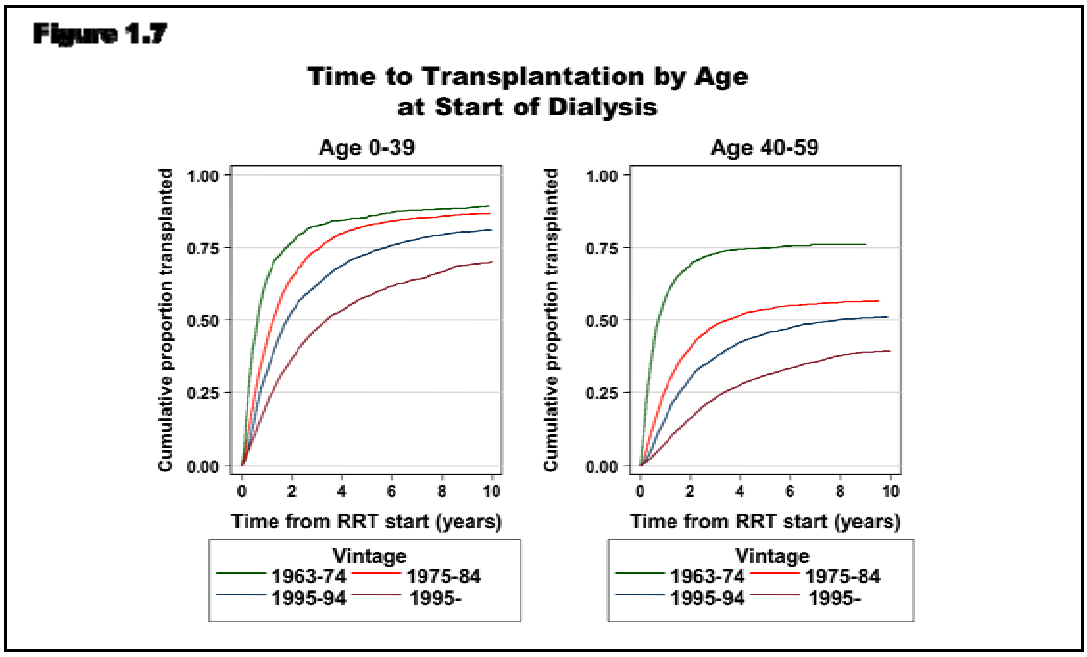
transplantation have been steadily improving over many years as a result of better immunosuppressive medication and care. However, the number of kidney transplants actually occurring is a key limiting factor as demand for transplantation continues to outstrip organ supply.

Criteria for acceptance to a transplant waiting list include medical suitability, age and commitment of the patient to treatment adherence. A number of medical tests must be completed to be accepted to the active transplant list and then repeated yearly to maintain active status. The transplant waiting list is for cadaver organs - organs from deceased donors. Not all States or Territories have a transplantation service within their jurisdictions and some, notably Tasmania, Northern Territory and the ACT, are serviced by interstate transplant services. The transplantation teams from the interstate partner hospital visit at least twice yearly to asses patients, although patients maybe reviewed and accepted to the active waiting list in between these visits. All transplant operations are attended at the interstate partner hospital and patients usually spend a further 6 - 8 weeks interstate before returning to their home States or Territory. Adequate volume of transplant operations and access to the necessary surgical skills are important factors in the establishment of a transplantation service.

ORGAN DONATION

The escalation in the demand for renal replacement therapy in recent years has not been met with a corresponding growth in available kidney donations, particularly from the cadaver pool. Despite this, the percentage of people with functioning transplants has remained relatively stable, due in part to the augmentation of the donor pool from living donors. The majority of living donors are related to the recipients, although growth in unrelated donors is also occurring. The average waiting time, from commencement of dialysis to kidney transplant, has grown considerably over the last 40 years (Figure 1).

Figure 1 Reproduced from ANZDATA 2007 Trends in Kidney Disease



Patient criteria for acceptance of a living related or non related transplant are less stringent. However, the assessment process also includes the potential donor's medical, physical and emotional suitability to donate a kidney. Survival rates for live donor transplants are better than for deceased donor transplants.

Data collected by the ANZDATA Registry also suggests that, while the number of transplants from deceased donors has been fairly static for ten years, and the number of transplants from live donors has been increasing, a lower proportion of people are actually reaching transplantation. This is not explained simply by the ageing of patients entering RRT- it is true even for the younger age groups in whom transplantation would be the usual option, if available (Fig. 1).[29] This reflects the growing demand for RRT and the inability of organ supply to keep pace with the number of eligible recipients for transplantation.

PALLIATIVE CARE

Dialysis is a time-consuming and burdensome treatment and has a significant impact on quality of life, both for an ESKD patient and their family. Renal clients are likely to suffer an unusually high and sustained level of anxiety and depression. Supporting patients to have treatment at or near home is one way of alleviating the impact of treatment regimes. In addition patients who have not yet commenced RRT and are receiving education regarding ESKD treatment options, should also be given information and support to understand and develop their own 'Advanced Care Plans' (ACP) – a script for how they would like to be cared for in the future. ACP and the 'Respecting Patient Choices Framework'[30] encourages patients to make decisions with their families on their future care and aims to ensure treatment is delivered according to the patients wishes at a time when the patient can no longer make those decisions.

Nationally and internationally[31], the drive to develop Renal Palliative Care programs and services is growing. The Australian Government has funded a pilot project in a number of states to identify and address the barriers for Indigenous patients with kidney disease, in accessing palliation closer to home. Other states are also developing programs and in Victoria, where the Respecting Patient Choices and ACP is well progressed, work has begun on developing a specific Renal Palliative Care program. Given the aging population in Tasmania and the increasing number of people aged 65 and over with chronic diseases including renal disease, a program of early education and assistance to complete ACP and support renal clients would be of some benefit.

CHALLENGES FOR THE DEPARTMENT

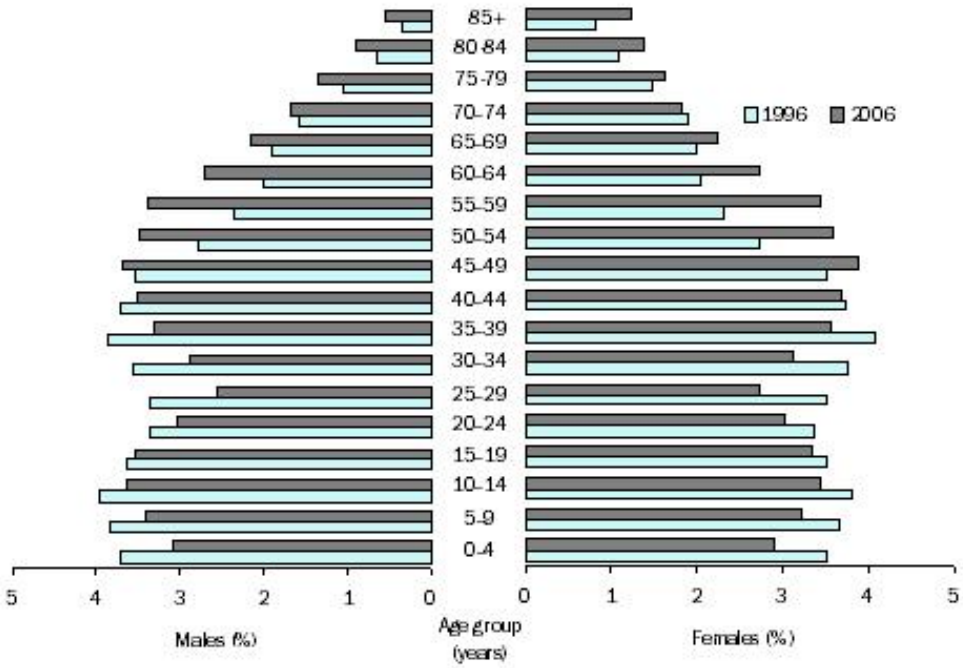
WORKING ENVIRONMENT

Tasmania's relatively small population is distributed differentially across the state. While the population distribution is comparatively even between the north and south, people in the south tend to live in Hobart and the surrounds and in the north the population is more widely dispersed along the coast from Devonport to Burnie. The distribution of the population is predicted to change in the coming years[32].

According to the Australian Bureau of Statistics (ABS), between 2008-2028 Tasmania's population is projected to increase by 11.8%, to a total of approximately 556 300. Almost all of this population growth is expected to occur in the older age groups. The Tasmanian population is the oldest of all states and territories and is aging more quickly than the national average. The increase in life expectancy and the emigration of younger adults from Tasmania to the Australian mainland has contributed to this accelerated ageing.[33]

Figures 2 and 3 describe the changes in the age distribution since 1996 and the projected changes to the year 2021.

Figure 2 Population Change by Age in Tasmania 1996 to 2006[34]



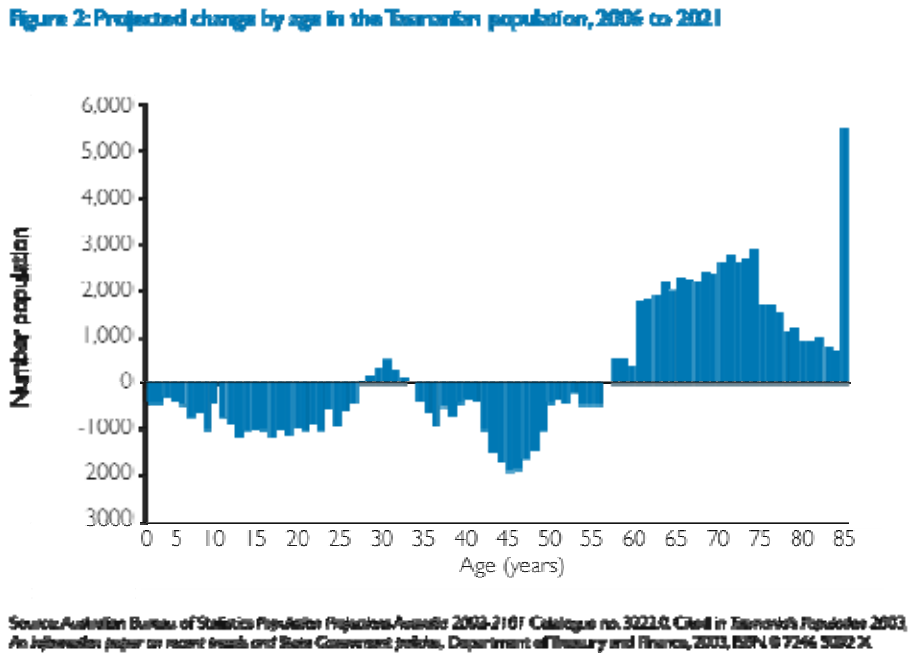
This rapid ageing of Tasmania's relatively small but dispersed population has important implications for the health care system. Not only are older people known to have greater needs for health services, but these needs are more likely to relate to chronic or complex diseases, which require multi-disciplinary and specialist care.

The predicted population growth is expected to vary across the state. Growth is projected in the south and north while the north-west is expected to experience a decline in population[35].

Tasmania's older population tends to reside along the east, north-east and central coast of Tasmania. Changes to this population distribution between 2003 and 2006 have seen an increase in the percentage of residents over 65 years residing in the central coast and northern midlands region. This is likely to increase as more people enter retirement and move away from the cities[36].

The distribution of Tasmania's population presents the challenge of balancing the need to deliver comprehensive health services locally, whilst ensuring that these services are structured so as to be sustainable.

Figure 3: Reproduced from Tasmania's Health Plan Summary May 2007



SOCIO-ECONOMIC STATUS

Socio-economic disadvantage is a powerful determinant of health. High unemployment, low education attainment and low income, which are strongly associated with unhealthy lifestyles, are risk factors for chronic diseases. The ABS[37] reported that Tasmania had the second highest level of disadvantage in Australia with only 6 out of 29 Local Government Areas (LGA) having a SEIFA (Socio-Economic Index For Area) score that is average or above average. This represents a decline from the previous census[38].

Census figures demonstrated that although the school retention rate had improved by 11.7% since 1996, indicating a narrowing of the gap between Tasmania and the national rate, it remained the second lowest in Australia, behind the Northern Territory. Tasmania has the second lowest proportion of people with undergraduate degrees and the lowest proportion of people with post graduate qualifications of all states and territories. This is reflected in the unemployment rate, which has traditionally been higher than the national average. At the 2006 census only 56% of the labour force was noted to be employed full-time and 30.7% were

employed part-time (compared nationally with 60.7% and 27.9% respectively)[39].

In addition, the median weekly individual income in Tasmania is $398 — the lowest of any state or territory. However, this represents an increase of more than 26% in the last 5 years[40]. The Tasmanian Department of Treasury and Finance expects income growth to continue; however recent projections predict the State's economic growth will be constrained by population ageing, which will have a flow-on effect for the growth of the Tasmanian economy.[41]

Tasmania's Health Indicators 2008 report noted that a higher proportion of Tasmanians smoked, drank alcohol at unhealthy levels, were inactive and obese, reported a long term illness and had higher smoking related mortality rates[42]. A lower socioeconomic status whether measured by income, educational attainment or occupation results in poorer health and higher usage of health resources.

The picture emerging is that Tasmania will experience an increase in demand for primary health and community based services over the next 10 years due to an ageing population and rising levels of chronic disease. The range of indicators establishing a consistent picture of disadvantage also suggests that the population might be relatively poorly equipped and resourced to cope with a deterioration in their health status.

SOCIAL AND ECONOMIC BURDEN

Social, psychological and financial issues factor strongly in patient decision-making about which dialysis modality to adopt. Attendance at regular dialysis sessions in hospitals and clinics requires changes in patient lifestyle, adjustments to employment and family situations and access to reliable transportation. For those living remotely, survival often depends on relocation to regional centres or cities, which can cause accommodation and income insecurity, social isolation and family stress.

Treatment for ESKD is expensive. On average, a year on dialysis costs between $45,000 and $80,000 per patient compared to transplantation costs of $70,000 in the first year followed by markedly reduced outlays. In 2006, the estimated Australian health expenditure on ESKD was $700 million.[43] Based on patient population projections, it is conservatively predicted that by the year 2010 the annual health allocation for ESKD in Australia will be close to $900 million.[44] Tasmanian spending on kidney dialysis and transplantation in 2018 is estimated to rise to approximately $21 million.

A recent cost-effectiveness analysis of CKD prevention suggested that opportunistic screening of 50-69 year olds in general practice together with the intensive management of diabetes, hypertension and proteinuria would be highly cost effective. Opportunistic screening for early renal disease consists of a simple and inexpensive urine dipstick for albumin and a blood pressure. Compared to the cost-effectiveness of contemporary screening programs, including those for breast, cervical and colorectal cancers, screening for risk factors of CKD offers comparable, if not better, value for money.[45]

HEALTH SERVICES

The health system in Tasmania consists of public, private and Australian Government funded health services. The services are interdependent and often collocated. There are 11 private inpatient facilities, which provide a range of services from acute care to rehabilitation including dedicated facilities for specialties such as ophthalmology and mental disorders. DHHS funds and manages the three main public acute facilities at Hobart, Launceston and Burnie and supplies more than 98% of acute public hospital services.

DHHS Service provision is divided into the three DHHS Areas – Southern, Northern and NorthWest. Area Health Services. The Southern Area Health Service is responsible for RHH which provides a referral and outreach service for some specialist services such as vascular surgery, burns and neurosurgery[46]. The Northern Area Health Service incorporating the LGH provides the majority of renal services for the people living in the North and North West Areas of the state with an outreach service to the North West Health Service (Burnie and Devonport).

There are a further 20 DHHS funded rural inpatient facilities, which provide a range of subacute beds and services. The Tasmanian Health Plan noted that these facilities are relatively inefficient and costly to maintain and a reconfiguration of their core services to better meet the needs of the community is being planned. The reconfiguration will include a four tier model for health service to facilitate decentralisation of services for sub-acute and post acute care and the development of Integrated Care Centres delivering a mix of short stay acute and primary care services. A greater emphasis in the primary health sector on prevention and community-based care is also planned[47].

PRIMARY HEALTH SERVICES

Tasmania has 23 community health centres that provide a range of non-inpatient services and act as an access and referral point for community health services and links into other parts of the health care system. Community Health Coordinators are implementing a new system consisting of focussed assessments and health promotion and prevention strategies that include a comprehensive assessment tool. This assessment tool will be applied to people referred to the community sector by hospital or GP services and will include screening for risk factors for chronic disease. This provides a new, population-wide opportunity to improve the identification and management of people with undiagnosed CKD and related chronic diseases.

DHHS has indicated that the development of a Chronic Disease Strategy is planned and in the interim the “Working in Health Promoting Ways Framework”[48] provides the guidance for health promotion for Tasmania. The Framework identifies seven health promotion priorities (No. 7: Improving the prevention and management of chronic conditions) and eight principles designed to address the priorities in an effective and sustainable way.

Palliative care services in Tasmania are community-based and clinicians work within a consultancy framework across the whole health sector, to support primary health service providers. The specialist community teams are based in Hobart, Launceston and Burnie and there are dedicated inpatient beds at Hobart and Launceston. The palliative care team provides an in-reach service to the RHH and LGH[49].

General practitioners in Tasmania are supported by three GP networks that roughly equate to the DHHS Area Health Services of South, North and North West. In May 2006 there were 541 GPs in Tasmania, approximately 1 for every 1,000 people. The THP advocates improved working relationships with general practice and in particular the progression of primary health services from Tiers 1-3 sites. This would also include the establishment of a demonstration site at Launceston, where delivery of GP services, from a state funded community health service, is proposed[50].

The links between renal services and the primary health sector and GP networks are tenuous with little exchange of information, education or protocols. Consultation with the primary health sector revealed a sense of being overwhelmed by the multitude of care plans and protocols, difficulty with implementing integrated recall systems and difficulty attaining efficiencies in practices that would allow the full uptake of Medicare reimbursed items for chronic disease care. Patients reported inadequate information on renal disease and management from GP services and a sense of being unprepared for renal replacement therapy. Some positive responses from

the primary health sector regarding renal education and coordination of patient care were provided and these were directly attributed to the work of the externally funded CKD nurse located within the renal team at RHH.

RENAL SERVICE PROVISION

Renal services are funded by DHHS and delivered under the auspices of Royal Hobart Hospital (RHH) and Launceston General Hospital (LGH). Both centres offer, albeit to varying degrees, acute and maintenance dialysis services, access to the transplantation program and training and support of the home dialysis therapies.

RHH has an in-centre facility that operates for acute dialysis treatments on an 'as needed' basis only. A dedicated renal ward does not exist at RHH and renal patients are managed in the medical ward. All dialysis patients are rostered to the St Johns satellite unit, which is off campus, for maintenance haemodialysis treatments and home dialysis training and support in both peritoneal dialysis (PD) and haemodialysis (HD). All patients are admitted at the St Johns facility as outpatients and approximately 40% are identified as private patients. This procedure provides an additional funding source for specialists and DHHS.

LGH has a 13 station in-centre facility which is utilised for both acute and maintenance dialysis. Like RHH, a dedicated renal ward also does not exist at LGH and all renal inpatients are managed on the medical ward. The LGH facility also has a self-care training and support program for PD but not a funded self-care HD program.

LGH also funds the 15 station North West Renal Unit at Burnie. This facility, in the main, is managed independently and has a funded PD self-care program but not a funded HD self-care program. Patients at both facilities are admitted as public inpatients.

With differences between the services in admission and billing procedures, as well as obvious differences in terms of nephrologist availability (from being on-site through to being several hours drive away), there is substantial variation in the frequency of specialist and other medical review. During recent times of specialist staffing shortfalls, this variability has been exacerbated and has had the potential to impact on the quality of care and oversight offered to ESKD patients.

Currently renal programs are not staffed and funded consistently across Tasmania, and there is significant variation in the nature, quality and extent of services in each region. The recommendations in this report relate to providing an accessible, equitable and quality service which requires standardisation of programs including staffing levels and development and implementation of procedures and protocols governing service delivery.

PRIVATE PROVIDERS AND CONTRACTED SERVICES

There are no private dialysis facilities currently operating in Tasmania although there are a considerable number of people with private health insurance. Private dialysis providers are reliant on adequate reimbursement from Health Insurance Providers for each dialysis treatment, in order to ensure the viability and sustainability of a privately managed satellite dialysis facility. Current indications are that the major private health insurance provider in Tasmania does not

offer reimbursement for dialysis treatments to the same or similar amount as other insurance providers. As a result, the 'out of pocket costs' incurred by the patient based on three times a week treatment, would be substantial and patients would opt for the public system making the service unviable for the private provider. That said, other Australian jurisdictions have used private dialysis providers to deliver care for both privately insured and public patients in the same facility, improving the viability of such facilities for the providers.

Further, private dialysis companies are now choosing to expand their services through partnerships and contracts with the public sector. The establishment and delivery of satellite services and even home therapies programs by dialysis companies contracted to the public sector, is a model of service delivery that is gaining support across Australia. The three main dialysis companies in Australia have historically provided machinery and consumables to enable the public sector to deliver dialysis treatments.

In the last 15 years, contracts for dialysis machinery and consumables have changed from a combination of capital outlay and variable recurrent costs, to a lease arrangement inclusive of maintenance and consumables for a single price per treatment. As invoicing is based on a set price per dialysis treatment and reimbursed according to the number of treatments concluded per month, this form of contract has been received favourably by Health Departments. It has allowed service providers access to the latest technology without capital funds; provides known recurrent costs for the life of the contract; eliminates maintenance (including technical staff) and capital replacement programs and the requirement to divest obsolete technology. Further, such contracts removed the need for the development and management of multiple, costly and time-consuming tenders for the gamut of consumables and machinery.

In recent years, this form of contracted service has expanded to include a variety of models that may or may not include:

- construction of dialysis facilities and the transfer of the asset to the organisation on completion of the contract;
- refurbishment of existing facilities and incorporating a lease payment to the facility owners;
- staffing and complete management of the service for public patients under the direction of publicly funded Nephrologists,

in addition to the provision of machines and consumables.

For the funder, this form of contracted service has several benefits that include;

- elimination of the need for capital expenditure while still procuring an asset;
- reduced risks related to delays in construction and financial over runs;
- reduced costs associated with recruitment, training, retention and staffing fluctuations; and
- improved planning and budgetary process as a result of a set price per treatment for the life of the contract — potentially for capital, personnel and operational costs.

The exploration of this type of contract is worthy of further investigation but importantly the benefits of a well written contract cannot be underestimated and guidance should be sought from jurisdictions that have undergone this process.

DATA MANAGEMENT AND FINANCIAL MANAGEMENT

Information systems in Tasmania and particularly within renal services are not standardised or interconnected. Such systems fail to promote the flow of patient information efficiently between service providers. The available clinical systems do not allow electronic viewing of patient demographic or clinical information across DHHS sites and patient records must be manually transferred between facilities. Performance indicators, data collection and activity monitoring are not standardised across the service nor reported into a single framework and clinicians have little understanding of the budgetary process or access to their expenditure reports.

The silo nature of funding and service delivery models in DHHS make patient tracking and activity monitoring difficult and impact on quality of care.

DHHS has recognised the difficulty in providing quality services in an information vacuum and the benefits of a coordinated information and communication system. The E-Health Strategy Development and Management Project[51] supports the collection, transmission, storage and access of patient and clinical information across sectors including the acute, primary, rural and diagnostic services.

Improved information management and information communication technology are generally regarded as critical drivers of health systems reform. The object of this reform is to improve individual outcomes while also improving the effectiveness and cost efficiency of health service provision. Application of a health information system that crosses health sectors has significant implications and benefits for renal services where care covers the continuum.

The iSOFT's iPatient Manager system will be implemented in Tasmania's acute hospital system allowing the tracking of patients between hospitals.

Although the implementation of this system will be an improvement on current capabilities, the system is not designed to manage operational and support information such as financial, performance or activity data for collection and reporting. A set of database tools that can be implemented across the service to manage performance indicators and quality assurance processes must be developed for renal services.

CURRENT WORKFORCE PROFILE

Nationally, the nursing workforce profile is ageing with 44% of nurses aged 55 years and over in 2005.[52] During consultations undertaken for this report, hospital managers indicated that the percentage of nurses over 55 in Tasmania was higher than the reported national figure. The Tasmanian labour force includes relatively fewer full time and more part time workers than the national average[53]. Responses from the renal workforce survey completed as part of the consultation process, illustrated that the majority of renal nurses in Tasmania were employed in a part time capacity with 72 people filling less than 51 FTE positions. The workforce profile of renal staff in Tasmania reflects the entire state labour force with an ageing population working part time.

Despite these statistics, Tasmania is one of the few jurisdictions in Australia where there does not appear to be a current shortage of renal trained staff. The renal services within Tasmania indicated that staffing shortfalls are currently not an issue and although individual units have necessity to train staff, this did not impact on the ability of the service to deliver care. New staff were allocated supernumerary time during training and this varied in length (between 3 and 10 weeks) depending on whether a renal educator was attached to the unit.

A recent survey by the Renal Society of Australasia (RSA) 2008[54], of all renal and dialysis units in Australia, noted that Tasmania was the only jurisdiction to be staffed solely with Registered

Nurses. Enrolled Nurses, dialysis technicians and Aboriginal Health Workers are not employed within Tasmanian's renal services and acute health system.

The workforce profile evident in Tasmania should raise concerns for the department. The combined effect of an ageing workforce, an ageing population with an exodus of younger people from the state will have significant implications for Tasmania's health industry within the next 5 to 10 years.

One of the work force issues resulting from high levels of part time and casual staff is the lack of ownership and responsibility by staff for aspects of service delivery and the potential for a decline in the quality and standard of service. It is important that staff are supported with education and professional development and senior staff are assisted with the change management process. Program ownership and unit support through clinical educators can assist with strategy implementation.

Another area of concern is the under utilisation of support staff such as ward clerks, patient care assistants and orderlies to manage non clinical and administrative duties within the renal units. These positions are unevenly employed across the renal services and the majority of non-clinical functions are carried out by nursing staff, particularly at the LGH and NWRU.

Further, programs within renal services which are nationally recognised as necessary to delivering a quality service are either not funded or not implemented equally across all sites. Staff within the service have recognised the need for these programs and have undertaken the work as part of their other duties. In some cases the programs are externally funded - usually a time limited grant from pharmaceutical companies. Table 7 illustrates the funded programs delivered by each unit.

ALLIED HEALTH

The Allied Health (AH) workforce numbers in Tasmania are equitable compared to Australia but distribution within the State is uneven. Regional and remote regions have 26% of the population but only 24% of allied health workforce. The AH workforce in Australia grew by 5% between 1996 and 2001. The largest growth was in nutrition and dietetics, which also had the highest percentage of students undertaking studies[55].

The input of Allied Health into renal services in Tasmania is limited. There are no full time positions attached to renal services for dietetics, social work, pharmacy or psychology and again the limited number of part-time positions is distributed unevenly across the service. National and international benchmarks are available for Allied Health in renal services and are included in the Appendices.

Renal Social Workers, Dietitians and Pharmacists have become integral to renal service delivery on a national and international level. Limited positions are attached to Tasmanian renal service and are primarily based in the southern region.

Table 4: Funding and Staffing of Renal Programs across Tasmania

Program	RHH	LGH	NWRU	Comment
Peritoneal Dialysis training and support	✓	✓	✓	
Home Haemodialysis training and support	✓			
Renal Clinical Educator	✓			0.6 Full Time Equivalent (FTE)
Transplantation coordinator	✓			0.4 FTE
CKD RN	✓			External funding 0.6 FTE
Access RN		✓		External funding 0.6 FTE
Renal Social Worker	✓	✓		RHH 0.5 FTE LGH 0.5 FTE External
Renal Dietitian	✓			0.5 FTE
Renal Pharmacist	✓			0.4 FTE
Psychologist				
Ward Clerk	✓	✓		
Orderly or care Assistants	✓	✓	✓	
Operational support	✓			Access to cars for PD and HHD programs

MEDICAL

Nationally there is an average of 1 GP per 1,000 people and in 2006 in Tasmania there were 1.1 GPs to 1,000 people. More than 50% of Tasmania's GPs practice in the cities, with 25% living and working in rural areas of less than 10,000 people[56]. The Tasmanian Health Plan noted that Tasmania was not disadvantaged in GP numbers generally, although the number of GPs in 22 of the 29 Local Government Areas (LGA) fell below the national average reflecting the high number of GPs in the urban areas. The number of GPs in the North and North West of the state was lower. Further, the plan highlighted that when actual full time equivalents (FTEs) were taken into account rather than a head count, the number of GPs per 1,000 persons reduced to an average of 0.73 in the state[57].

The Australian Institute of Health and Welfare (AIHW) in the 'Australia's Health 2008 Report'[58], noted that the average age of a GP was 50 years, with an increase in the number of GPs that were over 55 years. The report also noted that even though the overall number of GPs had increased in recent years, the actual FTEs had declined significantly. This reflected the increase in GPs working part-time. Tasmania had the oldest GP population and the lowest number of hours worked per GP in Australia[59].

The main reason for permanent loss from the workforce is the retirement of older workers and the health workforce is particularly affected, especially when evidence from tertiary training facilities is considered. Tertiary Educational Institutes indicated that medical and nursing studies make up only 4% and 7% respectively of health studies[60]. There is concern locally and nationally that the workforce replacement is insufficient to serve the ageing population with increasing health needs and specifically in Tasmania, which already has the oldest population in Australia and a declining GP FTE.

Nephrologists are benchmarked nationally at 1 nephrologist for 50 dialysis patients and 1 nephrologist per 200 chronic kidney disease patients. At 173 dialysis patients in 2007 the Tasmanian requirement is for 3.5 FTE Nephrologists, although the evidence from recent local studies suggest that the CKD numbers are in excess of 1000 patients and this is likely to impact on dialysis requirements. Currently there are 2 full time staff specialists, a 0.5 FTE specialist and a Visiting Medical Officer providing approximately 16 hours or 0.4 FTE making a total of 2.9 FTE. A further specialist (staff or VMO) has recently retired from RHH and there are plans to recruit to this position. Recruitment is also underway at LGH for a second nephrologist.

RENAL DISEASE IN TASMANIA

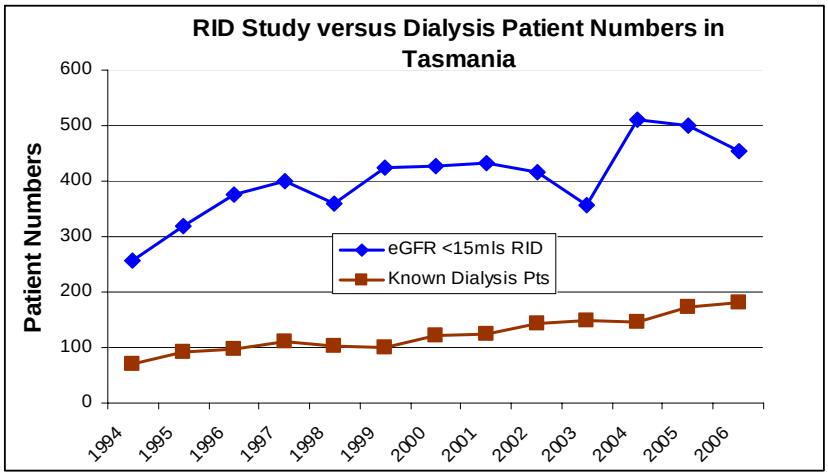
CKD PREVALENCE

The Tasmania Health Indicator Report 2008[61] reported on findings from the AUSDIAB study which assessed the renal function of over 10,000 people in 1999 and again in 2005. The report indicated that Tasmania had the highest prevalence of significantly reduced kidney function of all states and Territories. The report suggested that approximately 8.9% of the Tasmanian population had an eGFR of less than 60mls/min. It was also noted that the presence of blood or protein in the urine was highly prevalent in the Tasmanian population and only second to South Australia.

The Tasmania Health Indicator report also discussed the outcomes of the RID Study 2006. The Renal Impairment Database (RID)[62] project is a retrospective data base collection of all results of serum creatinine tested by Hobart pathology (and associated laboratories) between 1993 and 2006 and captures between 20 and 25% of the Tasmanian population in any one year. According to the results of this study, there are a significant number of people with severely reduced renal function who would appear not to be accessing renal replacement therapy.

Figure 4 compares findings from the RID study, identifying the high numbers of people who appear to have advanced CKD, with the number of people on dialysis. The lesser number of people taking up dialysis treatment suggests that there is a failure of progression for a significant number of people with advanced CKD to renal replacement therapy.

Figure 4: Dialysis Patient Numbers Compared to Unknown CKD Patients



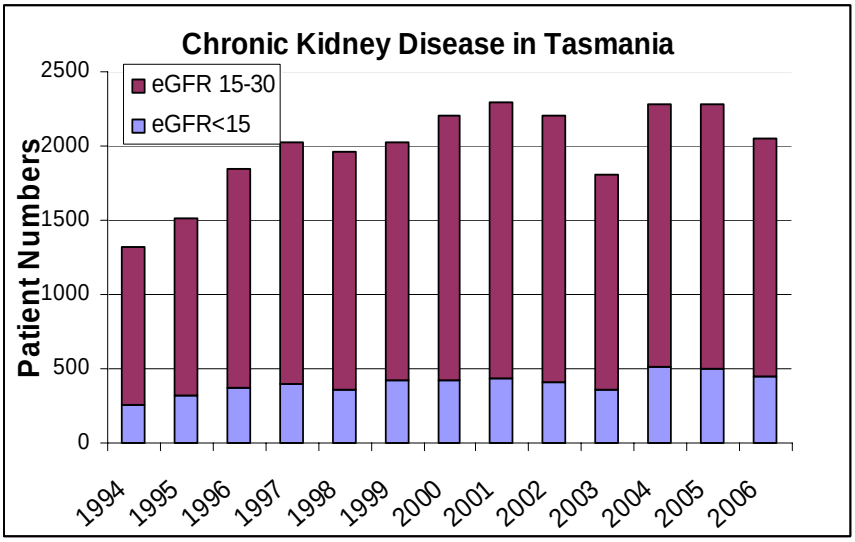
Source: Renal Impairment Data Base Project 2006[63]

Figure 5 has been reproduced from the RID study and identifies the number of people with advanced renal disease between 1999 and 2006 who would have been expected to present for renal disease management in the intervening period – over 2000 people. The concern is that a considerable number of people in the community might have unrecognised and unmanaged CKD and never progress to dialysis, possibly due to a high rate of premature CKD-associated cardiovascular death and poor access to quality health care.

It appears this situation has not changed as a more recent review of eGFR from both the private and public pathology providers in the northern region of Tasmania also noted very high levels of renal disease. The information from 2008 identifies nearly 2000 people with eGFR below 60 mls/min.

The data from each system can be checked to remove duplication, however neither system uses the same patient identifiers in the report (date of birth, home address or medical record number) and therefore it is not possible to cross-reference the lists and be assured of the final number of individuals. Nevertheless the results are consistent with there being a significant number of people with advanced CKD, unknown to renal services, who might require dialysis or kidney transplantation in the future.

Figure 5: Unknown Patients Identified with CKD



Source: Renal Impairment Data Base Project 2006[64]

The TPRS recognises the need for renal services in Tasmania to have better integration and communication with primary and secondary services. The development of partnerships with Primary Health (GPs, Practice Nurses, community health centres) and secondary services to promote opportunistic screening, early identification, management and referral of people with chronic kidney disease is necessary to delay progression to end stage and the requirement for dialysis. In addition, a shift from hospital to community-based renal provision is required. However, promotion of self-care treatments that can be safely delivered in the community will require a shift in mind-set for renal consumers in Tasmania. This will best be achieved by facilitating timely access to services in order to target patients in the early stages of CKD to promote informed decision making and improve the mental and physical preparedness for treatment of patient's and their families.

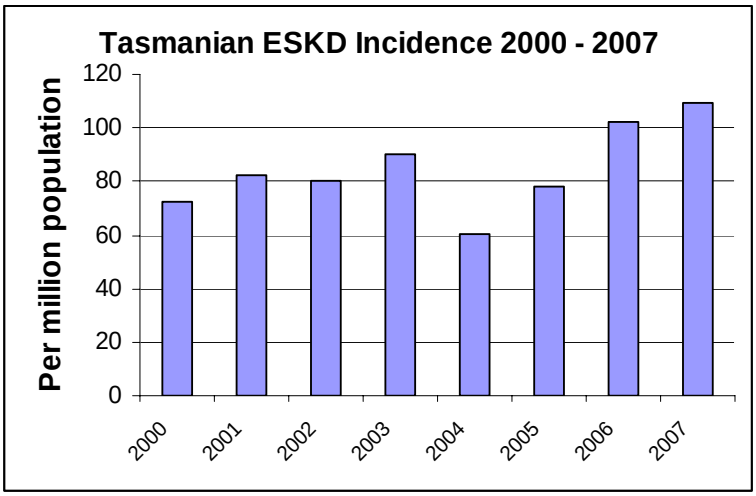
UPTAKE OF TREATMENT

The demand for renal replacement therapy is growing nationally by 6% per year. In 2007, there were 16,770 people with end-stage kidney disease of whom 42.5% were living with a functioning transplant and 57.5% were receiving dialysis.[65] In the 25 years between 1982 and 2007 the Australian population grew by 39% while the end stage kidney population (those receiving

kidney dialysis or transplantation) grew by 382%. This scenario is reflected locally where during the same period, the Tasmanian population grew by less than 14% while people requiring renal replacement therapy (RRT) grew by more than 135%[66 67].

Tasmania has experienced continuing growth in the number of new people presenting for RRT throughout the most recent decade. Figure 6 shows the number of new patients per million population in Tasmania since 2000 and illustrates the rise in the overall incident rate, equivalent to 8.3% per year[68].

Figure 6: Tasmanian Incidence Rates 2000 – 2007



Source ANZDATA 2008

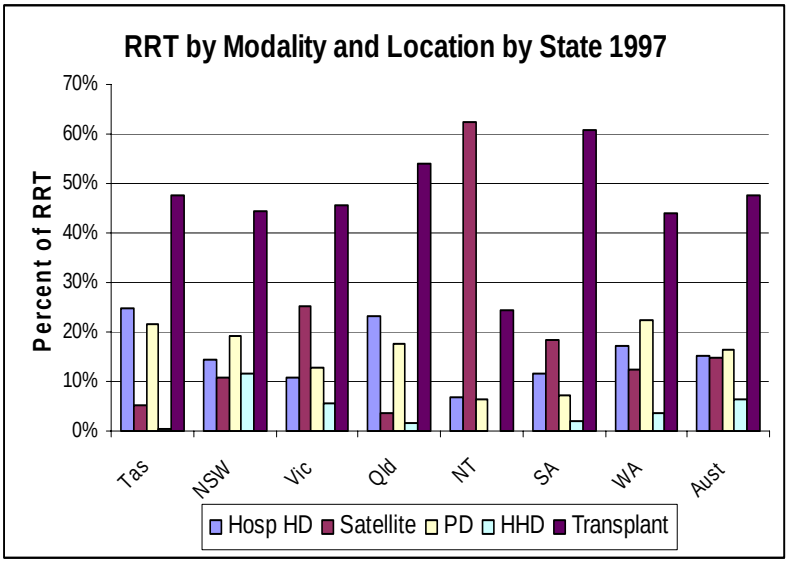
The increase in people requiring dialysis treatment is a major challenge for all health departments. Dialysis therapy is an expensive and resource intensive treatment and health systems struggle under the pressure of providing and funding appropriate treatment options suitable for their population. Institutional dialysis (haemodialysis in a satellite or in-centre facility) is the most expensive and least flexible of all options, yet the majority of people receiving dialysis in Australia commence treatment with institutional haemodialysis.

The reasons for this are unclear and may include:

- physician preference;
- lack of patient awareness and education regarding other treatment options;
- inaccurate perception of outcomes;
- the burdensome nature of self-care treatment regimes; and
- late referral or presentation for treatment leading to lack of choice and uninformed decision making.

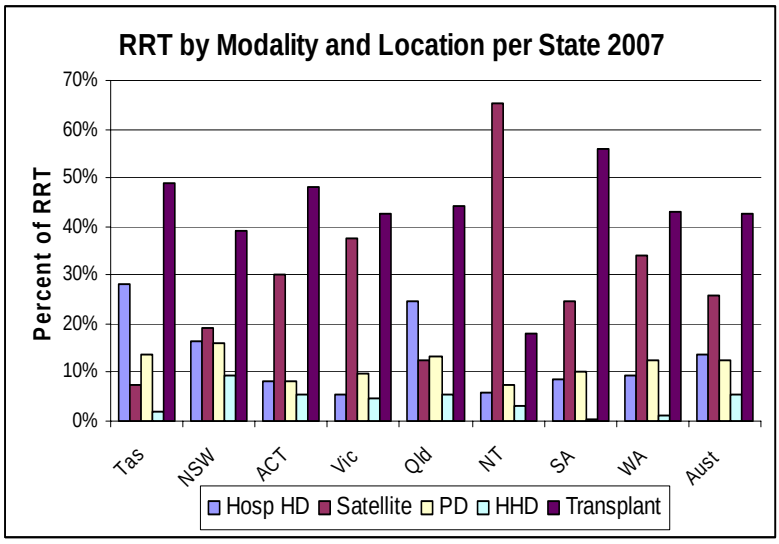
Figures 7 and 8 compare the number of patients undertaking each modality and their location by state in 1997[69] and 2007[70]. (In 1997, the ACT figures were reported in NSW data.) These graphs illustrate how location and modality has changed over the last 10 years as each state and Territory strives to decentralise services away from high-cost, hospital based dialysis to satellite and community-based modalities and closer to where people live.

Figure 7 Renal Treatment by Modality and Location 1997



Source: ANZDATA 1998

Figure 8 Renal Treatment by Modality and Location 2007



Source: ANZDATA 2008

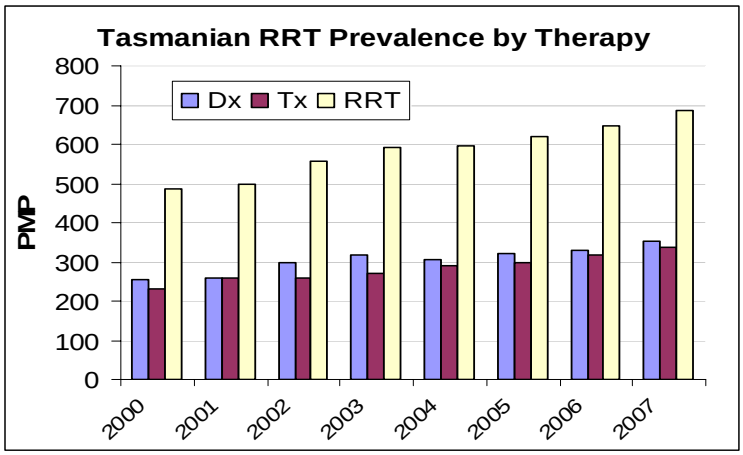
Satellite activity has increased across Australia with a corresponding decrease in in-centre use in most states. Home therapy usage has decreased with all states noting a drop in peritoneal dialysis patients except SA and NT and only Queensland, Tasmania and NT demonstrating small rises in Home HD acceptance. It should be noted, however, that these statewide averages conceal large variations between renal units in the proportion of patients using home-based

dialysis. The percentage of people living with a kidney transplant has also decreased somewhat in most states.

In 2008, ANZDATA reports that Tasmania has the greatest proportion of patients utilising hospital based dialysis in Australia. However this is inaccurate as the Nephrology South unit is physically based off campus at the St Johns Park facility and should therefore be considered a satellite facility and not an in-centre unit. Hospital HD usage is therefore significantly lower than the estimated 28%. Even so, a satellite facility is not currently available in the Northern Area Health Service and all maintenance and acute dialysis patients utilise the same facility at LGH. There are considerable efficiencies in work practice, patient flow and patient safety to be made from establishing a satellite facility in the Launceston area.

Tasmania has experienced a steady rise in the prevalence of renal patients and a subsequent increase in demand for dialysis treatments (Figure 9)[71]. Individual unit data demonstrates that the largest growth in haemodialysis activity has been in the north where demand has risen by an average of 600 treatments or 4 new patients each year. In contrast, haemodialysis activity at RHH has stayed relatively stable with little change in treatment numbers since 2004. RHH has historically experienced higher incidence rates than LGH although this difference has narrowed in the last few years. Over the seven years between 2001 and 2007 RHH accepted approximately 20% more patients than LGH[72].

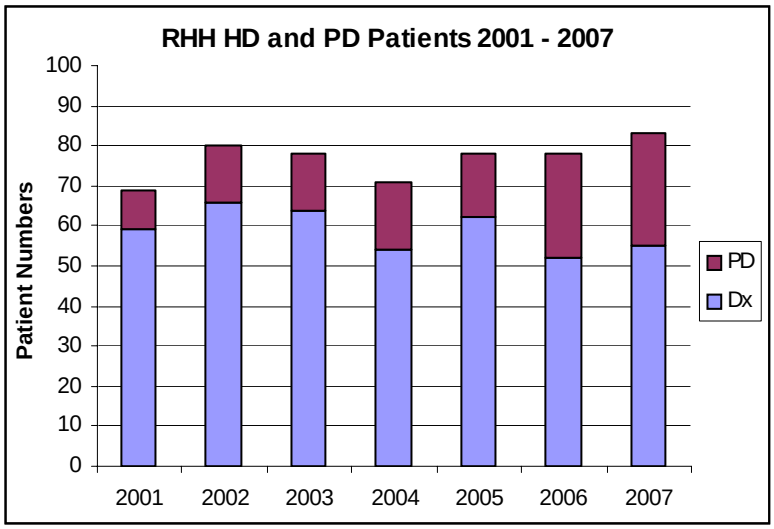
Figure 9: Tasmanian Renal Treatment Prevalence



Source ANZDATA 2008

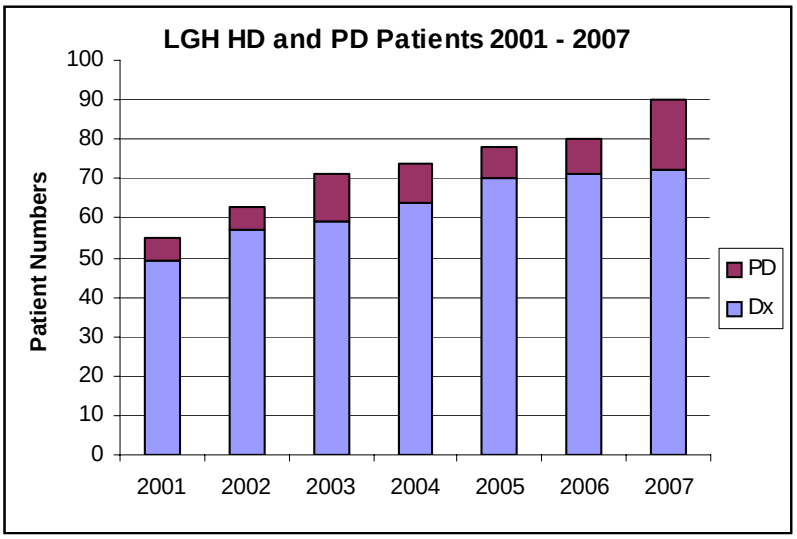
The majority of the growth in Hobart has been absorbed into the self-care PD program and to some extent, particularly in 2007, this also occurred at LGH. Figures 10 and 11 describe how growth in the peritoneal dialysis and home haemodialysis programs has been the greatest in Hobart, reflecting the additional resources allocated for their self-care programs.

Figure 10: Royal Hobart Hospital Dialysis Patient Numbers



Source ANZDATA 2008

Figure 11: Launceston General Hospital Dialysis Patient Numbers



Source ANZDATA 2008

HOME-BASED AND SELF-CARE THERAPIES

The reduction in home therapies uptake across Australia (as noted in Figures 7 and 8) between 1997 and 2007 is not expected to be sustained in the coming years. Increasing health department support for self-care and home therapies is evident in most State and Territory strategies, and has been necessitated by the demand for dialysis treatments outstripping infrastructure capacity. As health funders and policy makers realise the false economy of

stripping back outreach and support services and the increasing difficulty of funding the capital and recurrent costs of satellite services, there has been a move to treat people at home or at least closer to their homes.

The number of people on home haemodialysis in Tasmania is very small and one of the lowest in the country at 2%[73]. This phenomenon cannot be accounted for by the age of the dialysis population. The Home HD percentage in some states is as high as 9% and these jurisdictions treat a higher proportion of older dialysis patients. More likely is that historically, physician preference and clinical and planning decisions have not seen the necessary resources allocated to developing and supporting a sustainable home therapies program.

The barriers to developing a robust home dialysis (both PD and HD) program are eminently surmountable and require health planners to dedicate the necessary resources.

Home therapies

- Provide equivalent or superior clinical and quality of life outcomes for the patient;
- utilise lower staff to patient ratios;
- have lower capital requirements;
- cause less pressure on satellite facilities; and
- result in lesser demand for an expanding skilled renal workforce.

The program does however require a dedicated training area with dedicated personnel and operational resources. Service planners and funders need to recognise that treatment regimes are burdensome, consume considerable portions of patient's lives and impact on every aspect of their day-to-day living. Taking on the responsibility of learning and undertaking their treatment or their partner's treatment three times a week, is not an easy decision. Home and self-care therapies are not sustainable if a 'train them and send them home' mentality exists. Appropriate staff ratios for each program that consider patient demographics such as age, distance from service and available support networks, should be established.

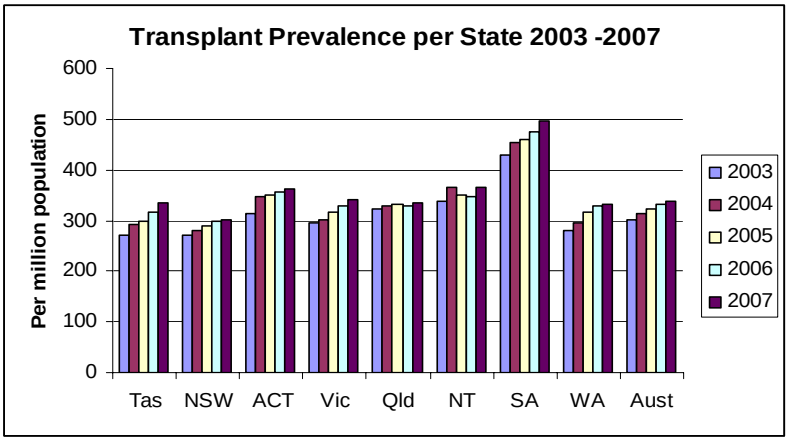
The resources required to support people at home and assist them maintain their independence include:

- adequate staff levels to provide self-care training - in a patients' home if necessary;
- regular home visits to assess the treatment environment, observe technique and the interactions between patients and family;
- program funding that includes cost of the minor infrastructure changes required in the patients home;
- program funding that allows patient reimbursement of electricity and water usage if this is not supported by the relevant authorities;
- dedicated training areas;
- respite for patients and their carers; and
- operational support such as access to vehicles.

TRANSPLANTATION AND ORGAN DONATION

For the majority of people with renal disease, transplantation offers the best quality of life. For health service providers this is also the preferred treatment option providing superior clinical outcomes and significantly decreased health expenditure after the first year. Nationally, the majority of transplants originate from deceased donors; however the use of living donor organs has been steadily increasing throughout Australia. This trend is driven by a number of factors including the shortage of deceased donors, better surgical techniques for living donors that reduce pain and hospitalisation time and advances in medical management allowing donors previously considered immunologically "incompatible", to be used. There were 271 live organ donor (LD) kidney transplants performed in 2007 in Australia, 44% of all transplant operations. In the period 2003-2007, the region of Victoria and Tasmania was the first in Australia to use live donor grafts in over half (51%) of transplants. A growing proportion of live donations are unrelated and the majority of donors are female, generally spouses.[74]

Figure 12: Transplant Prevalence 2003 -2007



Source ANZDATA 2008 31st Report

Figure 12 highlights the growth in prevalence of kidney transplantation in Tasmania. The split between dialysis and transplantation uptake in Tasmania is relatively even, with 49% of all renal patients living with a transplant (Figure 9). In 2007, 50% of the prevalent transplant population had received a living donation[75].

ANZDATA reported that in 2007, 9% (16 people) of the dialysis population in Tasmania were on the transplant waiting list, compared to 13% nationally. All patients on the waiting list in Tasmania were Caucasian[76]. Waiting times for transplantation vary, but most dialysis patients will wait up to four years for a transplant, although much longer time frames have been known for people where compatibility matching has been an issue. The longer a patient is on dialysis before transplantation, the higher the probability that outcomes post transplantation will be poor. Kidney donations are provided to states and territories in two ways. The National Organ Matching System maintains a data base of all people on the transplantation list in Australia. Approximately 20% of cadaver organs, regardless of originating state, are allocated according to the best match between recipient and organ nationally. The remaining 80% of organs are allocated according to the originating states own formula[77].

Tasmania is affiliated with Victoria for kidney transplants, with transplant surgery being performed at Royal Melbourne Hospital and 6-monthly visits occurring to Hobart and Launceston to assess potential recipients. The ANZOD (Australia and New Zealand Organ Donation) Registry collects and reports data on the number and characteristics of deceased organ donors. There is considerable variation in rates between states, and the number (and therefore rate) of deceased organ donors in Tasmania fluctuates. The balance between the number of organs donated by Tasmanians and the number received by Tasmanian ESKD patients also fluctuates.

Figure 13. Numbers of Donors per Million Population

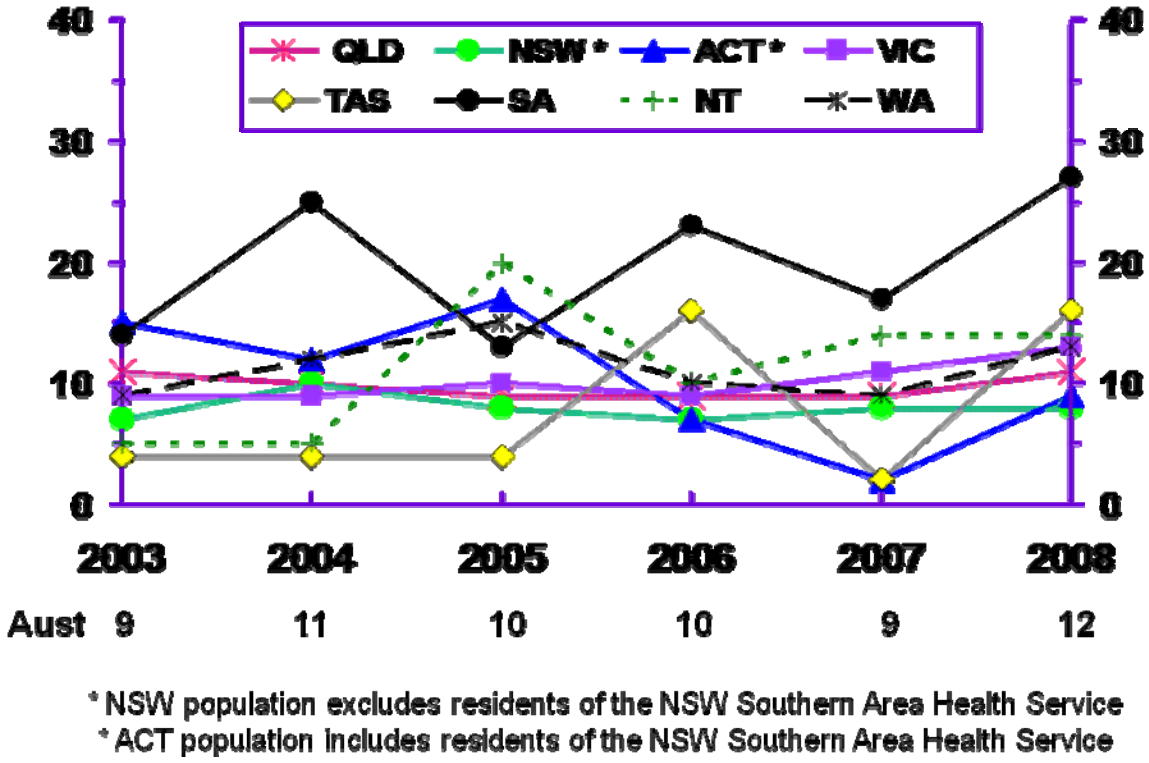


Table 5 Numbers of Deceased Donors, Kidneys and Recipients for Tasmania 2000-2008.

Year	2008	2007	2006	2005	2004	2003	2002	2001	2000
Deceased donors	8	1	8	2	2	2	6	3	1
Kidneys retrieved	13	2	14	4	3	3	12	6	2
Tasmanian recipients of DD kidneys	8	10	5	6	7	9	2	8	3

Data from ANZOD and ANZDATA. Note that Tasmanian recipients do not necessarily receive the "Tasmanian" kidneys; as Tasmania operates as part of a Vic/Tas allocation system.

The mean age of donors in Tasmania was 36 years, the youngest in Australia although the most common cause of death for Tasmania and Australia-wide was cerebrovascular accident (CVA). Most organs arose from donors in Intensive Care and the donor coordinator in Victoria made contact with all families in all cases, either in person or via the phone[78]. Only one of the donors was registered with the Organ Donation Registry and none identified themselves on their driving licence as a donor.

Improving transplantation rates in Tasmania will require strategies to increase donation rates from both deceased and live donors. South Australia, which has consistently had the highest transplantation and donor rate in Australia, attributes its success to a variety of factors including a "pro-donation" culture in Intensive Care units, centralised tertiary care hospitals in Adelaide, the use of Donor Coordinators in hospital settings and an active single kidney transplant unit with a prominent local profile. Efforts to raise awareness of the importance of organ donation are required along with strategies to:

- increase the number of people on the donor registry;
- increase the number of people who identify themselves as donors on their driver's licence;
- provide education, support and closer liaison with clinicians in hospital settings to identify more potential donors; and
- increase support for donor families.

Nationally, the Australian Government is rolling out funding to establish clinicians in each State and Territory, dedicated to increasing organ donation rates. A National Medical Director of the Organ and Tissue Donation and Transplantation Authority[79] has recently been appointed and positions in Tasmania have been advertised and filled.

Early education, assessment and introduction to other transplant recipients may also help CKD patients and their families reach decisions on live donor transplantation and whether this option meets their needs. An important aspect of recipient and donor assessment is psychological interviews to ensure emotional coercion and unrealistic expectations are mitigated.

DIALYSIS ACCESS

In order to receive dialysis treatment – peritoneal or haemodialysis – an 'access' must be created that will facilitate the purification of the blood system.

- For haemodialysis patients, the optimal access is a native fistula – the joining of a superficial vein with an artery.
- For peritoneal dialysis patients, it is a tunnelled catheter into the abdomen called a Tenckhoff catheter.

Creating a permanent dialysis access requires surgical intervention and the longer the delay in establishing a functioning permanent access, the poorer the clinical outcomes for the patient. In the absence of permanent access, a temporary catheter can be inserted into a major blood vessel. However these are often associated with increased rates of localised and systemic infection, vessel stenosis or narrowing and sub-optimal treatment due to lower blood flow rates.

Late referral to renal services, uncoordinated treatment planning and poorly resourced surgical services will lead to an increased use of temporary and artificial accesses[80]. In addition, a poorly constructed access, requiring multiple interventions and revisions, can increase patient morbidity and mortality and significantly increase health care costs.

In Australia, information is collected by ANZDATA on the number of new patients starting with each type of access, and the prevalence in each dialysis unit of native fistulas, grafts and permanent and temporary central lines.

The data collected by ANZDATA is collated and provided to the Head of Units in each state in the 'Individual Hospital Reports'. The reports compare several indices over a 5-year period between the hospital and the national average, including dialysis survival, cause of death, vascular access and peritonitis rates[81 82]. A comparison of the reports noted that although the overall rates of temporary and permanent vascular access were comparable with the national average, there were significant differences between RHH and LGH.

RHH had fewer people start treatment with a native fistula at 26% versus the national average of 39%, and considerably lower than LGH where 48.5% of patients started treatment with a native fistula. Even when the data was censored for 'late referral' (that is those patients that were referred to a nephrologist less than 3 months before they required treatment), only 31% of patients at RHH, compared to 50% nationally and 59.3% at LGH, commenced treatment with a native fistula.

However, the prevalence rates (that is the number of established patients with a native fistula) increased to 87% at RHH compared to 80% at LGH and 75% nationally[83 84].

Dialysis access is a complicated and technical procedure and few surgeons specialise in both vascular access surgery and PD catheter insertions. Vascular access surgery requires a certain level of skill, experience and volume to maintain proficiency. However, it is usually part of a broader surgical practice and vascular access surgery for renal patients is generally viewed as a minor, although often problematic component, due to the high intervention rate.

Several initiatives are being trialled and pursued in other jurisdictions. Some promote 'PD First': the commencement of peritoneal dialysis as a first treatment, rather than haemodialysis, with subsequent transfer to HD. These initiatives include:

- Insertion of buried catheters in CKD patients to be exteriorised when needed;
- Public private partnerships utilising funding from dialysis companies to carry out the insertion of PD catheters in private hospitals, under private surgeons, for public patients; and
- The promotion of peritoneoscopic catheter insertions – the insertion of PD catheters under local anaesthetic by nephrologists in 'clean treatment rooms' rather than theatres.

Poorly inserted catheters can cause extreme discomfort to the patient, delay treatment commencement, lead to infection or other complications, require further surgical intervention increasing costs and morbidity and often lead to patients opting to discontinue PD in favour of HD.

Establishing and maintaining dialysis access is a complicated and multidisciplinary process, involving nursing staff, physicians, specialist surgeons and interventional radiology and can consume significant expenditure. Timely, well planned and constructed access can reduce these health costs five fold[85]. The lower access rates at first treatment at RHH, indicate that despite the Statewide Vascular Surgery service being delivered from the same facility, there are opportunities for improvement. Discussions with stakeholders have indicated that there is a lack

of coordination between renal services and surgical services. This lack of coordination, coupled with individual surgeon preferences for referral and management, impacts on the timely insertion of access and on emergency interventional surgery for established fistulas.

The superior access rates at first treatment at LGH have been attributed to the work of the externally funded Access RN. The role of the Access RN includes monitoring all CKD and established dialysis patients to facilitate timely access to surgical services and collate quality data on infection rates, access failure rates and invasive and non-invasive interventions. The position works closely with the nephrologists, surgeons and patients to coordinate access planning, radiological and theatre scheduling. The Access RN also has a role in educating and assisting nursing staff in the correct care and management of fistulas including needling techniques and monitoring of the access site and function to pre-empt fistula failure.

A patient's access is their lifeline and significantly poorer outcomes can be attributed to late and multiple interventions to establish permanent access. Better financial, clinical and quality of life outcomes are achievable through simple measures to improve coordination and referral. These include:

- Establish the combined CKD/Access RN position as integral to renal care planning.
- Establish renal access clinics where surgeons, nephrologists and the Access RN review pending and established patients and jointly plan their care.
- Monitor and regularly asses the function of established patients' access.
- Establish joint protocols with surgical and radiology services for timely referral and intervention for renal patients requiring access review.

MORTALITY RATE

Renal patients have known reduced survival rates when compared to the general Australian population. Nationally the survival of patients on dialysis is less than 50% at 5 years and the main cause of death is cardiovascular disease, which accounts for 44% of deaths, followed by infection and malignancy[86]. In Tasmania, survival data is provided to Head of Units in the 'Individual Hospital Reports' for both RHH and LGH. The reports for the 2002-2007 period indicate that Tasmania has poorer survival than the national average; however with small patients numbers at each centre, these differences are not statistically significant and should be interpreted with caution. The centre reports contain comparisons of patient demographics, numbers of late referrals and information about vascular access, issues which need to be carefully reviewed by the centres when interpreting this data.

PREDICTIONS OF FUTURE SERVICE DEMAND

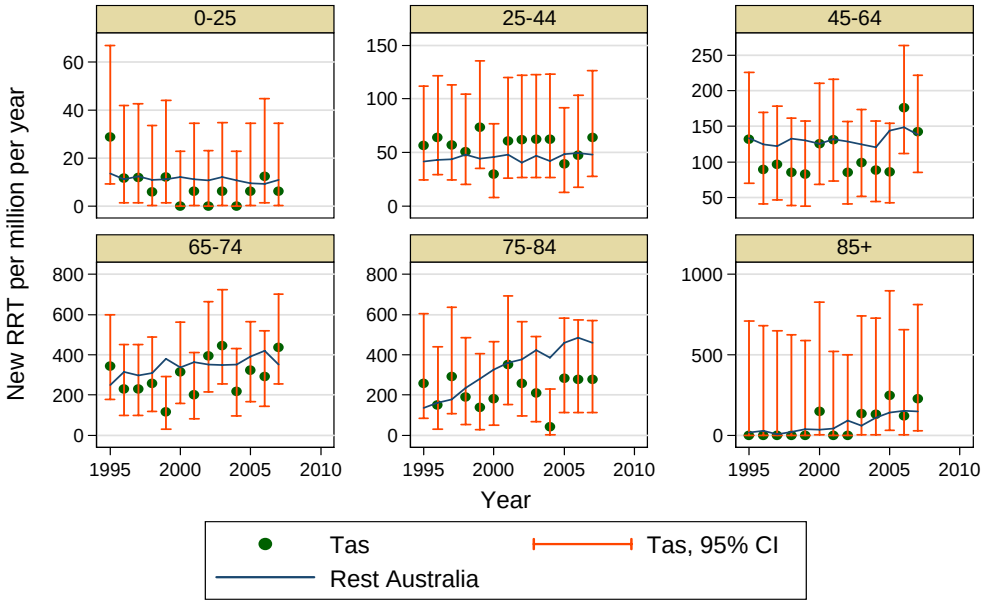
Predictions of the number of people requiring RRT in Tasmania up to and including 2018 have been developed to inform the economic costing model detailed in Part Two of this report.

Incidence and prevalence data from 1997 to 2007 for both Australia and Tasmania were obtained from ANZDATA. Although kidney disease amongst Indigenous Australians is an important health issue in Tasmania, the proportion of people receiving dialysis or transplantation who were indigenous is very low in comparison with the rest of Australia (5/412=1.2 % of people who started 1997-2007). For this reason, Tasmanian RRT rates are compared with Australia non-indigenous rates.

New Patient Numbers

Tasmanian incidence rates (that is the number of new people starting treatment) for the period 1997 – 2007 were separated into age cohorts and compared to the Australian rates (Figure 14). For all age groups, the Tasmanian rates are similar to the overall Australian rates. Further comparison of the rate of change in each age group suggested no differences in the rate of change in age-specific incidence rates between Tasmania and Australia. Given the greater statistical precision of the overall Australian trends in incidence rates, forward projections used the Australia-wide non-indigenous trends.

Figure 14: ESKD incidence for Tasmania with Australian (non-indigenous)



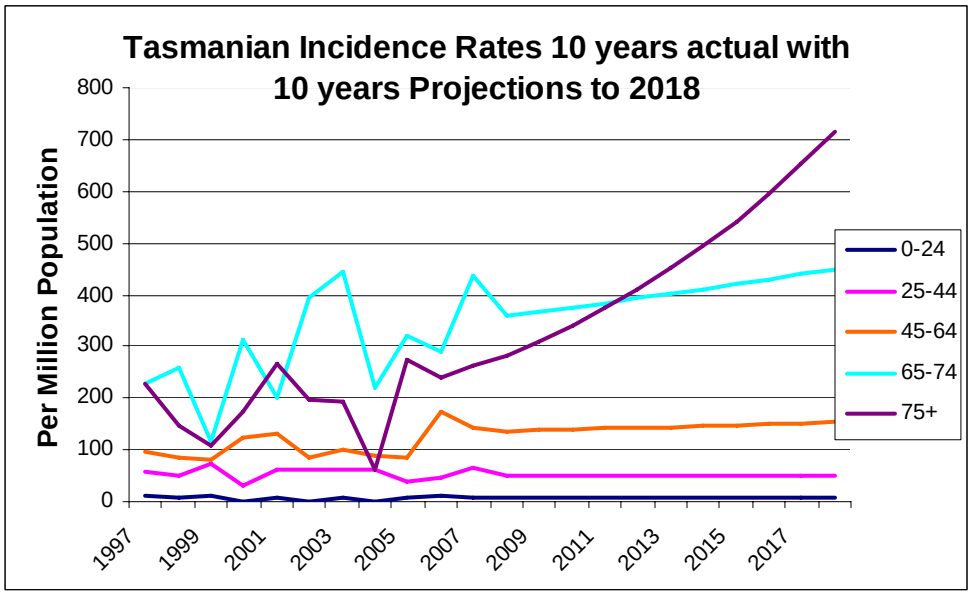
ANZDATA / ABS data

Trends in the incidence of ESKD in Tasmania are consistent with national trends showing the most rapid increase in the older age groups. The age specific rates were then multiplied by the projected population for Tasmania to derive predicted numbers. Importantly, in a state with a population base the size of Tasmania, there will be considerable variation from year to hear simply on the basis of statistical uncertainty. This is illustrated by the wide 95% confidence intervals in Figure 14.

It is difficult to accurately predict the number of new patients presenting for treatment each year. These figures are likely to fluctuate from year to year and there are no reliable biological measures of the rate of progression of chronic kidney disease. A number of other factors could possibly affect changes in incident numbers including increased opportunistic screening, alterations in control of risk factors such as diabetes and hypertension, improved awareness in the primary health sector of CKD management, earlier referral or conversely improved Advanced Care Planning and palliation.

Figure 15 explores the predicted incidence rates and the age of new patients commencing treatment between 2008 and 2018. These were derived from current incident rates and applied to the expected population growth in Tasmania. Based on current data, a rise in the number of people over 75 years is expected. This increase in elderly patients reflects the national situation and will have implications for service delivery strategies to increase the rates of transplantation and home therapies.

Figure 15: Projected New Patients by Age 2007 to 2018



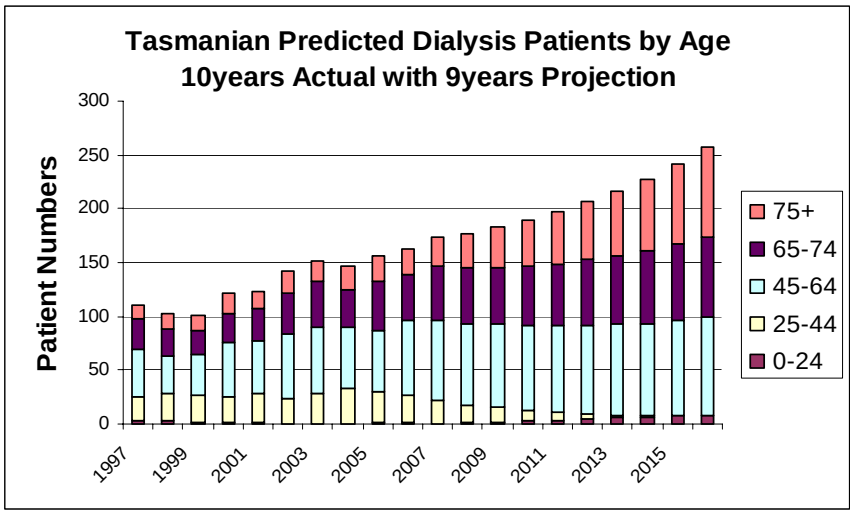
Patients Treated by Each RRT Modality

A Markov model was used to predict the number of people at the end of each year requiring RRT. This type of model uses the predicted numbers of new patients together with estimated chance of existing patients receiving transplants, returning to dialysis following transplantation, and dying (transition probabilities) in each age group. Uptake of each modality was determined from actual Tasmanian data. The predicted rates were then applied to the predicted future Tasmanian population drawn from Australian Bureau of Statistic Data - Estimated Resident Population of Tasmania. The model and assumptions underlying this step are outlined fully in Part Three.

Predicted prevalence rates of people on dialysis (that is the number of people on dialysis but not transplanted) by age were modelled based on ten years of actual data and extrapolated to 2018

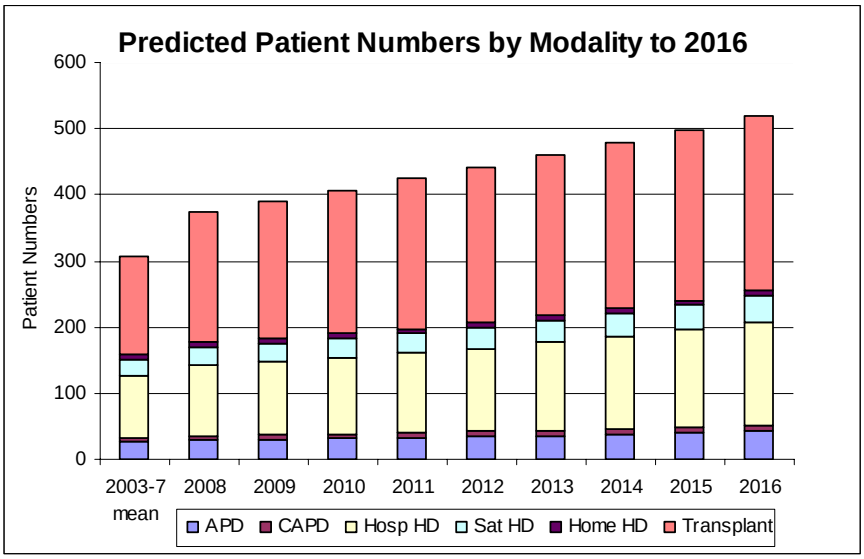
(Figure 16). Projected trends suggest a decrease in the number of patients aged 44 years and less and an increase in the number of people aged over 75 years. A slight increase in the number of people aged between 45 and 64 years is also expected.

Figure 16: Projected Trend in Dialysis Patient Numbers and Age



The projected uptake of each modality was based on current Tasmanian specific ANZDATA information and modelled to 2018. A low rate of home haemodialysis and an increasing usage of hospital services is evident, as is an increase in the number of people with a transplant (Figure 17). Currently, haemodialysis location is reported to ANZDATA as either Royal Hobart Hospital or Launceston Hospital (in-centre units) or North West Renal Unit in Burnie (satellite unit). Patients treated at the St John Dialysis unit are currently reported as being treated in hospital, and are therefore counted in ANZDATA as “in-centre” patients. This would not materially affect the modelling of cost benefits associated with the promotion of home-based therapies.

Figure 17: Projected Trend in Renal Replacement Therapies



This modelling assumes the current distribution between modalities is maintained. It does not account for strategic changes recently implemented in Tasmania or planned for the immediate future. A drive to integrate services across the health sectors, closer working relationships with primary health and implementation of E-Health, might result in an increase in the number of people identified with renal disease and referred to nephrology services. Further the recent appointment of dedicated Organ Donor Coordinators might have an impact on the number of available kidneys for donation, increasing the number of people transplanted.

The following table (Table 9) shows the number of new patients predicted to commence RRT in Tasmania by year and by age. Between 2008 and 2018 Tasmania can expect 764 people to present for treatment – equivalent to twenty-four satellite units of 8 stations. Nearly a third of the new patients will be over 75 years of age. While not all of the new patients will choose or require institutional haemodialysis, current service delivery strategies suggest that a good proportion of new patients will commence haemodialysis as a first option.

Table 6: Projected Incident Patient Numbers per Year, by Age

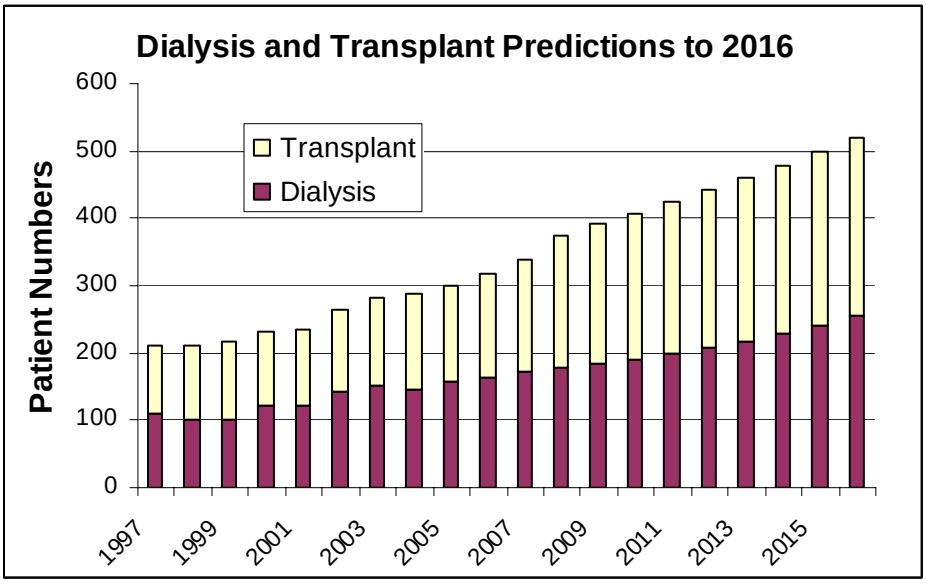
Age group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
0-24	1	1	1	1	1	1	1	1	1	1	1	1
25-44	8	6	6	6	6	6	6	6	6	6	6	6
45-64	19	19	19	19	20	20	20	21	21	21	22	22
65-74	17	14	15	16	17	19	20	21	22	24	25	27
75+	9	12	13	14	16	18	20	23	26	29	33	37
Total new patients	**54**	**52**	**54**	**56**	**60**	**64**	**67**	**72**	**76**	**81**	**87**	**93**

The modelling undertaken for this report factored in mortality rates and movements between modalities based on clinical parameters such as technique and graft survival rates. The economic modelling is based on historical data (from 1997-2007) of how long Australian non-indigenous ESKD patients stay on one type of treatment before moving to another or exiting the program due to death.

The projected split between dialysis and transplant uptake, with consideration of the above factors is illustrated in Figure 18. The relatively even split between dialysis and transplant patients will continue, but renal services in Tasmania can expect an increase in demand for dialysis treatments with an approximate net gain of 100 dialysis patients over the next 7 years. If current service arrangements are not altered and focussed towards home therapies, services will not be able to keep pace with demand. Significant additional infrastructure will be required including capital for satellite facilities.

The economic modelling undertaken in Part Two utilised the age specific transition probabilities to determine patient numbers entering each modality between 2007 and 2018. Various scenarios were then modelled to assess the cost benefit of shifting treatment usage between modalities. Scenarios were adjusted according to age, likely technique survival and mortality rates. Without changes to current treatment patterns, an increase in recurrent funds for renal services with be required each year from a current $16.3 million to $22 million in 2018. The compounding of the increase in yearly recurrent funds will equate to spending $250 million over 10 years.

Figure 18: Projected Split Between Dialysis and Transplant Patient Numbers to 2016



Shifting the focus of service delivery to home and self-care therapies has the following benefits:

1. A decrease in recurrent expenditure;
2. An improvement in patient quality of life and health outcomes; leading to
3. A greater chance for transplantation further reducing health expenditure.

The economic modelling demonstrated significant cost savings by focussing on home and self-care therapies. By switching to home HD and PD, it is proposed that DHHS will realise cost savings in the vicinity of $16.25 million over 10 years.

Increasing transplantation rates by 10% above current rates by 2012, demonstrated a reduction in predicted costs of over $0.8million. With a projected aim of an increase in transplants of 50% above current rates, far greater savings will be evident. See Part Three for a detailed description of modelling and projected quality of life and health care cost benefits.

Stakeholder Forums

Consultation with stakeholders and consensus attainment was integral to the development of the Plan. Consultation forums were held in the week of the 14th April to the 21st April 2009 in Hobart, Launceston and Burnie to capture the views of renal clinicians, surgical specialists, general practitioners, allied health professionals, health service managers and administrators and patient and consumer groups.

Three consumer/patient/carer forums were held – one in each location, with a total of 35 attendees. Most consumers attended the Launceston meeting (28) where the majority of issues were raised in relation to access to services, standard of service including availability of education and support services and perceived inaction by the Department /Government over the need to develop an appropriate and sustainable service in the north of Tasmania.

Similarly consumers attending the Burnie meeting also noted the lack of education and information available about their disease, how to delay progression and a perceived late referral to the renal unit for preparation for treatment. Consumers at both Burnie and Launceston noted the lack of surgical services and information and support available for transplant patients and their families who are required to leave the state to undergo transplantation.

Consumers in Hobart were generally happy with the services they were able to access but did identify the cost of medications – particularly transplant medications - for those who worked, as an area of concern.

Consumers unable to attend the meetings were able to provide written submissions and documentation was received from consumers from all three geographical areas.

Four renal clinician forums were held with a number of smaller meetings offered to clinicians and specialists who were unable to attend the forums. A total of 34 renal multidisciplinary team members attended the meetings with the largest participant group present at the Launceston meeting with 16 participants.

In addition meetings were held with CEOs of Hobart, Launceston and Mersey Hospitals, CEOs of North and North West Area Health services, physicians of Burnie and Mersey Hospitals, program managers for Community Health, Chronic Disease and the GP networks. Teleconferences were also held with the vascular and general surgeons based at RHH and the GP network.

The renal clinicians within Hobart noted that renal services were well resourced for in-centre care and the satellite facility (Nephrology South at St John Park), but that outreach services and services that would enable links to be established to improve the continuum of care for patients were tenuous. Services such as chronic kidney disease education for GPs, community health staff, and practice nurses were limited by the ability of staff to devote time to organising and delivering the service in addition to their in-centre workload.

A lack of other support services such as dietitians, social workers and access nurses also impacted on this strategy. The nephrologists recognised the need to support the north of the state with outreach services due to the recent departure of a senior nephrologist, but had been unable to do this in a sustained manner due to fluctuations in their own staffing levels.

Clinicians at Launceston and Burnie were clearly stretched. They identified inadequate nephrological staff resources and support services for the management of established and

pending patients including CKD clinics. Infrastructure at Launceston General Hospital was inadequate and inappropriate for the number and category of patients and a lack of approved and dedicated staff for home therapies, transplantation pre- and post-care, and non clinical support staff. While the facility at Burnie was suitable as a satellite service, it was inadequately resourced for home therapies, CKD management, pre- and post-transplant care and access management. Access to emergency surgical services and interventional radiology at LGH was considered inadequate.

Neither of the northern clinical areas had access to a renal educator and staffing complements in all renal facilities were solely registered nurse-based. Clinicians also provided written submissions.

Meetings with Health Department and Hospital management personnel confirmed that the need to move the majority of renal outpatients at LGH to a specifically designed, off campus satellite service in Launceston was a priority.

Discussions with the Vascular and General Surgeons highlighted some issues with planning and consistent management of renal patients. Not all of the vascular surgeons utilised the Access RN at LGH to coordinate referrals and plan surgery. The surgeons who did, noted an improvement in the quality of information regarding the patient including clinical background and issues that may impact on surgery, a more streamlined management plan for theatre and follow-up which reduced the specialist's burden for assessing, reviewing and planning patient care.

The general surgeon is responsible for insertion of Tenckhoff catheters and did not attend any vascular surgery. Much of the Tenckhoff surgery was attended in the private hospitals as a result of a public-private partnership with a dialysis company. There is a suggestion that this agreement may not be renewed and services for insertion of Tenckhoff catheters within the public system will need to be provided.

Current Activity and Capacity of Tasmanian Renal Services

Service Hub and Facility	Location	Number of stations	Number of shifts	Current patient load	Maximum capacity	Comment
Royal Hobart Hospital Acute Nephrology	In-centre	5	3 days x 2 shifts 3 days x 1 shift	As needed	20 patients	Patients admitted
Royal Hobart Hospital Nephrology South St John	St Johns Park New Town	20	6 days x 2 shifts	53	80	Outpatient status
Launceston General Hospital In-centre	In-centre	13	6 days x 2 shifts	44	52	3 annexed stations used for self-care Patients Admitted
Launceston General Hospital NorthWest Renal Unit	Parkside Building Burnie	15	3 days x 2 shifts	27	60	Patients Admitted

Renal Programs Offered, Staffing Ratios and Ancillary Services

Service Name	Location	Pre-dialysis Education	Access Educator	Clinical educator	Transplant Coordinatio	Self-care PD Program	Self-care Home HD	Social worker	Dietitian	Pharmacist	Access Surgery	Interventional radiology
Royal Hobart Hospital	In-centre											
• Nephrology South	New Town	0.6 FTE	X	0.6 FTE	0.4 FTE	2: 28	1:7	0.5 FTE	0.4 FTE	0.4 FTE	✓	✓
Launceston General Hospital	Launceston	X	0.6 FTE	X	X	1:16	X	0.5 FTE	X	X	✓	X
• NWRU	Burnie	X	X	X	X	1:16	X	X	X	X	X	X

Workforce Benchmarks

Discipline	National	Qld[lxxxvii]	International (UK)[lxxxviii]
Nephrologist - Dialysis CKD/ Transplant	1:50 (WA) 1:60 (NT)	1:50	1:75 RRT
Nursing			
In-centre haemodialysis	1:2.5 - 3	1:2.5	1:3
ICU	1:1-2	n/a	1:2
Satellite	1:4	1:3 Dependent 1:4 low dependence 1:6 Self-caring	1:3 Training and complex care 1:4 Low dependence
Home HD	All included 1:10 1:15 (NT)	1:2 Training 1:20 Home	n/a
PD	All included 1:20 or 25 1:15 (NT)	1:2 Training 1:20 Home 1:20 Rural	1:20
CKD	1:100 - 125	1:80	n/a
Transplant Coordinator	1:300 1:50 post transplant (NT)	1:300	2 per Transplantation unit
Clinical Educator	1:60 staff	1:60	n/a
Access coordinator	0.5 FTE per hub	1:200	n/a
Clinical data Manager	1 per hub	1 per hub	1 per unit
Allied Health			
Social Worker and ALO	1:100	1:70	1:144 RTT
Dietitian	1:150 dialysis	1:100	1:200 dialysis pts
Pharmacist	0.2 per hub	1:250	1:250 RRT
AO Clerical	1 per unit (NT)	0.4FTE: 1 Nephrologist	1 per consultant plus 1 per 100 dialysis pts
Patient Care Orderly	1 per shift	n/a	n/a

Tasmania Statewide Renal Health Services Plan

2010–20

Part Three

Economic Modelling Report: Modelling the Current and Future Costs and Benefits of Renal Replacement Therapy in Tasmania

August 2009

Contents

Part Three: Economic Modelling Report: Modelling the Current and Future Costs and Benefits of Renal Replacement Therapy in Tasmania

Part Three explores the potential impact of changing the current renal health service delivery patterns within Tasmania and the resulting costs and health benefits to 2020. It has taken the perspective of the health care funder and has modelled the health sector costs of providing RRT on the basis of the best available data. In order to determine the impact on costs and health outcomes, of changes in the clinical management of end-stage kidney disease (ESKD), current costs and benefits must be defined and estimated. A Markov model for treated end-stage kidney disease patients was constructed, upon which the existing patterns of renal replacement therapy (RRT) in Tasmania were used to predict the future health care costs and benefits of treating new and existing end-stage kidney disease patients for each year up to and including 2018.

The model takes into account personnel, interventional, pharmaceutical, diagnostic, infrastructure, maintenance and consumable item costs. The costs of comorbidities such as diabetes mellitus, ischemic heart disease and cancer have not been modelled as attribution of the costs incurred by these conditions to end-stage kidney disease or renal replacement therapy is usually not straightforward. Specifically, it is not possible to quantify to what extent these conditions are worsened by RRT and therefore to what extent these costs can be attributed to renal replacement therapy. This, together with the absence of detailed Australian data about admission rates for specific renal and non-renal causes among the renal replacement therapy population, is a major deficiency in the published literature. It is likely that costs associated with lost earnings and productivity, and other out of pocket costs of patients and families such as the cost of carers, travel, over-the-counter medications as well as other consumables are also very large. Due to a lack of available data, it has not been possible to quantify these costs in this document.

Method

The approach used in this analysis follows a previously developed and reported methodology for the analysis of costs and benefits of renal replacement therapy in Australia.[2] Many of the data limitations identified in this earlier work are also applicable in the Tasmanian setting. Additional detail of the model, data sources and assumptions are reported in Appendix A.

The Economic Model

A Markov model was constructed as the basis for estimating the costs and benefits of renal replacement therapy (RRT) in Tasmania. This model is based upon the general structure (including some assumptions) of an earlier model used to estimate costs and health outcomes of RRT on a national level.
The model follows multiple cohorts of men and women newly treated for end-stage kidney disease, along with existing renal replacement therapy patients. The length of each ‘treatment’ cycle in the model is one year. The structure of the model is shown in detail in Appendix A. The model is stratified by age.

[2] Agar, J, Knight, RJ, Simmonds, RE, Boddington, JM, Waldron, CM, Sommerville, CA 2005, 'Nocturnal haemodialysis: An Australian cost comparison with conventional satellite haemodialysis.' *Nephrology (Carlton)*, vol. 10, no. 6, pp. 557-70.

Sources of estimates

In the absence of good-quality individual randomised control trials or large prospective observational studies conducted in Australia, this study uses the best available Australian published data to derive estimates for the model parameters. This required a substantial secondary analysis of ANZDATA in order to derive transition probabilities between health states and renal replacement therapy (RRT) modalities. Details of the sources of cost and quality of life data are outlined in the following section. If no published evidence could be found, the opinion of clinical experts was sought.

Projection of the incidence of End-Stage Kidney Disease 2008 to 2018

Future incidence of treated end-stage kidney disease (ESKD) is based on:

- A Poisson model of incidence trends over time (for all patients); and

See the related document *Tasmanian State Plan for Renal Services 2010-2020, Part One: Current Service Analysis and Future Demand Predictions* for a detailed description of the modelling of future end-stage kidney disease (ESKD) incidence used in this document.

Age group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
0-24	1	1	1	1	1	1	1	1	1	1	1	1
25-44	8	6	6	6	6	6	6	6	6	6	6	6
45-64	19	19	19	19	20	20	20	21	21	21	22	22
65-74	17	14	15	16	17	19	20	21	22	24	25	27
75+	9	12	13	14	16	18	20	23	26	29	33	37
Total new patients	**54**	**52**	**54**	**56**	**60**	**64**	**67**	**72**	**76**	**81**	**87**	**93**

Health State Utilities (Quality of life weights)

No Australian data exists on utility (QOL) scores for patients in pre- (ie dialysis) and post-transplant health states. The health utility scores for dialysis, and post transplant states are summarised in Table 1

Table 1: Health utility scores for dialysis and post-transplant states

Assumptions	Value	Source	Justification for source
Renal transplant		Laupacis et al (1996)	Pre and post transplant time trade-off (TTO) utility valuation study conducted on transplant patients and on dialysis patients (pre-transplant)
Time after transplant			
1 month	0.68		
3 month	0.71		
6 month	0.75		
12 months	0.74		
Time weighted average 0-12 months	*0.7325*		
18 months	0.7		
24 months	0.7		
Time weighted average 12-24 months	*0.7*		
Dialysis (pre-transplant)	0.55	Laupacis et al (1996)	
Death	0	Convention	

Resource use and costs

Cost data were based on the best available published data that conform to Australian government guidelines for the application of economic evaluation to funding submissions to the Pharmaceutical Benefits Advisory Committee (PBAC) and the Medical Services Advisory Committee (MSAC). The most recent (2006-7) NHCDC Round 11 AR-DRG cost -weights have been used for relevant DRG-based costs. Australia-wide data has been used because Tasmanian specific information is not available. Additional detail is available in Appendix A.

A primary costing study of dialysis modalities or transplantation was not undertaken. Estimates of the cost of each treatment modality were based on the best available published data and were derived from Australian studies. Although a number of costing studies have reportedly been undertaken in various States and Territories, almost none of these studies have been published in peer-reviewed manuscripts or government reports.

Other inpatient resource use by dialysis modality is also partially captured. Data are not available to estimate the total inpatient resource use (renal and non-renal related admissions) for patients on dialysis. Therefore, to capture some of the possible resource use associated with admissions for peritoneal dialysis (PD) patients, an estimate has been generated based upon ANZDATA information on admissions for peritonitis, and for haemodialysis (HD) patients based on ANZDATA information of access revisions. This will likely underestimate true inpatient resource use for both PD and HD patients, although in the absence of other Australian data on patient admissions, this is the only available data.

The annual cost of transplant includes surgery and hospitalisation, immunosuppressive therapy, specialist review and consultations and other drugs, as well as donor costs for a transplant. Data sources are discussed in more detail in Appendix A.

The unit costs of renal replacement therapy (RRT) per patient per annum, by treatment modality, are summarised in Table 2 and Table 3 (with further details of the costs of RRT provided in Appendices A and B).

Table 2: Unit cost of dialysis per patient per year by modality (AUD$2008)

Resource items	*Home Haemodialysis $ unit cost per annum*	*Satellite Haemodialysis $ unit cost per annum*	*PD $ unit cost per annum*	*Hospital Haemodialysis $ unit cost per annum*
Dialysis costs (incl fixed costs, salaries and wages, consumables)	**38373**	**42984**	**45249**	**80652**
Drugs(incl Epoietin alfa, Darbepoetin alfa, Calcitriol & Iron)	**9666**	**9666**	**9666**	**9666**
Hospitalisation due to infection/ other complications / access revisions*	**2483**	**2483**	**7923**	**2483**
Specialist consultations and review	**530**	**530**	**530**	**530**
Work up costs for patients on transplant waiting list	**730**	**730**	**730**	**730**
TOTAL ANNUAL COST (not including initial access)	**51782**	**56393**	**64099**	**94061**
Initial access (incl temporary access)	**15490**	**15490**	**12762**	**15490**

* 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.

Table 3: Unit cost of kidney transplant per patient per year by modality (AUD$2008)

Resource items	*Live donor Recipient unit cost $*	*Live donor Donor unit cost $*	*Deceased donor Recipient unit cost $*	*Deceased donor Donor unit cost $*
Transplant				
Year 1				
Surgery and hospitalisation	**35962**	**13836**	**35962**	**3,000**
Regular Immunosuppressive therapy (PBS)	**19038**		**19038**	
Additional Immunosuppression	**2,620**		**2,620**	
Other drugs	**8619**		**8619**	
Non drug follow-up costs	**6367**		**6367**	
TOTAL YEAR 1 COST	72606	13836	72606	3000
Year 2 onwards				
Regular Immunosuppressive therapy	**8881**		**8881**	
Other drugs	**724**		**724**	
Non drug follow-up costs	**819**		**819**	
TOTAL YEAR 2 ONWARDS COST	10424		10424	

Transition probabilities

The full set of transition probabilities has been reported previously[3]. Because of small patient numbers in Tasmania (relative to all of Australia), Australian data has been used as they are more robust. The main areas where these probabilities differ from the previous Australia-wide report is the proportions of patients utilizing different RRT modalities. Tasmanian specific data have been used to capture current practice, which then forms the basis for examining the costs and health outcomes of alternative patterns of renal replacement therapy modality delivery (See Appendix A).

Calculation methods

Methods of calculating costs and benefits from 2007-2018 are explained in detail in Appendix A. Appendix A also provides details of the methods used for calculating the incremental costs and benefits, and the incremental cost-effectiveness ratio of changing patterns of renal replacement therapy modality.
The specific calculations are:

- the present value of costs and benefits of treating all existing and new cases of ESKD (from 2007 - 2018)
- the additional health care costs (savings) and benefits of increasing the proportion of new ESKD patients who receive a kidney transplant
- the additional health care costs (savings) that accrue by changing the proportion of patients that undergo different types of dialysis (hospital haemodialysis, home haemodialysis, peritoneal dialysis ,and satellite haemodialysis).

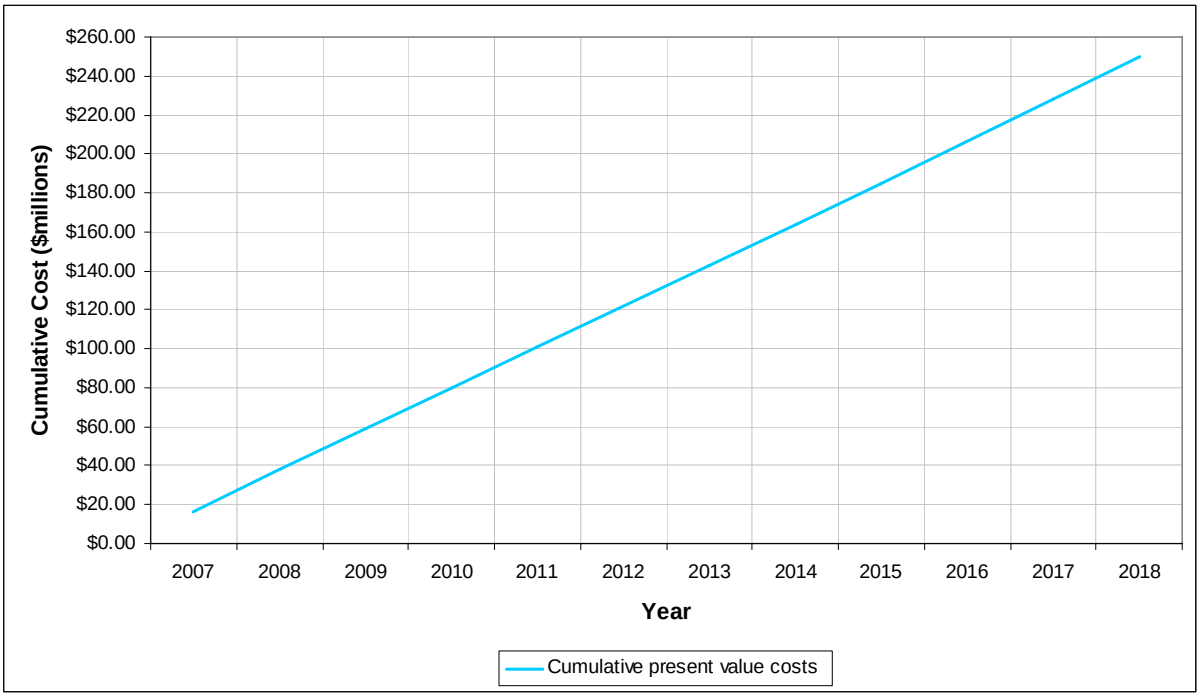
[3] Cass, A, Chadban, S, Craig, J, Howard, J, McDonald, S, Salkeld, G, White, S 2006, *The Economic Impact of End-Stage Kidney Disease in Australia.* , Kidney Health Australia, Melbourne.

Results

Health sector costs (in present dollar values) of treating current and new cases of end-stage kidney disease (ESKD) out to 2018

In today's dollars the cumulative cost of renal replacement therapy for all current and new cases of end-stage kidney disease treated out to 2018 in Tasmania is estimated to be $250 million by the end of 2018 (Figure 1). The component costs of new and existing ESKD patients are presented separately in Appendix A.

Figure 19: The cumulative present value treatment cost of all new and existing Tasmanian ESKD patients treated out to 2018



Projected annual health sector costs of treating all cases of end-stage kidney disease (ESKD) to 2018

The annual present value cost of renal replacement therapy (RRT) is estimated to rise from $16.3 million in 2007 to $22 million in 2018 (Table 4).

Table 4: Total present value projected annual health care costs of treating all cases of ESKD for 2007- 2018 ($ millions)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total annual cost	$16.34	$21.31	$21.28	$20.88	$20.85	$20.89	$20.99	$21.13	$21.30	$21.50	$21.74	$22.00
Cumulative annual total costs	$16.34	$37.65	$58.93	$79.82	$100.67	$121.56	$142.55	$163.67	$184.97	$206.47	$228.22	$250.22

Benefits (in life years and quality-adjusted life years[4]) of treating new cases of ESKD (to 2018)

The present value of the benefits of renal replacement therapy (RRT) for all new cases of ESKD out to 2018 will approach 2300 life years by 2018. The present value of the benefits of RRT for all new cases of ESKD (to 2018) will be approximately 1300 quality adjusted life years.

The annual and cumulative present value of total health benefit for treatment of all new cases of ESKD out to 2018 are summarised in Table 5, and are summarised graphically in Appendix A.

[4] Quality adjusted life years (QALYs) are a multidimensional outcome measure used in health economics. This economic index of outcome combines patient survival in life years with an adjustment for the quality of life, where adjustment is based on interval scale from 0 (worst health) to 1 (full health).

Table 5: The present value (annual and cumulative) of health benefit (Life years and quality adjusted life years) for all new ESKD cases out to 2018

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total annual life years	51.24	92.20	125.30	152.02	173.85	192.57	208.57	222.27	234.16	244.61	253.99	262.47
Cumulative life years	51.24	143.44	268.75	420.76	594.61	787.18	995.75	1,218.02	1,452.18	1,696.79	1,950.77	2,213.25
Total annual quality adjusted life years	28.42	51.71	70.84	86.52	99.33	110.31	119.68	127.68	134.60	140.66	146.06	150.92
Cumulative quality adjusted life years	28.42	80.14	150.97	237.49	336.83	447.14	566.82	694.50	829.10	969.76	1,115.82	1,266.74

Cost effectiveness and cost-utility analysis of changing patterns of RRT modality for all new ESKD patients

A cost-effectiveness and cost-utility analysis was conducted to examine the incremental cost effectiveness ratio (ICER) of increasing transplant rates. Under both models of incidence projection, the incremental cost effectiveness of increasing kidney transplants by 10% or 50% is dominant over current practice. That is, increasing the transplant rate is less expensive and more effective than current treatment patterns for ESKD. The incremental cost savings range from $0.81 million to $3.85 million out to 2018. Results are shown in Table 6 and Table 7.

Table 6: The present value costs and health benefit (out to 2018) of increasing the current transplant rate in Tasmania by 10% by 2012 over current levels

Costs and Benefits to 2018	Total cost	Incremental cost	Total Life Years	Incremental life years	ICER	Total QALYs	Incremental QALYs	ICER
Base case	$170,724,145	-$810,771	2213.25	8.97	Dominant	1266.74	10.33	Dominant
Increased transplant rate	$169,913,374		2222.22			1277.07		

Table 7: The present value costs and health benefit (out to 2018) of increasing the current transplant rate in Tasmania by 50% by 2012 over current levels

Costs and benefits to 2018	Total cost	Incremental cost	Total Life Years	Incremental life years	ICER	Total QALYs	Incremental QALYs	ICER
Base Case	$170,724,145	-$3,850,928	2213.25	44.98	Dominant	1266.74	51.62	Dominant
Increased transplant rate	$166,873,217		2258.23			1318.36		

The incremental costs and health outcomes of the sensitivity analysis examining switching dialysis modality are summarized in Table 8 below. Increasing the rate of both home haemodialysis (HD) and peritoneal dialysis (PD) utilization (as detailed in Appendix A) will lead to net savings of up to $16.25 million. Without Australian data on utility-based quality of life on each dialysis modality it is not possible to estimate the incremental benefits of the 'switch modality' scenarios. However, it is reasonable to assume that there would also be a significant improvement in quality of life resulting from these changes.

Table 8: The present value costs and health benefit (out to 2018) of increasing the utilisation of both Home HD and PD services in Tasmania*

Costs and benefits to 2018	Total cost	Incremental cost ($million)	Total Life Years	Total QALYs
Base Case	$170,724,145	-$16,247,455	2213.25	1266.74
Increased Home HD & PD utilisation	$154,476,691		2213.25	1266.74

* The savings produced through increasing the utilization of both home haemodialysis (HD) and peritoneal dialysis (PD) services in Table 10 are dependent on achieving the targeted levels of modality utilization, as discussed in the Appendix.

Appendix A: Details of rationale, methods and results

Introduction

In order to determine the impact on costs and health outcomes, of changes in the clinical management of end-stage kidney disease (ESKD), current costs and benefits must be defined and estimated. A Markov model for treated ESKD patients was constructed, upon which the existing patterns of RRT in Tasmania were used to predict the future health care costs and benefits of treating new and existing ESKD patients for each year up to and including 2018.

Renal replacement therapy (RRT) programs incur direct costs, which include the cost of all resources necessary to provide RRT, from buildings and equipment to pharmaceuticals to professional services, as well as productivity, or indirect costs. The pain, suffering or fear associated with treatment are regarded as negative benefits in the economic analysis and are captured as changes in quality of life. This report has taken the perspective of the health care funder, and has modelled the health sector costs of providing RRT on the basis of the best available data. These take into account personnel, interventional, pharmaceutical, diagnostic, infrastructure, maintenance and consumable item costs. The costs of comorbidities such as diabetes mellitus, ischemic heart disease and cancer have not been modelled as attribution of the costs incurred by these conditions to ESKD or RRT is usually not straightforward. Specifically, it is not possible to quantify to what extent these conditions are worsened by RRT and therefore to what extent these costs can be attributed to RRT. This, together with the absence of detailed Australian data about admission rates for specific renal and non-renal causes among the RRT population, is a major deficiency in the published literature. It is likely that costs associated with lost earnings and productivity, and other out of pocket costs of patients and families such as the cost of carers, travel, over-the-counter medications as well as other consumables are also very large. It has not been possible to quantify these costs in this report, due to a lack of available data.

Methods

The approach used in this analysis follows a previously developed and reported methodology for the analysis of costs and benefits of RRT in Australia[5]. Many of the data limitations identified in this earlier work are also applicable in the Tasmanian setting.

[5] Cass, A, Chadban, S, Craig, J, Howard, J, McDonald, S, Salkeld, G, White, S 2006, *The Economic Impact of End-Stage Kidney Disease in Australia.* , Kidney Health Australia, Melbourne.

Background data available

The following section describes the data that was available for assessing Australian and Tasmania costs and health outcomes of renal replacement therapy (RRT).

Costs

The most readily available information in Australia on the cost of dialysis relates to the price of dialysis modality used to *fund* services. However, the cost of providing a service may be different to the reimbursed amount per service i.e. the funded amount. It is the opportunity cost of resources involved in RRT that should drive an economic model, not State-based funding agreements. Funding of renal dialysis can vary considerably by State and agreed levels of funding do not necessarily reflect the opportunity cost of RRT.
In contrast to many other estimates that report *funding* (rather than actual *costs*) for dialysis services, in 1999, Bird Cameron Chartered Accountants were commissioned by the Health Department of Western Australia (HDWA) to conduct a cost analysis of the renal dialysis services funded by the HDWA. The authors used 1997-98 financial data from three public hospitals in WA to estimate the *cost of delivering* each dialysis modality and to recommend a benchmark price for HDWA to fund dialysis services. This was a rigorous, bottom up costing, and as such represents some of the best available data on the cost of providing RRT. The results of the study are summarised in Table 1. For this analysis, these data have been inflated to 2008 values using the AIHW Health Price Inflators[6]

Table 1: 1997/98 Costs and pricing by modality for teaching hospitals in Western Australia

Modality	Royal Perth Hospital Costs per patient $	Sir Charles Gairdner Hospital Costs per patient $	Fremantle Costs per patient $	1997/98 Health Dept of Western Australia Price Schedule $
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

[6] AIHW Health Expenditure 2005-6 Table D1http://www.aihw.gov.au/publications/hwe/hea05-06/hea05-06.xls#'Table D1'!A3

You et al (2002)[7] estimated the hospital costs of Aboriginal and non-Aboriginal patients having haemodialysis in the Northern Territory (NT) of Australia. Based on 1996-7 and 1997-8 fiscal years, all episodes of care for 101 Aboriginal patients and 64 non-Aboriginal patients, grouped by the Diagnosis Related Group Version 3 classification system, were derived for three public hospitals in the NT. The study authors report the number of admissions, days of hospitalisation and costs for all causes as well as the number of dialysis treatments received by patients. In total there were 488 hospital admissions, 4,312 days of hospitalisation at a total cost of $2,933,917. The data were then used to project future demand (through to 2005) for dialysis treatments in the NT, costing an estimated $49.8 million.
In 2003/2004, Agar et al conducted a costing analysis of nocturnal home haemodialysis (NHHD) compared to conventional satellite haemodialysis (SHD) within the renal program at the Geelong Hospital in Victoria, Australia[8]. 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 throughout the 2003-2004 financial year were including in the patient-based cost study. The cost of NHHD included i) the costs associated with training and program maintenance and ii) the ongoing costs of dialysis in the home once a patient is 'installed' at home. For both NHHD and SHD, the authors estimated the staff and recurrent (consumables) expenditure as well as capital and other infrastructure costs. The costing did not specifically include erythropoietin (EPO), medical service costs and initial access. The estimated cost per patient per month of treatment for SHD was $3,023.66 (consisting of wage and recurrent costs $2,495.67 and fixed and estimated costs of $527.99) and for NHHD it was $2,699.31 (consisting of wage and recurrent costs of $2,336.31 and fixed and estimated costs of $363). Again, these figures have been inflated to 2005 values using the AIHW Health Price Inflators.

Utility-based Quality of Life (QoL) on Dialysis

Quality of life is a significant factor when assessing the outcome of RRT from the patients' perspective. The extent to which one treatment modality provides patients with good physical, social and emotional well-being and allows them independence can be measured and valued using a preference-based measure of quality of life such as the QALY (quality adjusted life year). This economic index of outcome combines patient survival with an adjustment for the quality of life, where the adjustment is based on an interval scale from 0 (worst health) to 1 (full health). Changes in quality of life that may result from switching RRT modalities, for example from hospital haemodialysis to home haemodialysis or from dialysis to transplant, can be measured on the 0-1 scale and the impact of the change captured in the number of QALYs derived from each treatment modality.
A number of quality of life studies have been undertaken and reported among dialysis and transplant patients. This economic model uses the utility-based quality of life reported in a well designed pre- and post-transplant study by Laupacis et al in

[7] 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*, vol. 176, no. 10, pp. 461-5.
[8] Agar, J, Kinght, RJ, Simmonds, RE, Boddington, JM, Waldron, CM, Sommerville, CA 2005, 'Nocturnal haemodialysis: An Australian cost comparison with conventional satellite haemodialysis.' *Nephrology (Carlton)*, vol. 10, no. 6, pp. 557-70.

1996[9]. Laupacis et al conducted an earlier study on 188 haemodialysis patients enrolled in a RCT of the effect of erythropoietin (EPO). The authors used one disease specific measure of QoL, the Kidney Disease Questionnaire and two generic instruments, the Sickness Impact Profile (SIP) and the utility-based Time Trade-off (TTO) method. The results of the Laupacis study were: for haemodialysis and no EPO (at 6 months) the mean utility score was 0.42, with EPO and maintaining Hb 95-110g/L utility equals 0.51, with EPO and maintaining Hb 110-130g/L utility equals 0.58[10]. There is limited and somewhat inconsistent utility based QoL information available on alternative dialysis modalities, and there is no published information available on QoL for Australian patients.

Russell and colleagues (1992) used the TTO method to measure QoL for a group of 27 patients on dialysis who subsequently received a successful kidney transplant[11]. The mean utility score whilst on dialysis was 0.41.

De Wit et al (1998) administered a series of QoL questionnaires alongside a clinical study of dialysis treatments in thirteen Dutch dialysis centres[12]. Three instruments were used, the EQ-5D Visual Analogue Scale, the TTO and the standard gamble (SG) technique. The mean utility scores (SG, TTO and EQ-5D) for each type of dialysis were: for hospital haemodialysis (HD) 0.84, 0.87 and 0.58 respectively; for satellite centre HD 0.91, 0.93 and 0.65; for continuous ambulatory peritoneal dialysis (CAPD) 0.81, 0.86 and 0.61 and for continuous cycling peritoneal dialysis (CCPD) 0.74, 0.93, 0.61.

In a subsequent study, de Wit used two health profile (generic) instruments, the EQ-5D and the SF-36 and two utility-based instruments, the SG and TTO, to compare health-related QoL for haemodialysis and peritoneal dialysis health states. A total of 135 dialysis patients participated in the study (69 on HD and 66 on PD). The mean utility scores for HD were 0.86 (SG) and 0.89 (TTO) and for PD 0.82 (SG) and 0.87 (TTO)[13]. The SG and TTO scores were higher than previously published data, which lead the authors to speculate that their results reflect adaptation by patients to their current state of health on dialysis.

Wasserfallen used the EQ-5D multi-attribute utility instrument to measure quality of life in Swiss dialysis patients[14]. The EQ-5D measures five dimensions of QoL, including mobility, self care, usual activity, pain/discomfort and anxiety/depression. At the time of the survey 419 respondents were receiving HD and 49 PD. The mean utility score for HD was 0.62 and the mean score for PD was 0.58.

Churchill (1987, 1991) has published two studies in which the TTO method was used to derive utility scores for hospital HD (0.43), home HD (0.49) and peritoneal dialysis (0.56).[15],[16] McFarlane et al (2003) used the SG technique in a survey of 24 patients

[9] Laupacis, A, Keown, P, Pus, N, et al, 1996, 'A study of the quality of life and cost-utility of renal transplantation', *Kidney International*, vol. 50, no. 1, pp. 235-42.

[10] Laupacis, A, Wong, C, Churchill, D. 1991, 'The use of generic and specific quality-of-life measures in hemodialysis patients treated with erythropoietin', *Control Clinical Trials*, vol. 12, no. 4 Suppl, pp. 168s-79s.

[11] Russell, J, Beecroft, ML, Ludwin, D, Churchill, DN. 1992, 'The quality of life in renal transplantation - a prospective study', *Transplantation*, vol. 54, no. 4, pp. 656-60.

[12] de Wit, G, Ramsteijn, PG, de Charro, FT. 1998, 'Economic evaluation of end stage renal disease treatment', *Health Policy*, vol. 44, no. 3, pp. 215-32.

[13] de Wit, G, Merkus, MP, Krediet, RT, de Charro, FT. 2002, 'Health profiles and health preferences of dialysis patients', *Nephrology, Dialysis and Transplant*, vol. 17, no. 1, pp. 86-92.

[14] Wasserfallen, J, Halabi, G, Saudan, P, et al. 2004, 'Quality of life on chronic dialysis: Comparison between haemodialysis and peritoneal dialysis.' *Nephrology, Dialysis and Transplant*, vol. 19, no. 6, pp. 1594-9.

[15] Churchill, D, Torrance, GW, Taylor, DS, et al. 1987, 'Measurement of quality of life in end-stage renal disease: the time-trade-off approach.' *Clin Invest Med*, vol. 10, no. 1, pp. 14-20.

to value patients' quality of life for home nocturnal haemodialysis (0.77) and in-centre haemodialysis (0.53).[17]

Utility-based Quality of Life (QoL) with Transplant

The most extensive Quality of Life (QoL) study done on transplant patients was conducted by Laupacis et al (1996). The TTO method was used to measure pre- and post-transplant QoL for 136 patients who were on dialysis when they entered the study.[18] In addition to rating their own health status at baseline (on dialysis and pre transplant) at 1 month, 3, 6, 12, 18 and 24 months post transplant, patients were also asked at the same points in time to rate four hypothetical scenarios representing patients who were doing well and poorly on both dialysis and transplantation. The mean utility score pre-transplant was 0.57 (for the whole group) and 0.55 (for those patients on dialysis prior to transplant), and 0.68 (1 month), 0.71 (3 months), 0.75 (6 months), 0.74 (12 months), 0.70 (18 months) and 0.70 at 24 months.
Moons et al (2003) used the EQ-5D to derive utility scores for 350 renal transplant recipients on a tacrolimus-based immunosuppressive regimen. The mean utility score for transplant patients on tacrolimus +/- steroids was 0.80 and 0.73 for those on tacrolimus + steroids + azathioprine.[19]
Girardi et al (2004) used the TTO and SG to estimate the utility associated with return to dialysis after a graft failure. Based on the responses of 166 patients, the mean utility score was 0.59 for the SG and 0.57 for the TTO.[20]
As with dialysis, there is no published information available on QoL for Australian transplant recipients.

The Economic Model

A Markov model was constructed as the basis for estimating the costs and benefits of renal replacement therapy (RRT) in Tasmania. This model is based upon the general structure (including some assumptions) of an earlier model used to estimate costs and health outcomes of RRT on a national level.
The model follows a cohort of men and women newly treated for ESKD, along with existing RRT patients. The length of each 'treatment' cycle in the model is one year. The structure of the model is shown in detail in Figures 1 and 2. The first diagram represents the pathway for patients undergoing their first year of any type of RRT. The second diagram represents the pathway for patients undergoing any type of RRT in the second and subsequent years. Treatment and outcomes are shown in the elliptical shapes and arrows show the transitions that can occur. The model is stratified by the following age groups:

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[16] Churchill, D, Wallace, JE, Ludwin, D, Beecroft, ML, Taylor, DW 1991, 'A comparison of evaluative indices of quality of life and cognitive function in hemodialysis patients', *Control Clinical Trials*, vol. 12, no. 4 Suppl, pp. 159s-67s.
[17] McFarlane, P, Pierratos, A, Redelmeier, DA. 2002, 'Cost savings of home nocturnal versus conventional in-centre hemodialysis', *Kidney International*, vol. 62, no. 6, pp. 2216-22.

[18] Laupacis, A, Keown, P, Pus, N, Kreuger, H, Ferguson, B, Wong, C, Muirhead, N 1996, 'A study of the quality of life and cost-utility of renal transplantation', *Kidney International*, vol. 50, no. 1, pp. 235-42.
[19] Moons, P, Vanrenterghem, Y, Van Hooff, JP, et al 2003, 'Health-related quality of life and symptom experience in tacrolimus-based regimens after renal transplantation: A multicentre study.' *Transpl Int*, vol. 16, no. 9, pp. 653-64.
[20] Girardi, V, Schaedeli, F, Marti, HP, Frey, FJ, Uehlinger, DE. 2004, 'The willingness of patients to accept an additional mortality risk in order to improve renal graft survival', *Kidney International*, vol. 66, no. 1, pp. 375-82.

- 25-44 years
- 45-64 years
- 65-74 years
- 75 years and older

Figure 1: Markov model for ESKD patients in the first year of treatment

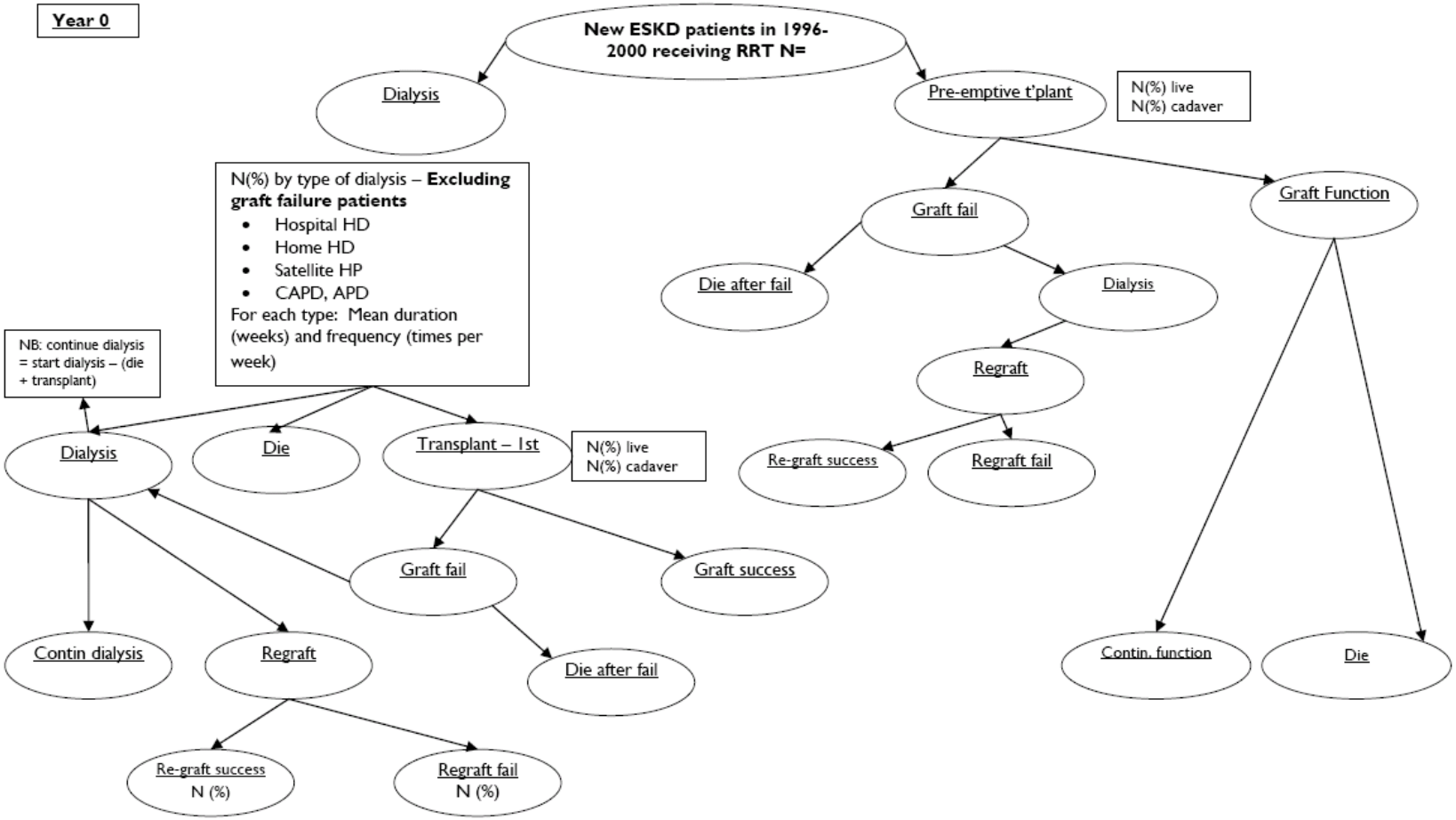
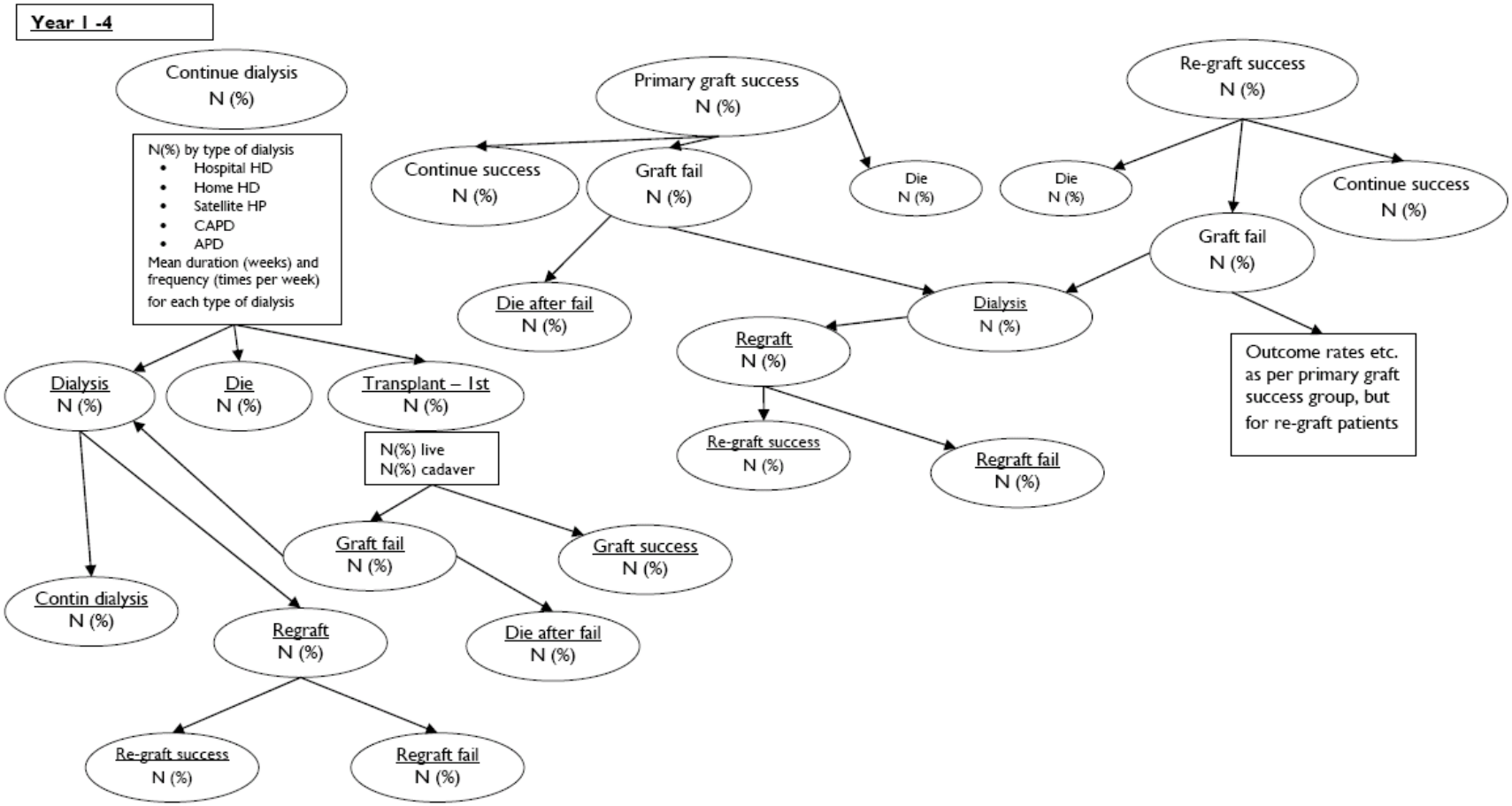


Figure 2: Treatment and outcome in the 2nd and subsequent years



Sources of estimates

In the absence of good-quality individual randomized control trials (RCTs) or large prospective observational studies conducted in Australia, the Tasmanian economic modelling exercise uses the best available Australian published data to derive estimates for the model parameters. This required a substantial secondary analysis of ANZDATA in order to derive transition probabilities between health states and RRT modalities. Details of the sources of cost and quality of life data are outlined in the following section. If no published evidence could be found, the opinion of clinical experts was sought.

Assumptions used in the model

The assumptions and sources of data for transition probabilities between states, costs, discounting and utilities used in the model are summarised in the text and tables below. Each of these components of the model is discussed in the following sections.

Main overall Assumptions

The health states and pathways are the same for all types of ESKD. The treatment and outcome states in the ESKD model are as follows:

- Dialysis – includes hospital haemodialysis (HD), home HD, satellite HD and PD.
- Functioning kidney transplant – patients may undergo a pre-emptive transplant from a live after diagnosis of ESKD or a first transplant following dialysis.
- Transplant outcomes – graft success or failure. A graft failure may result in a re-graft, a return to dialysis or death.
- Death – may occur whilst on dialysis or after transplant.
- Transition probabilities for year 0 to year 4 are based on the actual treatment and outcome probabilities derived from a cohort of RRT patients (1996-2000) from ANZDATA (for the entire Australian indigenous and non-indigenous cohorts over this time). Because of small numbers, it was not possible to estimate these transition probabilities for a Tasmanian specific cohort. The Australia-wide data give more robust estimates on which to base estimates of future costs and benefits.
- Transition probabilities from year 4 onwards are based on the application of constant year 4 transition probabilities.
- Total resource utilisation and benefits are calculated based on probability transitions at 6 months in each treatment cycle.

Other parameters included in the model are:

- Costs of each treatment modality (based on the best available *published* Australian data).
- Utility weights (quality of life assessments) associated with the outcomes of each treatment modality (based on Laupacis et al 1996, a before and after study of utility based QoL in transplant recipients).
- The present value of all future costs and benefits was used (discounted at 5% per annum).

Transition probabilities

Published Australian data on the probability of an ESKD patient undergoing a particular type of RRT, of switching between treatment modalities and on the outcomes were not available. For that reason, a dedicated secondary data analysis was conducted on the treatment and outcome patterns for a cohort of ESKD patients as recorded in the ANZDATA Registry.
Grouped data on RRT received and treatment outcomes were extracted for all people diagnosed with ESKD in the period 1996 to 2000. The data were grouped by age group (25-44 years, 45-64 years, 65-74 years, and 75 years and older) and Aboriginality. An annual transition probability was estimated for each of the first four years of treatment with the year 4 rate applied as a constant transition probability for years 5 onwards. All transitions between states occur at 6 months (that is, midway through the yearly cycle).

Projection of the incidence of end-stage kidney disease (ESKD) 2008 to 2018

See *Tasmanian State Plan for Renal Services, 2010–20, Part One: Current Service Analysis and Future Demand Predictions* for a detailed description of the modelling of future ESKD incidence used in this document.

Age group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
0-24	1	1	1	1	1	1	1	1	1	1	1	1
25-44	8	6	6	6	6	6	6	6	6	6	6	6
45-64	19	19	19	19	20	20	20	21	21	21	22	22
65-74	17	14	15	16	17	19	20	21	22	24	25	27
75+	9	12	13	14	16	18	20	23	26	29	33	37
Total new patients	**54**	**52**	**54**	**56**	**60**	**64**	**67**	**72**	**76**	**81**	**87**	**93**

Health State Utilities (quality of Life)

Only two studies report utility-based quality of life scores for people with ESKD, pre- and post-transplant [21,22]. The authors elected to use the Laupacis study because Russell et al had fewer than 30 patients (Laupacis et al had over 150), and was conducted prior to 1992, meaning both dialysis and transplantation treatments may no longer be applicable to current practice. The TTO derived utility scores from Laupacis et al for the pre-transplant dialysis state and the post-transplant state (using a weighted average of QoL score over 0-12 and 12-24 months post transplant) have been used to value outcomes in this study. Other studies have measured dialysis-specific quality of life, but the methods and values vary to such an extent that the measures of utility-based QoL are not comparable between modes of dialysis treatment.
The health utility scores for dialysis, post- transplant states are summarised in Table 2.

[21] Laupacis, A, Keown, P, Pus, N, Kreuger, H, Ferguson, B, Wong, C, Muirhead, N, 1996, 'A study of the quality of life and cost-utility of renal transplantation', Kidney International, vol. 50, no. 1, pp. 235-42.
[22] Russell, J, Beecroft, ML, Ludwin, D, Churchill, DN. 1992, 'The quality of life in renal transplantation - a prospective study', Transplantation, vol. 54, no. 4, pp. 656-60.

Table 2: Health utility scores for dialysis and post-transplant states

Assumptions	*Value*	*Source*	*Justification for source*
Renal transplant		Laupacis et al (1996)	Pre- and post-transplant time trade-off (TTO) utility valuation study conducted on transplant patients and on dialysis patients(pre-transplant)
Time after transplant			
1 month	0.68		
3 month	0.71		
6 month	0.75		
12 months	0.74		
Time weighted average 0-12 months	*0.7325*		
18 months	0.7		
24 months	0.7		
Time weighted average 12-24 months	*0.7*		
Dialysis (pre-transplant)	0.55	Laupacis et al (1996)	
Death	0	Convention	

Resource use and costs

Cost data were based on the best available published data that conform to Australian government guidelines for the application of economic evaluation to funding submissions to the Pharmaceutical Benefits Advisory Committee (PBAC) and the Medical Services Advisory Committee (MSAC). Neither the PBAC nor MSAC consider the economic impact of productivity changes in their recommendations to the Minister for Health regarding public expenditure on drugs and other health technologies. For that reason, the costs related to productivity changes associated with the treatment for ESKD are not included in this study.
The most recent (2006-7) NHCDC Round 11 AR-DRG cost -weights have been used for relevant DRG-based costs. Australia-wide data has been used because Tasmanian specific information is not available.

Renal Replacement Therapy costs

This document explores health sector costs arising from the provision of RRT services. However, the authors did not undertake a primary costing study of dialysis modalities or transplantation. Estimates of the cost of each treatment modality were based on the best available published data and were derived from Australian studies. Although a number of costing studies have reportedly been undertaken in various States and Territories, almost none of these studies have been published in peer-reviewed manuscripts or government reports. Tables 3 to 5 provide information regarding the data sources used in this report and estimates of unit costs of dialysis and transplant service provision.
The annual cost of renal dialysis includes dialysis equipment, buildings, maintenance, salaries and wages (nursing and allied health), consumables, the cost of initial access, revision of access, drugs (including Epoetin alfa and darbepoietin, Calcitriol and Iron), hospitalisation due to infection/ other complications, specialist consultations and review and work up costs for patients on the transplant waiting list. The data sources used to estimate per annum patient utilisation of each resource item and the valuation source are summarised in Table 3. Other inpatient resource use by dialysis modality is also partially captured. Data are not available to estimate the total inpatient resource use (renal and non-renal related admissions) for patients on dialysis. Therefore to capture some of the possible resource use associated with

admissions, for PD patients an estimate has been generated based upon ANZDATA information on admissions for peritonitis, and for HD patients based on ANZDATA information of access revisions. This will likely underestimate true inpatient resource use for both PD and HD patients, although in the absence of other Australian data on admissions in the patients, this is the only available data.
The annual cost of transplant includes surgery and hospitalisation, immunosuppressive therapy, specialist review and consultations and other drugs. The cost of a kidney transplant for the recipient (both live and deceased donor) was based on Australian NHCDC Round 11 (2006-7) cost weights for AR-DRG A09A (Renal Transplant + Pancreas or + complications and/or combmorbidities)/ A09B (Renal Transplant without pancreas transplant or without comorbidities of complications) for a public hospital admission. Thirty-six per cent of all transplants are classified as AR-DRG code A09A and 64% as AR-DRG code A09B.
As there is no specific AR-DRG code for donor costs for a kidney transplant, an assumption based upon expert opinion was made to base the cost of a kidney transplant for a live donor on Australian NHCDC Round 11 (2006-7) cost weights for AR-DRG L04A (Kidney, urinary tract and major bladder procedures (no neoplasms) with complications and/or comorbidities) with complications)/ L04C (Kidney, urinary tract and major bladder procedures (no neoplasms) without complications and/or comorbidities) for a public hospital admission. The cost of organ procurement from a deceased donor was unavailable from any published sources and has been estimated at $3000 (expert opinion), which is likely to be an underestimate. As with dialysis, there is little available data on renal and non-renal inpatient resource use in patients with a functioning transplant. As such these costs have not been estimated.
The unit costs of RRT per patient per annum, by treatment modality, are summarised in Table 3 and Table 4 (Further details of the costs of RRT are provided in Appendix B).

Productivity costs

Productivity changes have not been included in this analysis as they are not relevant from the pre-specified, health care funders' perspective. In addition, there are no reliable Australian data that can be used to estimate the opportunity cost of lost productivity due to ESKD, therefore the present analysis has not included productivity changes.

Table 3: Type of cost, source of data by treatment resource item

Resource items	Data Source Utilisation	Data Source Cost	Reference to further details
Dialysis			
Home / Satellite Haemodialysis	**ANZDATA**	**Agar *et al*, inflated to 2008**	**Appendix B, Tables 2-4**
Equipment	"	"	"
Buildings	"	"	"
Maintenance	"	"	"
Salaries and wages	"	"	"
Consumables	"	"	"
Hospital Haemodialysis	**ANZDATA**	Australian NHCDC Round 11 (2006-7) cost weights (published Sept 2008)	"
Peritoneal dialysis	**ANZDATA**	**Health Dept of Western Australia, inflated to 2008**	"
Initial access	**ANZDATA**	Australian NHCDC Round 11 (2006-7) cost weights (published Sept 2008)	"
Revision of access	**ANZDATA**	Australian NHCDC Round 11 (2006-7) cost weights (published Sept 2008)	"
All dialysis Drugs			
EPO/Darbepoietin	**ANZDATA/Expert opinion**	**PBS, 2008**	"
Calcitriol	**Expert opinion**	**PBS, 2008**	"
Iron	**Expert opinion**	**PBS, 2008**	"
			"
Hospitalisation due to infection/ other complications	**ANZDATA**	Australian NHCDC Round 11 (2006-7) cost weights (published Sept 2008)	"
Specialist consultations and review	**Expert opinion**	**MBS, 2008**	"
Work up costs for patients on transplant waiting list	**Expert opinion**	**MBS, 2008**	"
Transplant			
Inpatient recipient costs	**ANZDATA**	Australian NHCDC Round 11 (2006-7) cost weights (published Sept 2008)	**Appendix B, Tables 5-12**
Annual cost of immunosuppresion Yr 1	**ANZDATA / expert opinion**	**PBS, 2008**	"
Annual cost of non-immunosuppresive related drugs Yr 1	**Expert opinion**	**PBS, 2008**	"
Annual cost of non-drug follow-up Yr 1	**Expert opinion**	**MBS, 2008**	"
Annual cost of immunosuppresion Yr 2 onwards	**ANZDATA / expert opinion**	**PBS, 2008**	"
Annual cost of non-immunosuppresive related drugs Yr 2 onwards	**Expert opinion**	**PBS, 2008**	"
Annual cost of non-drug follow-up Yr onwards	**Expert opinion**	**MBS, 2008**	"
Inpatient donor costs (live donor)	**ANZDATA**	Assumptions; Australian NHCDC Round 11 (2006-7) cost weights (published Sept 2008)	"
Donor procurement costs (deceased donor	**ANZDATA**	**Expert Opinion**	"

Table 4: Unit cost of dialysis per patient per year by modality (AUD$2008)

Resource items	Home Haemodialysis $ unit cost per annum	Satellite Haemodialysis $ unit cost per annum	PD $ unit cost per annum	Hospital Haemodialysis $ unit cost per annum
Dialysis				
Total costs incl equipment, building maintenance, salaries and consumables	**38373**	**42984**	**45249**	**80652**
Drugs(total)	**9666**	**9666**	**9666**	**9666**
Epoietin alfa	**5,217**	**5,217**	**5,217**	**5,217**
Darbepoetin alfa	**4,169**	**4,169**	**4,169**	**4,169**
Calcitriol	**156**	**156**	**156**	**156**
Iron	**124**	**124**	**124**	**124**
Hospitalisation due to infection/ other complications / access revisions*	**2483**	**2483**	**7923**	**2483**
Specialist consultations and review	**530**	**530**	**530**	**530**
Work up costs for patients on transplant waiting list	**730**	**730**	**730**	**730**
TOTAL ANNUAL COST (not including initial access)	$51,782	$56,393	$64,099	$94,061
Initial access (incl temporary access)	**15490**	**15490**	**12762**	**15490**

* NB these costs are estimated from ANZDATA record hospitalisations for peritonitis in PD patients and access revisions in HD patients and are therefore likely to underestimate the true cost of inpatient resource use for renal and non-renal causes in these patients

Table 5: Unit cost of kidney transplant per patient per year by modality (AUD$2008)

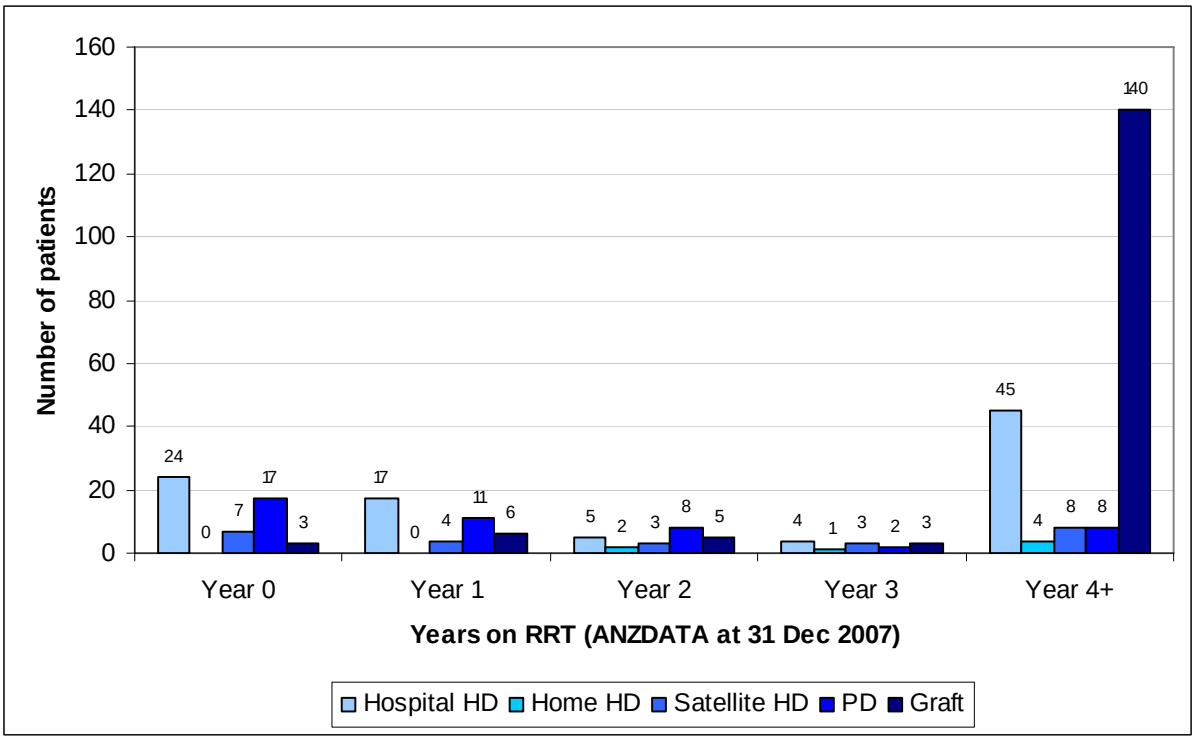
Resource items	*Live donor Recipient unit cost $*	*Live donor Donor unit cost $*	*Deceased donor Recipient unit cost $*	*Deceased donor Donor unit cost $*
Transplant				
Year 1				
Surgery and hospitalisation	**35962**	**13836**	**35962**	**3,000**
Regular Immunosuppressive therapy (PBS)	**19038**		**19038**	
Additional Immunosuppression	**2,620**		**2,620**	
Other drugs	**8619**		**8619**	
Non drug follow-up costs	**6367**		**6367**	
TOTAL YEAR 1 COST	$72606	$13836	$72606	$3000
Year 2 onwards				
Regular Immunosuppressive therapy	**8881**		**8881**	
Other drugs	**724**		**724**	
Non drug follow-up costs	**819**		**819**	
TOTAL YEAR 2 ONWARDS COST	$10424		$10424	

Transition probabilities

The full set of transition probabilities has been reported previously.[23] As discussed earlier, because of comparatively small patient numbers in Tasmania, Australian data has been used as they are more robust. The main areas where these probabilities differ from the previous Australia-wide report is the proportions of patients utilizing different dialysis modalities. Tasmanian specific data have been used to capture current practice, which then forms the basis for examining the costs and health outcomes of alternative patterns of RRT modality delivery. This is important, as patterns in service delivery in Tasmania appear to be somewhat different from the rest of Australia, with a lower proportion of home dialysis patients. Figure 3 presents the Tasmanian patterns of RRT modality usage by years on RRT.

[23] Cass, A, Chadban, S, Craig, J, Howard, J, McDonald, S, Salkeld, G, White, S 2006, *The Economic Impact of End-Stage Kidney Disease in Australia.* , Kidney Health Australia, Melbourne.

Figure 3: Pattern of RRT modality usage by years on RRT in existing Tasmanian patients (25+ years)



Calculation methods

Present value of costs and benefits of treating all existing and new cases of ESKD (from 2007 - 2018)

The formula for calculating the present value of the cost of treating current ESKD patients is summarised in equation 1. The prevalent cohort is based on the number of ESKD patients in Tasmania, by modality of treatment, as recorded on the ANZDATA registry to end December 2007. Patients are followed up until the end of 2018.

Prevalent Cohort

Equation 1 $$PVTC_p = \sum_{\int t \int 2005 prevalent cohort}^{n=13} (P_{1tp})\,[(P_{2tp})\,(C_{2p}) + (P_{3tp})\,(C_{3p})]$$

where:

$PVTC_p$	=	present value of the total cost of treatment for the ESKD prevalent cohort as at 2007 out to end 2018
$P1_{tp}$	=	probability of being alive in year *t*
$P2_{tp}$	=	probability of having dialysis in that year
C_{2p}	=	present value of the annual cost of dialysis (by modality)
P_{3tp}	=	probability of having a kidney transplant in that year
C_{3p}	=	present value of the annual cost of transplant (by type of transplant)

Incident Cohort

The formula for calculating the present value of the cost of treating new ESKD patients (2008 to 2018) is summarised in equation 2.

Equation 2 $$PVTC_i = \sum_{\int t \int 2006-2017 incident cohort}^{n=13} (P_{1ti})\,[(P_{2ti})\,(C_{2i}) + (P_{3ti})\,(C_{3i})]$$

where:

$PVTC_i$	=	present value of the total cost of treatment for the ESKD incident cases out to end 2018
P_{1ti}	=	probability of being alive in year *t*
P_{2ti}	=	probability of having dialysis in that year
C_{2i}	=	present value of the annual cost of dialysis (by modality)
P_{3ti}	=	probability of having a kidney transplant in that year
C_{3i}	=	present value of the annual cost of transplant (by type of transplant)

Benefits are calculated using a similar formula, where the present value of annual cost of dialysis and transplant in Equation 1 is replaced by the present value of the health outcomes (QALYs) generated by dialysis and transplant. In the Markov model, the number of patients entering each treatment and outcome state is used to estimate the present value of quality adjusted life years (QALYs) based on follow-up to the end of 2018. This highlights the impact of quality of life, by treatment modality, for prevalent and incident patients, based upon the data assumptions discussed earlier.

The total present value of cost and benefits of treating existing and new cases of ESKD in Tasmania, projected out to end 2018, is the sum of Equation 1 and 2 ($PVTC_p + PVCT_i$)

Change in RRT modality

A number of analyses have also been conducted to examine the effect of changing patterns of RRT modality on costs and health outcomes in Tasmania. Specific questions address the effect of increasing transplant rates, the effect of different proportions of patients receiving alternative dialysis modalities.

Additional health care costs and benefits of increasing the proportion of new ESKD patients who receive a kidney transplant

The formula for estimating the incremental cost effectiveness of increasing the number of new ESKD patients who receive a kidney transplant by between 10% and 50% over current levels by 2012 is summarised in equation 3.

Equation 3

$ICER_{transplant} = (TC_{low/high\ increase\ in\ transplants} - TC_{current\ practice}) \div (TB_{low/high\ increase\ in\ transplants} - TB_{current\ practice})$

where:

$TC_{low/high\ increase\ in\ transplants}$	=	the total cost of treatment for the ESKD incident cohort out to 2018 assuming an increase in the number of transplants by 10% to 50% by 2012 (and concomitant reduction in dialysis rate)
$TC_{current\ practice}$	=	the total cost of treatment for the ESKD incident cohort out to 2018 with current transplant rates
$TB_{low/high\ increase\ in\ transplants}$	=	the total number of quality adjusted life years (QALYs) for the ESKD incident cohort out to 2018, assuming an increase in the number of transplants by 10% to 50% by 2012 (and concomitant reduction in dialysis rate)
$TB_{current\ practice}$	=	the total number of quality adjusted life years (QALYs) out to 2018 for the ESKD incident cohort with current transplant rates

Additional health care costs (savings) that accrue by changing the proportion of patients that undergo different types of dialysis (hospital haemodialysis, home haemodialysis, CAPD and satellite)

The formula for estimating the incremental cost effectiveness of switching the proportion of current ESKD patients who different types of dialysis is summarised in equation 4.

Equation 4.

$$\text{Cost (saving)} = (TC_{\text{current practice}} - TC_{\text{switch mode of dialysis}})$$

$TC_{\text{current practice}}$	=	the total cost of treatment for the ESKD incident cohort
$TC_{\text{switch mode of dialysis}}$	=	the total cost of treatment for the ESKD incident cohort assuming the changes in dialysis modality as specified below

The total proportions of patients receiving each dialysis modality by age group and year on RRT that are modelled in the sensitivity analysis are:

Age group		**Proportion of new dialysis patients for sensitivity analyses**				
		Year 0	**Year 1**	**Year 2**	**Year 3**	**Year 4+**
25-44	Home HD	60%	60%	60%	60%	60%
	PD	20%	20%	15%	15%	10%
	Other (split satellite & hospital)	20%	20%	25%	25%	30%
45-64	Home HD	35%	35%	35%	35%	35%
	PD	30%	25%	20%	15%	10%
	Other (split satellite & hospital)	35%	40%	45%	50%	55%
65-74	Home HD	15%	15%	15%	15%	15%
	PD	50%	40%	30%	20%	10%
	Other (split satellite & hospital)	35%	45%	55%	65%	75%
75+	Home HD	5%	5%	5%	5%	5%
	PD	50%	40%	30%	20%	10%
	Other (split satellite & hospital)	45%	55%	65%	75%	85%

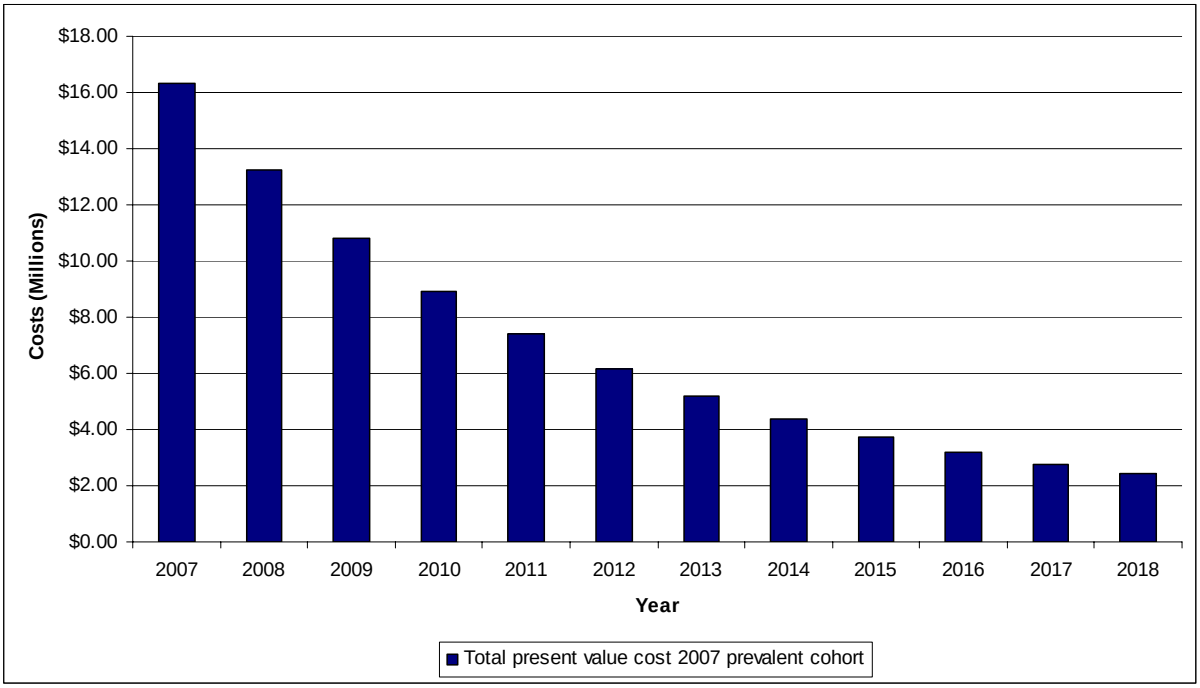
Results

Health sector costs (in present dollar values) of treating current and new cases of ESKD out to 2018

Cost of treating current cases of ESKD

In today's dollars, the total cost of providing RRT until 2018 for people with ESKD in 2007 is almost $85 million. The present value of total annual cost of RRT for current ESKD patients (as at 2007), based on treatment up to and including the year 2018, is summarised in Figure 4. The declining annual cost reflects the diminishing patient cohort due to death. The costs do not include RRT for new cases of ESKD.

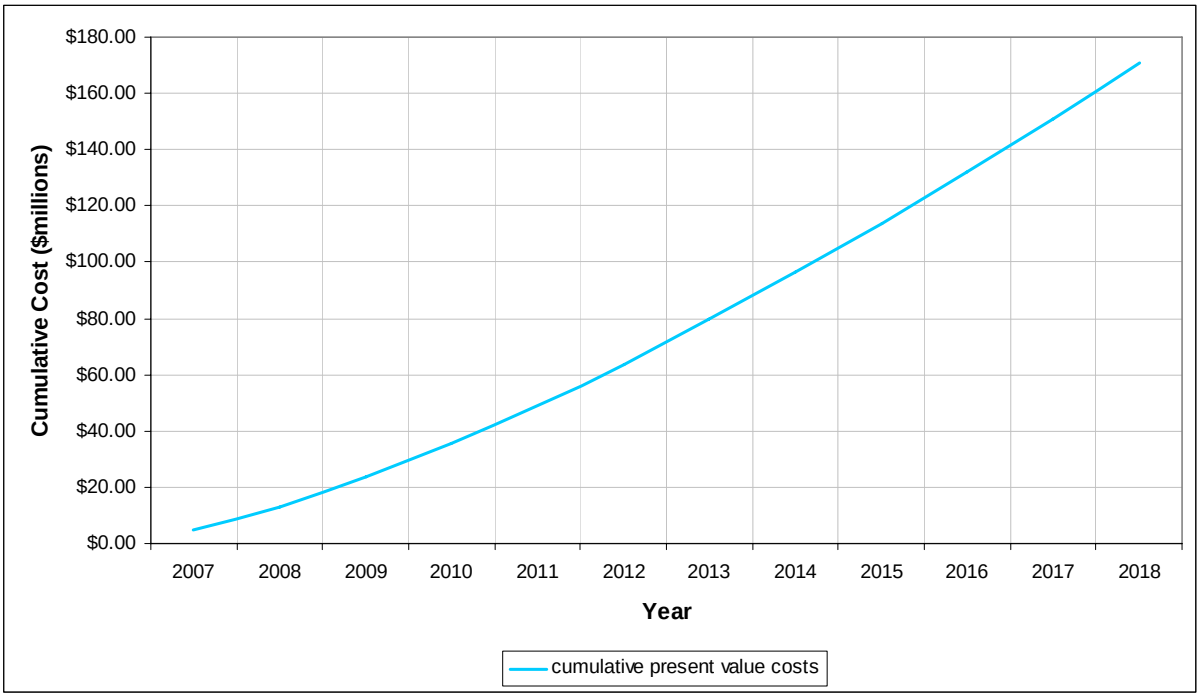
Figure 4: The total discounted annual cost of RRT for current ESKD patients



Cost of treating new cases of ESKD out to 2018

The present value cumulative cost of RRT for all new cases of ESKD treated out to 2018, is estimated to be almost $170 million by the end of 2018 (Figure 5).

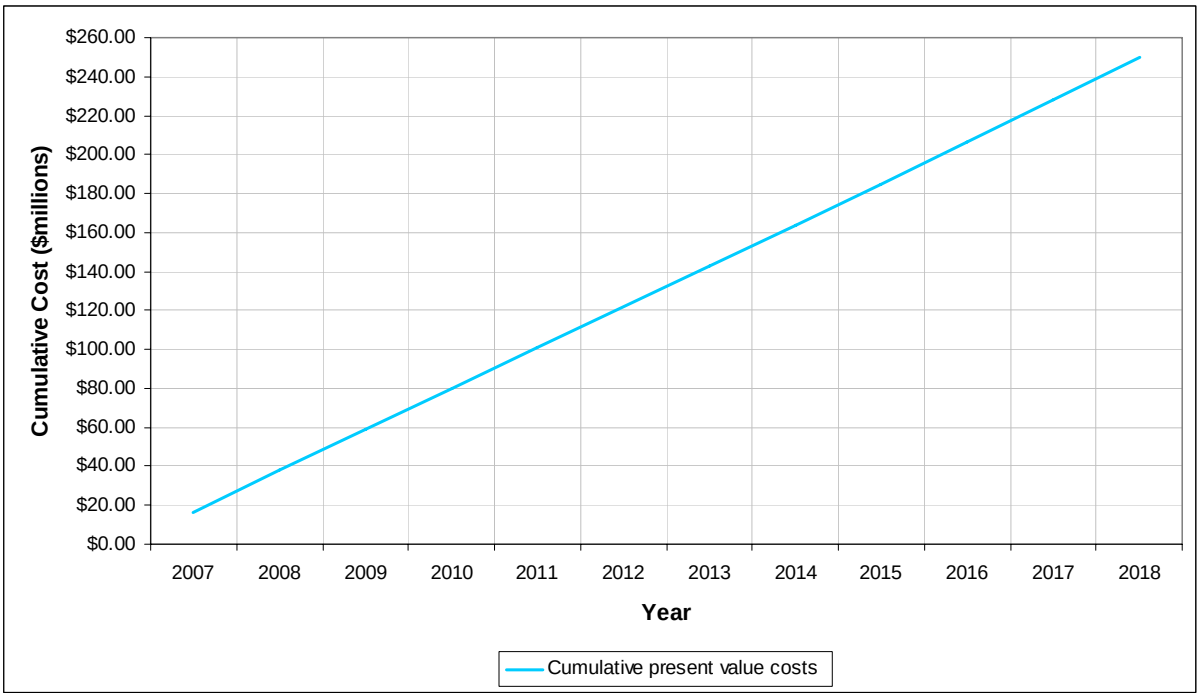
Figure 5: The cumulative present value costs for all new ESKD patients treated out to 2018



Cost of treating current and new cases of ESKD

In today's dollars the cumulative cost of RRT for all current and new cases of ESKD treated out to 2018, is estimated to be approximately $250 million by the end of 2018. (Figure 6)

Figure 6: The cumulative present value costs for all new and existing ESKD patients treated out to 2018



Projected annual health sector costs of treating all cases of end-stage kidney disease (ESKD) to 2018

The annual present value cost of renal replacement therapy (RRT) is estimated to rise from $16.3 million in 2007 to $22 million in 2018 (Table 4).

Table 6: Total present value projected annual health care costs of treating all cases of ESKD for 2007-2018 ($ millions)

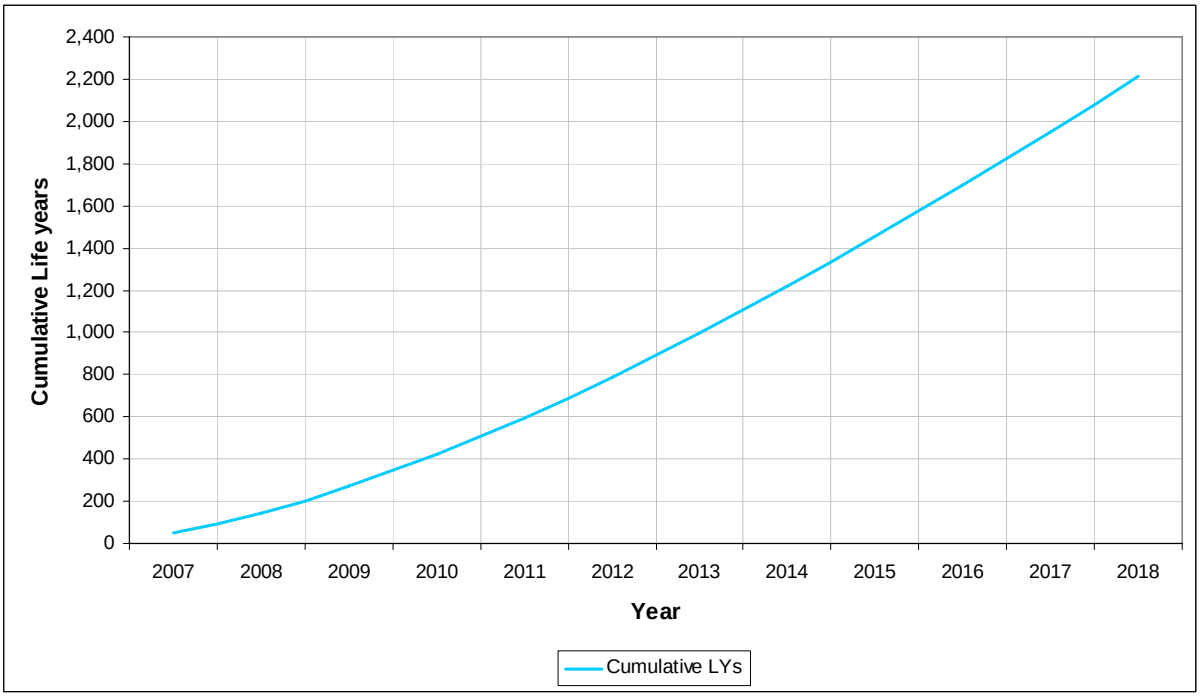
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total annual cost	$16.34	$21.31	$21.28	$20.88	$20.85	$20.89	$20.99	$21.13	$21.30	$21.50	$21.74	$22.00
Cumulative annual total costs	$16.34	$37.65	$58.93	$79.82	$100.67	$121.56	$142.55	$163.67	$184.97	$206.47	$228.22	$250.22

Benefits (in life years and quality-adjusted life years) of treating new cases of ESKD (to 2018)

Present value of the benefits of treating all new cases of ESKD

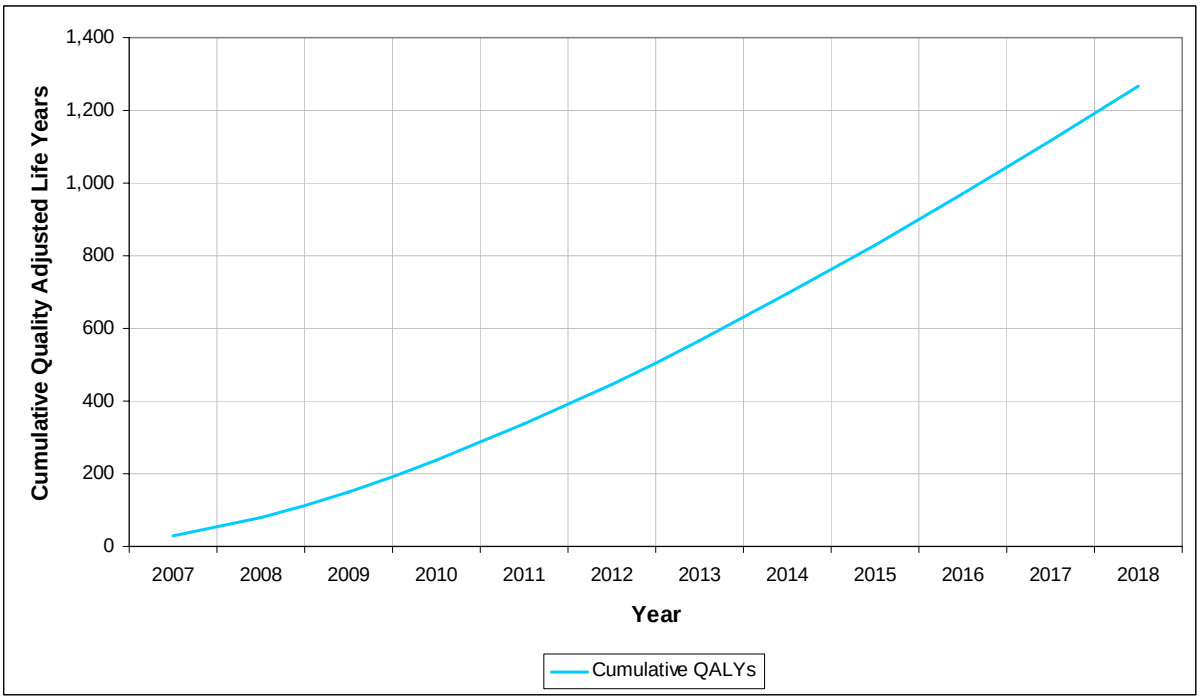
The present value of the benefits of RRT for all new cases of ESKD will be approximately 2200 life years by 2018 (Figure 7).

Figure 7: The present value cumulative health benefit (in life years) for all new cases of ESKD (to 2018)



The present value of the benefits of RRT for all new cases of ESKD (2005-2017) will be approximately 1300 quality adjusted life years. (Figure 8)

Figure 8: The present value cumulative health benefit (in quality adjusted life years) for all new cases of ESKD (to 2018)



The cumulative present value of total health benefit for all new cases of ESKD, based on treatment out to 2018 are summarised in Table 7.

Table 7: The present value (annual and cumulative) of health benefit (Life years and quality adjusted life years) for all new ESKD cases out to 2018

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total annual life years	51.24	92.20	125.30	152.02	173.85	192.57	208.57	222.27	234.16	244.61	253.99	262.47
Cumulative life years	51.24	143.44	268.75	420.76	594.61	787.18	995.75	1,218.02	1,452.18	1,696.79	1,950.77	2,213.25
Total annual quality adjusted life years	28.42	51.71	70.84	86.52	99.33	110.31	119.68	127.68	134.60	140.66	146.06	150.92
Cumulative quality adjusted life years	28.42	80.14	150.97	237.49	336.83	447.14	566.82	694.50	829.10	969.76	1,115.82	1,266.74

Effect on cost and benefits (out to 2018) of changing patterns of RRT modality for all new ESKD patients

A number of analyses have also been conducted to examine the effect of changing patterns of RRT modality on costs and health outcomes in Tasmania. Specific questions address the effect of increasing transplant rates, and the effect of different proportions of patients receiving alternative dialysis modalities.

Additional health care costs and benefits of increasing the number of new ESKD patients who receive a transplant

A cost-effectiveness and cost-utility analysis was conducted to examine the incremental cost effectiveness ratio (ICER) of increasing transplant rates. Under both models of incidence projection, the incremental cost effectiveness of increasing kidney transplants by 10% is dominant over current practice. That is, increasing the transplant rate is less expensive and more effective than current treatment patterns for ESKD. The incremental cost savings range from $0.81 million to $3.85 million out to 2018. Results are shown in Table 8 and Table 9.

Table 8: The present value costs and health benefit (out to 2018) of increasing the current transplant rate in Tasmania by 10% by 2012 over current levels

Costs and Benefits to 2018	Total cost	Incremental cost	Total Life Years	Incremental life years	ICER	Total QALYs	Incremental QALYs	ICER
Base case	$170,724,145	-$810,771	2213.25	8.97	Dominant	1266.74	10.33	Dominant
Increased transplant rate	$169,913,374		2222.22			1277.07		

Table 9: The present value costs and health benefit (out to 2018) of increasing the current transplant rate in Tasmania by 50% by 2012 over current levels

Costs and benefits to 2018	Total cost	Incremental cost	Total Life Years	Incremental life years	ICER	Total QALYs	Incremental QALYs	ICER
Base Case	$170,724,145	-$3,850,928	2213.25	44.98	Dominant	1266.74	51.62	Dominant
Increased transplant rate	$166,873,217		2258.23			1318.36		

Additional health care costs and benefits of increasing the number of new dialysis patients receiving home-based or community based, rather than hospital-based dialysis services

The incremental costs and health outcomes of the sensitivity analysis examining switching dialysis modality are summarized in Table 10 below. Increasing the rate of both home haemodialysis (HD) and peritoneal dialysis (PD) utilization will lead to net savings of up to $16.25 million. Without Australian data on utility-based quality of life on each dialysis modality it is not possible to estimate the incremental benefits of the 'switch modality' scenarios. However, it is reasonable to assume that there would also be a significant improvement in quality of life resulting from these changes.

Table 10: The present value costs and health benefit (out to 2018) of increasing the utilisation of both Home HD and PD services in new patients in Tasmania*

Costs and benefits to 2018	Total cost	Incremental cost ($million)	Total Life Years	Total QALYs
Base Case	$170,724,145	-$16,247,455	2213.25	1266.74
Increased Home HD & PD utilisation	$154,476,691		2213.25	1266.74

* The savings produced through increasing the utilization of both home haemodialysis (HD) and peritoneal dialysis (PD) services in Table 10 are dependent on achieving the targeted levels of modality utilization, as discussed earlier.

Appendix B: Details of unit costs

Table 1: Estimated Annual Total cost for each dialysis modality ($AUD 2008)

Dialysis	Average annual cost per patient	Source
Hospital Haemodialysis – by age group	$80,652.00	DRG L61Z = $517 per episode * average # episodes per pt per week * 52 (Australian NHCDC Round 11, 2006/7)
Other inpatient resource use	$2,482.75	
Outpatient resource use - consultations & imaging	$1,260.20	
Outpatient resource use – drugs	$9,666.13	
Total Annual Hospital HD costs	***$94,061.09***	
Initial access (incl temporary access)	$15,490.39	
Home Haemodialysis – by age group (Nocturnal Home HD, 6 nights out of 7)	$38,373.25	Agar (Nephrology, 10:555-570, 2005, inflated to 2008 values using AIHW health price index)
Other inpatient resource use	$2,482.75	
Outpatient resource use - consultations & imaging	$1,260.20	
Outpatient resource use – drugs	$9,666.13	
Total Annual Home HD costs	***$51,782.33***	
Initial access (incl temporary access)	$15,490.39	
Satellite Haemodialysis – by age group (low acuity, limited care facility)	$42,984.19	Agar (Nephrology, 10:555-570, 2005, inflated to 2008 values using AIHW health price index)
Other inpatient resource use	$2,482.75	
Outpatient resource use - consultations & imaging	$1,260.20	
Outpatient resource use – drugs	$9,666.13	
Total Annual Satellite HD costs	***$56,393.27***	
Initial access (incl temporary access)	$15,490.39	
CAPD – by age group	$45,249.75	Health Department WA 1999 (inflated to 2008 values using AIHW health price index)
Other inpatient resource use	$7,923.41	
Outpatient resource use - consultations & imaging	$1,260.20	
Outpatient resource use – drugs	$9,666.13	
Total Annual CAPD costs	***$64,099.49***	
Initial access	$12,762.53	

Table 2: Estimated annual inpatient resource use – dialysis ($AUD 2008)

In patient resource use (not included in dialysis costs above)	Proportion of patients per year	DRG	Unit cost	Number per year	Average annual cost per patient	Source
Initial access (HD) (all patients, one off cost, only added to year 0 sheets)	1	Separation weighted L09A/B/C	$15,071.86		$15,071.86	Australian NHCDC Round 11, 2006/7
Other proc for kidney UT disorders + CCC	0.312280702	L09A	$32,406.00			
Other proc for kidney UT disorders + SCC	0.171929825	L09B	$12,819.00			
Other proc for kidney UT disorders no CSCC	0.515789474	L09C	$5,328.00			
Temporary access for HD	0.58		$721.60		$418.53	ANZDATA (utilisation)
Insertion	0.58	MBS 34538	$251.60			MBS (2008 reimbursement)
VasCath	0.58	MBS 34527/34528	$380.60			
Xray to check placement	0.58	MBS 59503	$89.40			(2008 reimbursement)
Total initial access costs HD					**$15,490.39**	
Initial access (PD) (all patients, one off cost, only added to Year 0 sheets)	all PD patients	Separation weighted L02A/B	$12,762.53		**$12,762.53**	Australian NHCDC Round 11, 2006/7
	0.409615385	L02A	$21,391.00			
	0.590384615	L02B	$6,776.00			
Revision of access (HD) (Surgery)	0.149466667	Separation weighted L09A/B/C	$15,071.86		$2,252.74	ANZDATA (utilisation); Australian NHCDC Round 11, 2006/7 (unit cost)
Other proc for kidney UT disorders + CCC	0.58	L09A	$32,406.00			
Other proc for kidney UT disorders + SCC	0.58	L09B	$12,819.00			
Other proc for kidney UT disorders no CSCC	0.58	L09C	$5,328.00			
Revision of access (HD) (angioplasty day stay)	0.027533333	Z64B	$807.00		$22.22	ANZDATA (utilisation); Australian NHCDC Round 11, 2006/7 (unit cost)
Revision of access (HD) (angioplasty admitted)	0.027533333	F14B	$7,547.00		$207.79	ANZDATA (utilisation); Australian NHCDC Round 11, 2006/7 (unit cost)
Average Inpatient resource use per HD patient					$2,482.75	
Peritonitis (PD only) (ALOS 11.5days	0.63					ANZDATA (utilisation); National

from ANZDATA) (63% PD patients get peritonitis)						NHCDC round 11 2006/7 (unit cost)
Admitted (67%)	0.67	Weighted L09A/B	$18,695.80	0.67	$12,526.19	
	0.3	L09A (ALOS 20.6)	$32,406.00			
	0.7	L09B (ALOS 7.43)	$12,820.00			
Not admitted (33%)	0.33			0.33	$50.65	
daily visit from Specialist PD nurse for 7 days		MBS 23	$33.55	7	$77.50	(2008 reimbursement)
ceftriaxone 1-2 g q 24hr for 7 days		PBS 1785Y x 5 x 2g vials	$32.90	7	$76.00	
Total non-admitted peritonitis costs per patient with peritonitis	0.63					ANZDATA (utilisation); National NHCDC round 11 2006/7 (unit cost)
Inpatient resource use PD	0.67	Weighted L09A/B	$18,695.80	0.67	$12,526.19	

NB Does not include other hospital admissions other than as specified above due to lack of available data

Table 3: Estimated annual outpatient resource use – dialysis ($AUD 2008)

Outpatient resource use	Proportion of patients per year	DRG	Unit cost	Number per year	Average annual cost per patient	Source
Follow-up: consultations and imaging					$529.97	
Nephrology review	all	MBS 116	$69.75	6	$418.50	(2008 reimbursement)
Cardiology consult	0.5	MBS 110	$139.45	1	$69.73	(2008 reimbursement)
Fistulogram	0.3	MBS 59751	$139.15	1	$41.75	(2008 reimbursement)
Follow up (only for transplant waiting list)					***$730.23***	
Transplant physician consult	0.33249497	MBS 110	$139.45	1	$46.37	2644 on waiting list at some time during 2004; 7952 on dialysis (ANZDATA)
Transplant surgeon consult	0.33249497	MBS 104	$79.05	1	$26.28	(2008 reimbursement)
Thallium or Technetium 99 (sestamibi) stress test (SPECT + planar imaging)	0.33249497	MBS 61307	$834.90	0.5	$138.80	(2008 reimbursement)
stress ecg	0.33249497	MBS 11712	$140.50	0.5	$23.36	(2008 reimbursement)
Angiogram	0.33249497	MBS 38218	$641.70	0.25	$53.34	(2008 reimbursement)
Monthly Cross match bloods	0.33249497	MBS 65099	$1,329.60	1	$442.09	12 * unit cost (2008 reimbursement)
Total average annual cost per pt					***$1,260.20***	

Table 4: Estimated annual drug costs – dialysis ($AUD 2008)

Drug	Proportion of patients	PBS code	cost per script	Pack size	dose	duration of pack (days)	script per year	total cost	Average annual cost per patient	Source
Iron	all	2593L	$51.55	5 x 100mg	100mg/pt/month	5 months	2.4	$123.72	$123.72	Expert estimate
calcitriol	all	2502Q	$42.82	100	0.25ug	100	3.6525	$156.40	$156.40	Estimate
EPO	0.91		**Average $/U or /mcg**							
Epoetin alfa	0.455	6204M, 6205N, 6206P, 6207Q, 6251B, 6302Q, 6303R, 6305W, 6339P, 6434P	$0.01908		11555 u/pt/week			$11,465.91	$5,216.99	Estimate
Darbepoetin alfa	0.455	6320P, 63212Q, 6322R, 6323T, 6324W, 6325X, 6438W, 6326Y, 6365B	$3.81397		46.2 mcg/pt/week			$9,162.68	$4,169.02	Estimate
Total drug costs per dialysis patient per year									***$9,666.13***	

Table 5: Estimated Transplant surgery costs ($AUD 2008)

	DRG		Unit Cost	Source
Transplant – Live donor (recipient costs)(total)		**1**	**$35,962.46**	separation weighted National NHCDC round 11 2006/7
Transplant – Live donor (recipient costs) w CSCC	A09A (Renal + pancreas, or +CCC)	0.36	$48,540	National NHCDC round 11 2006/7
Transplant – Live donor (recipient costs) w/o CSCC	A09B (renal - pancreas or CCC)	0.64	$29,006	National NHCDC round 11 2006/7
Transplant – Live Donor (donor costs)			**$13,836.10**	separation weighted National NHCDC round 11 2006/7
Transplant – Live donor (donor costs) w CSCC	L04A	0.36	$21,177	National NHCDC round 11 2006/7
Transplant – Live donor (donor costs) w/o CSCC	L04C	0.64	$9,771	National NHCDC round 11 2006/7
Transplant – Deceased donor (recipient costs)		**1**	**$35,962.46**	separation weighted National NHCDC round 11 2006/7
Transplant – Deceased donor (recipient costs) w CSCC	A09A (Renal + pancreas, or +CCC)	0.36	$48,540	National NHCDC round 11 2006/7
Transplant – Deceased donor (recipient costs) w/o CSCC	A09B (renal - pancreas or CCC)	0.64	$29,006	National NHCDC round 11 2006/7
Transplant – Deceased donor (harvest costs)	**estimate**		**$3,000.00**	

Table 6: Estimated average annual drug costs post transplant – year of transplant ($AUD 2008)

Annual cost of immunosuppressive therapy (yr 1)	PBS or unit cost	Initial	1 month	3 months	6 months	Source
CsA + MMF + pred	$14,246.40	0.5	0.4	0.4	0.36	ANZDATA + PBS price
Tacrolimus + MMF + pred	$25,225.15	0.28	0.32	0.36	0.39	ANZDATA + PBS price
OTHER		0.22	0.28	0.24	0.25	ANZDATA + PBS price
sirolimus + CsA + pred.	$17,645.91	0.11	0.14	0.12	0.125	ANZDATA + PBS price
everolimus + CsA + pred	$17,417.49	0.11	0.14	0.12	0.125	ANZDATA + PBS price
Total Proportion and time weighted cost (PBS)	**$19,038.37**	$1,503.60	$3,113.25	$4,746.81	$9,674.72	
Additional immunosuppression (in addition to above)						
OKT3	$12,000.00	0.025	$300.00			Estimate
ATG Fresenius	$15,610.00	0.025	$390.25			Estimate
Basiliximab	$6,000.00	0.2	$1,200.00			Estimate
daclizumab	$3,650.00	0.2	$730.00			Estimate
Average additional immunosuppression	**$2620.25**					
Average annual cost for other concomitant meds: incl omeprazole; trimethoprim; calcitriol (all for 6mo); valacyclovir or valganacyclovir (80% for 3 mo); antihypertensives (50-70%); statins(50%); hypoglycaemics (10%)	**$8,619.27**					PBS price
Total drug costs yr 1	**$30,277.89**					
Average annual follow up costs (non-drug) Year 1	**$6,367.16**					MBS
Total outpatient costs yr 1 (drug + management)	**$36,654.06**					

Table 7: Estimated average annual drug costs post transplant – all subsequent years ($AUD 2008)

Annual cost of immunosuppressive therapy (subsequent yrs)	PBS	regimens at 12 months	Source
CsA + MMF + pred	$7,029.05	0.27	ANZDATA + PBS price
Tacrolimus + MMF + pred	$11,107.00	0.39	ANZDATA + PBS price
OTHER		0.34	
sirolimus + pred.	$8,883.13	0.17	ANZDATA + PBS price
everolimus + pred	$6,713.85	0.17	ANZDATA + PBS price
Total (all subsequent years)	**$8.881.06**		
Average annual cost for other concomitant medications : incl antihypertensives (50-70%); statins(50%); hypoglycaemics (10%)	**$724.46**		
Total drug costs subsequent years	**$9,605.52**		
Average annual follow up costs (non-drug) Subsequent years	**$818.90**		
Total outpatient costs subsequent yrs (drug + management)	**$10,424.42**		

Table 8: Annual cost immunosuppressive regimens post transplant – Year of transplant ($AUD 2008)

Drug	Dose range	Dose used	Total daily dose	Duration of tx in 1 yr (days)	PBS item number (auth)	Cost per mg or g (PBS)	PBS item number (s100)	Cost per mg or g (s100)	Total cost (PBS)
CsA									
CsA loading dose	15 mg/kg	15	1050	1	8657P; 8658Q; 8659R; 8660T; 8661W	$0.07104	6232B; 6352H; 6353J; 6354K; 6125J	$0.05766	$74.58850
CsA (0-14 days)	10-15mg/kg/d	12.5	875	14	8657P; 8658Q; 8659R; 8660T; 8661W	$0.07104	6232B; 6352H; 6353J; 6354K; 6125J	$0.05766	$870.19917
CsA (2wks - onwards)	2-6 mg/kg/d	4	280	351.25	8657P; 8658Q; 8659R; 8660T; 8661W	$0.07104	6232B; 6352H; 6353J; 6354K; 6125J	$0.05766	$6,986.45617
MMF	1 g bd	2000	2000	365.25	8649F; 8650G; 8651H	$0.00837	6208R; 6209T; 6364Y	$0.00741	$6,110.68120
Prednisone	10-100mg/d in divided doses	25	25	365.25	1935W; 1936X	$0.02239		$0.02239	$204.47913
								Total CsA/yr	**$14,246.40**
TAC									
TAC 0-1mo	0.26mg/kg/d	0.26	18.2	30.4375	8646C; 8647D; 8648E	$4.32943	6328C; 6216E; 6217F	$3.65674	$2,398.34002
TAC 1-3 mo	0.22 mg/kg.d	0.22	15.4	60.875	8646C; 8647D; 8648E	$4.32943	6328C; 6216E; 6217F	$3.65674	$4,058.72926
TAC 3-12 mo	0.15 mg/kg/d	0.15	10.5	273.9375	8646C; 8647D; 8648E	$4.32943	6328C; 6216E; 6217F	$3.65674	$12,452.91933
MMF	1 g bd	2000	2000	365.25	8649F; 8650G; 8651H	$0.00837	6208R; 6209T; 6364Y	$0.00741	$6,110.68120
Prednisone	10-100mg/d in divided doses	25	25	365.25	1935W; 1936X	$0.02239		$0.02239	$204.47913
								Total TAC/yr	**$25,225.15**

Drug	Dose range	Dose used	Total daily dose	Duration of tx in 1 yr (days)	PBS item number (auth)	Cost per mg or g (PBS)	PBS item number (s100)	Cost per mg or g (s100)	Total cost (PBS)
SRL									0
SRL loading dose	6mg loading	6	6	1	8724E; 8833X; 8725F	$8.03225	6436R; 6457W; 6437T	$7.23333	$48.19350
SRL (0-3 mo)	2mg/d	2	2	91.3125	8724E; 8833X; 8725F	$8.03225	6436R; 6457W; 6437T	$7.23333	$1,466.88966
SRL (3-12 mo)	6 mg/d	6	6	273.9375	8724E; 8833X; 8725F	$8.03225	6436R; 6457W; 6437T	$7.23333	$13,202.00691
Csa (0-3mo)	2-6 mg/kg/d	6	420	91.3125	8657P; 8658Q; 8659R; 8660T; 8661W	$0.07104	6232B; 6352H; 6353J; 6354K; 6125J	$0.05766	$2,724.34496
prednisone	10-100mg/d in divided doses	25	25	365.25	1935W; 1936X	$0.02239		$0.02239	$204.47913
								Total SRL/yr	**$17,645.91**
Everolimus									0
everolimus	0.75mg bd		1.5	365.25	8840G; 8841H; 8842J	$18.15759	6459Y; 6460B; 6461C	$16.02000	$9,948.09104
Csa	2-6 mg/kg/d	4	280	365.25	8657P; 8658Q; 8659R; 8660T; 8661W	$0.07104	6232B; 6352H; 6353J; 6354K; 6125J	$0.05766	$7,264.91990
prednisone	10-100mg/d in divided doses	25	25	365.25	1935W; 1936X	$0.02239		$0.02239	$204.47913
								Total Everolimus/yr	**$17,417.49**

Table 9: Annual cost immunosuppressive regimens post transplant – all subsequent years ($AUD 2008)

Drug	Dose range	Dose used	Total daily dose	Duration of tx in 1 yr (days)	PBS item number (auth)	Cost per mg or g (PBS)	PBS item number (s100)	Cost per mg or g (s100)	Total cost (pbs)
CsA									
CsA	1-2mg/kg/d	2.14	150	365.25	8657P; 8658Q; 8659R; 8660T; 8661W	$0.07104	6232B; 6352H; 6353J; 6354K; 6125J	$0.05766	$3,891.92138
MMF	500mg bd	1000	1000	365.25	8649F; 8650G; 8651H	$0.00837	6208R; 6209T; 6364Y	$0.00741	$3,055.34060
Prednisone	10-100mg/d in divided doses	10	10	365.25	1935W; 1936X	$0.02239		$0.02239	$81.79165
								Total CsA/yr	**$7,029.05**
TAC									
TAC	0.05 - 0.1 mg/kg/d	0.072	5.04	365.25	8646C; 8647D; 8648E	$4.32943	6328C; 6216E; 6217F	$3.65674	$7,969.86837
MMF	500mg bd	1000	1000	365.25	8649F; 8650G; 8651H	$0.00837	6208R; 6209T; 6364Y	$0.00741	$3,055.34060
Prednisone	10-100mg/d in divided doses	10	10	365.25	1935W; 1936X	$0.02239		$0.02239	$81.79165
								Total TAC/yr	**$11,107.00**
SRL									
SRL	3 mg/d	3	3	365.25	8724E; 8833X; 8725F	$8.03225	6436R; 6457W; 6437T	$7.23333	$8,801.33794
prednisone	10-100mg/d in divided doses	10	10	365.25	1935W; 1936X	$0.02239		$0.02239	$81.79165
								Total SRL/yr	**$8,883.13**
Everolimus									
everolimus	0.5mg bd		1	365.25	8840G; 8841H; 8842J	$18.15759	6459Y; 6460B; 6461C	$16.02000	$6,632.06069
prednisone	10-100mg/d in divided doses	10	10	365.25	1935W; 1936X	$0.02239		$0.02239	$81.79165
								Total Everolimus/yr	**$6,713.85**

Table 10: Regular additional drug costs post transplant ($AUD 2008)

Drug	Year used	Range	Duration	Dose	Proportion of patients	Cost per script	Pack size	Duration of pack (days)	Script per year	Total cost	PBS code	Cost for proportion of patients	Source
OKT3	Year 1 only	0.05	10-14 days (use 12)	5mg qd	0.025	$1,000	5mg	1	12	$12,000.00		$300.00	Estimate
ATG Fresenius	Year 1 only		7-14 days (use 10)		0.025	$1,561		1	10	$15,610.00		$390.25	Estimate
Anti-CD25	Year 1 only	0.4											Estimate
basiliximab (Simulect)	Year 1 only	0.2	2 doses	2 x 20mg doses	0.2	$3,000	1 dose per pack		2	$6,000.00		$1,200.00	Estimate
daclizumab (Zenapax)*	Year 1 only	0.2	5 doses	5 doses 1mg/kg	0.2	$3,650		5	1	$3,650.00		$730.00	Estimate
Omeprazole	Year 1 only	all	6mo	20mg qd	1	$28.91	30	30	6.0875	$175.99	8331L	$175.99	Estimate
trimethoprim / sulfamethoxazole	Year 1 only	all	6mo	160mg/800mg bd	1	$8.96	10	5	36.525	$327.26	2951H	$327.26	Estimate
calcitriol	Year 1 only	all	6mo	0.25ug bd	1	$42.82	100	50	3.6525	$156.40	2502Q	$156.40	Estimate
valacyclovir (total 80%)	Year 1 only	0.4	3mo	2g 4/day	0.4	$423.18	100	6.25	19.48	$8,243.55	6280M	$3,297.42	Estimate
valganacyclovir (total 80%)	Year 1 only	0.4	3mo	900mg qd	0.4	$2,245.80	60	30	4.058333333	$9,114.21	6357N	$3,645.68	Estimate
Hypoglycaemics (eg Humulin 30/70; Mixtard 30/70 : 100IU/ml)(HIC utilisation information)	All	0.1	ongoing	0.5 - 1 IU/kg/day (use 0.75IU/kg/d)	0.1	$223.89	100IU/ml, 3ml / vial, 5 vials/script	28	13.04464286	$2,920.57	1763T	$292.06	Estimate
Simvastatin	All	0.5	ongoing	40mg qd	0.5	$44.02	30	30	12.175	$535.94	8173E	$267.97	Estimate
antihypertensives	All	0.5-0.7	ongoing										Estimate
nifedipine	All		ongoing	20mg bd	0.6	$17.74	60	30	12.175	$215.98	1695T	$129.59	Estimate
enalapril	All		ongoing	20mg qd	0.6	$20.03	30	30	12.175	$243.87	1369C	$146.32	Estimate
irbesartan	All		ongoing	150mg qd	0.6	$24.72	30	30	12.175	$300.97	8247C	$180.58	Estimate
										Total cost year 1		$8,619.27	
										Total cost subsequent years		$724.46	

Table 11: Other follow up costs Post transplant – Year of transplant ($AUD 2008)

Item **Year 0 (year of Tx)**	Proportion of patients	Frequency	Total per year	MBS item number	Unit cost	Total cost per course	Average annual cost per patient	Source
Transplant Surgeon review	all	1/year	1	MBS 104	$79.05		$79.05	expert estimate
Transplant physician review (initial)	all	1	1	MBS 110	$139.45		$139.45	expert estimate
Transplant physician reviews (subsequent)	all	2/week for first 2 months; 1/week for1 month,then 1/month	30.66667	MBS 116	$69.75		$2,139.00	expert estimate
Dermatology specialist consult (initial)	all	1/yr	1	MBS 110	$139.45		$139.45	expert estimate
Dermatology specialist consult (subseq)	all	1/yr	1	MBS 116	$69.75		$69.75	expert estimate
Dermatology procedures (removal of skin lesion)	all	1 procedure /yr	0.5	MBS 30195 (benign lesion removal)	$58.65		$29.33	expert estimate
			0.5	MBS 30202 (malignant lesion removal by liq nitrogen cryotherapy)	$44.65		$22.33	expert estimate
De novo diabetes after Transplant	0.1	Total 4/yr						
Diabetes Specialist consult (initial)	0.1	1/yr	1	MBS 110	$139.45		$139.45	expert estimate
Diabetes Specialist consult (subsequent)	0.1	3/yr	3	MBS 116	$69.75		$209.25	expert estimate
Rejection rate (only data available for rejection within 6 mo)	0.23	within yr 0						expert estimate
Admitted (50%)			0.5	DRG - L09B	$25,451.20		$2,926.89	expert estimate
OKT3	10% of rejection episodes	7-14 days (use 12)	0.05	n.a.	$1,000	$12,000.00	$138.00	expert estimate
ATG	10% of rejection episodes	7-14 days (use 12)	0.05	n.a.	$1,561	$18,732.00	$215.42	expert estimate
Gancyclovir	10% of rejection episodes	IV 5mg/kg bd for 14 days	0.1	6136Y (for 5 vials)	$280.00	$1,568.00	$36.06	expert estimate
valgancyclovir	10% of rejection episodes	900mg qd 1 month	0.1	6357N	$2,245.80	$2,245.80	$51.65	expert estimate
Non-Admitted (50%)			0.5	MBS 166 x 4	$69.75	$279.00	$32.09	expert estimate
			0.5	PBS 8834Y	$98.67	$296.01	$34.04	expert estimate
Total additional follow up management costs (non-drug) Yr0							**$6,367.16**	

Table 12: Other follow up costs Post transplant – All subsequent years ($AUD 2008)

All subsequent years	Proportion of patients	Frequency	Total per year	MBS item number	Unit cost	Total cost per course	Average annual cost per patient	Source
Transplant physician reviews	all	5/year	5	MBS 116	$69.75		$348.75	expert estimate
Dermatology specialist consult (subseq)	all	2/yr	2	MBS 116	$69.75		$139.50	expert estimate
Dermatology procedures (removal of skin lesion)	all	1 procedure /yr	0.5	MBS 30195 (benign lesion removal)	$58.65		$29.33	expert estimate
			0.5	MBS 30202 (malignant lesion removla by liq nitrogen cryotherapy)	$44.65		$22.33	expert estimate
Diabetes Specialist consult (subsequent)	0.1	4/yr	4	MBS 116	$69.75		$279.00	expert estimate
Total additional follow up management costs (non-drug) Subsequent years							**$818.90**	

Appendix C: Glossary

Access surgery	See Vascular Access
Analgesic nephropathy	Damage within the internal structures of the kidney, caused by long-term use of compound analgesics.
Australian and New Zealand Dialysis and Transplantation Registry	A disease-specific registry, supported by funding from the Australian Government, which collects data from renal units throughout Australia and New Zealand about patients with End-Stage Kidney Disease.
Automated peritoneal dialysis	(APD) A form of peritoneal dialysis treatment where the patient's blood cycles through their peritoneal membrane (abdomen) via a machine overnight. It offers the patient lifestyle advantages, compared with continuous ambulatory peritoneal dialysis.
Cardiovascular disease	Describes a group of diseases that affect the heart and blood vessels, including coronary artery disease (heart attacks), cerebrovascular disease (strokes) and hypertension (high blood pressure). Also referred to as heart disease.
Chronic kidney disease	The slow and progressive deterioration of kidney function.
Community dialysis	Dialysis that is performed in a modified community facility often with the assistance of a carer.
Continuous ambulatory peritoneal dialysis	(CAPD) A form of peritoneal dialysis where the patient manually cleanses their blood through a 'bag system'. This is performed several times a day.
Coronary artery disease	One of a group of diseases that affect the heart and blood vessels - responsible for heart attacks.
Diabetes	A chronic disease in which the body is unable to regulate blood sugar.
Diabetic nephropathy	A complication of diabetes, characterised by high protein levels in the urine, indicating kidney damage.
Dialysis	A treatment for end-stage kidney disease that removes waste products from the blood by filtering the blood through a special membrane. There are two forms of dialysis—haemodialysis and peritoneal dialysis.
Dialysis modalities	Refers to the different types of dialysis treatments (haemodialysis and peritoneal dialysis) that vary depending on location of treatment.
Dominant	Dominant is a health economic term referring to a therapy that is more effective and less expensive than the comparator therapy.
Donor	Someone who provides an organ for transplantation. This person can be living (either related or non-related) or deceased.
End-stage kidney disease	The stage of chronic kidney disease where kidney function has been lost to the extent that death is inevitable unless the patient receives life-saving dialysis or transplantation.
Functioning transplant	Describes those individuals living with a functioning kidney transplant.
Glomerular filtration rate	An indirect estimate of kidney function.
Glomerulonephritis	A painless inflammation of the glomerulus in the kidney that can lead to high blood pressure and progressive loss of kidney function.
Haematuria	The presence of blood in the urine.
Haemodialysis	A treatment where blood is pumped from a patient into an artificial kidney machine (called a dialyser) and back.
Home dialysis	Dialysis performed in a patient's home often with assistance of a carer.
Hub	Hubs are centres within a statewide network renal service. They provide full-time nephrological and specialist nursing staff, and may also support a number of spoke services including outreach clinics.
Hypertension	High blood pressure.
Incremental cost	Incremental cost refers to the change in cost associated with introducing a change to current practice.
Incremental cost	The ratio of the change in costs as a result of a clinical intervention (compared to an

effectiveness ratio	alternative, such as doing nothing or using best available treatments) to the change in effects of the intervention.
In-centre dialysis	Predominately haemodialysis delivered in a tertiary hospital with the assistance of specialised nurses and on-site nephrologist support. Typically used to support patients with no self-care ability and complex care needs.
Incidence	The number of new cases of a condition occurring within a given population, over a certain period of time.
Indigenous health worker	Indigenous health workers provide primary health care to Aboriginal and Torres Strait Islander individuals, families and communities.
Inpatient	Health services provided to an individual who is admitted (for the day or overnight) to a hospital or health service facility.
Late referral	Those patients who are referred to nephrological care less than three months before commencing renal replacement therapy.
Linear growth	The linear growth model assumes that growth is occurring at absolute increments per year, decade or other unit of time.
Marginal donors	Kidney donations from non heart-beating deceased people or donors with sub-optimal kidney function.
Peripheral vascular disease	Disease that affects the peripheral blood vessels, i.e. those furthest from the heart.
Modality	Refers to the different clinical treatments that may be offered, depending on patient circumstances, clinical need, and availability of health services
Nephrologist	A medical doctor who specialises in kidney function and the treatment of kidney diseases.
Nephrology	Study of the function and diseases of the kidney.
Nurse practitioner	A registered nurse with specialised primary care training that enables them to perform some of tasks customarily conducted by a medical practitioner.
Opportunistic screening	Medical testing conducted to detect disease symptoms among high-risk populations or individuals during planned or unplanned interaction with primary care services.
Opportunity costs	What you may forego by choosing one approach rather than another.
Outpatient	A non-admitted health service provided or accessed by an individual at either a hospital or health service facility.
Peritoneal dialysis	A treatment where blood cleansing and waste removal occurs internally, using the body's own peritoneal membrane as a filter.
Polycystic kidney disease	An inherited condition where multiple cysts form on the kidneys, causing them to become enlarged.
Pre-emptive transplant	Kidney transplantation that occurs prior to the commencement of dialysis.
Prevalence	The proportion of a population living with a defined condition at a certain period of time.
Primary health care	General health care focused on the point at which an individual makes their first contact with the health system. Usually delivered by general practitioners, nurses and Indigenous health workers.
Primary renal disease	Attributed cause of end stage kidney disease.
Proteinuria	The presence of protein in the urine.
Quality adjusted life years(QALYs)	Quality adjusted life years (QALYs) are a multidimensional outcome measure used in health economics. This economic index of outcome combines patient survival with an adjustment for the quality of life, where adjustment is based on interval scale from 0 (worst health) to 1 (full health).
Reflux nephropathy	A condition in which the kidneys are damaged by the backward flow of urine into the kidney.
Renal	Of the kidneys. Used interchangeably with the words 'kidney' or 'kidneys'.
Renal replacement therapy (RRT)	Encompasses treatments for end-stage kidney disease including dialysis and kidney transplantation.
Satellite dialysis	Haemodialysis provided in a non-tertiary or secondary hospital or health facility.

	Patients may have some self-care abilities.
Self-care dialysis	Dialysis that is managed by a patient and their carer following extensive training, and with support from a dialysis centre.
Spoke	Services supported by specialised hubs that may provide satellite dialysis, patient education, self-care training and support.
Steady-state growth	A condition of constant rates of growth.
Telehealth	Health service delivery where the health service provider and the patient are geographically separated using two-way voice and visual communication (such as by satellite, computer or closed-circuit television).

Transplantation	A surgical procedure whereby a healthy organ from a deceased or living donor is implanted to replace the function of a damaged organ.
Vascular access	A necessary surgical procedure that connects an artery and vein in order for dialysis to take place. Access points may be located in the upper or lower arm for haemodialysis, and in the abdomen for peritoneal dialysis.
Vascular disease	Disease of the blood vessels.

Appendix E: Acronyms

ABS	Australian Bureau of Statistics
AusDiab	The Australian Diabetes, Obesity and Lifestyle Study
ANZDATA	Australian and New Zealand Dialysis and Transplantation Registry
CKD	chronic kidney disease
CAPD	continuous ambulatory peritoneal dialysis
dpmp	donors per million population
EPO	Erythropoietin
ERP	Estimated Resident Populations
ESKD	End-stage kidney disease
GRF	glomerular filtration rate
HD	haemodialysis
ICER	incremental cost effectiveness ratio
K/DOQI	Kidney Disease Outcomes Quality Initiative
KHA	Kidney Health Australia
MSAC	Medical Services Advisory Committee
NHCDC	National Health Cost Data Collection
PAH	Princess Alexandra Hospital
PBAC	Pharmaceutical Benefits Advisory Committee
PD	peritoneal dialysis
pmp	per million population
ppt	price per treatment
QALY	quality adjusted life years
RRT	renal replacement therapy
SG	standard gamble
TTO	Time trade-off

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GLOSSARY

Australian and New Zealand Dialysis and Transplantation Registry (ANZDATA)	A disease-specific registry, supported by funding from the Commonwealth Government, which collects data from renal units throughout Australia and New Zealand about patients with End Stage Kidney Disease.
Australian and New Zealand Donor Organ Registry (ANZOD)	Records and reports on a wide range of statistics that relate to organ donation following death within Australia and New Zealand.
Automated Peritoneal Dialysis	A form of peritoneal dialysis treatment where the patient's blood cycles through their peritoneal membrane via a machine overnight.
Cardiovascular Disease	Describes a group of diseases that affect the heart and blood vessels, including coronary artery disease (heart attacks), cerebrovascular disease (strokes) and hypertension (high blood pressure). Also referred to as heart disease.
Chronic Kidney Disease	The slow and progressive deterioration of kidney function.
Community Dialysis	Dialysis that is performed in a modified community facility often with the assistance of a carer.
Continuous Ambulatory Peritoneal Dialysis	A form of peritoneal dialysis that involves the patient manually cleansing their blood through a 'bag system' performed several times a day.
Corporatisation	Describes a partnership where private providers deliver dialysis services with clinical governance provided by the public sector.
Diabetes	A chronic disease in which the body is unable to regulate glucose (blood sugar).
Dialysis	A treatment for End Stage Kidney Disease that removes waste products from the blood by filtering the blood through a special membrane. There are two forms of dialysis – haemodialysis and peritoneal dialysis.
Dialysis Modalities	Refers to the different types of dialysis treatments (haemodialysis and peritoneal dialysis) that vary depending on location of treatment.
Donor	Someone who provides an organ for transplantation. This person can be living (either related or non-related) or deceased.

End Stage Kidney Disease	The stage of Chronic Kidney Disease when the kidneys have stopped functioning and death is imminent unless life-saving dialysis or transplantation is received.
Functioning Transplant	Describes those individuals living with a functioning kidney transplant.
Glomerular Filtration Rate	The rate at which urine is filtered through the kidneys.
Glomerulonephritis	A painless inflammation of the kidney which can lead to high blood pressure and progressive loss of kidney function.
Haematuria	The presence of blood in the urine.
Haemodialysis	A treatment where blood is pumped from a patient into an artificial kidney machine (called a dialyser) and back.
Home Dialysis	Dialysis that is performed in a patient's home often with the assistance of a carer.
Hub	Provides full-time nephrological and specialist nursing staff and may or may not have service functions in relation to service spokes including the provision of outreach clinics.
Hypertension	High blood pressure.
Incremental Cost Effectiveness Ratio	The ratio of the change in costs as a result of a clinical intervention (compared to an alternative, such as doing nothing or using best available treatments) to the change in effects of the intervention.
In-Centre Dialysis	Predominately haemodialysis delivered in a tertiary hospital with the assistance of specialised nurses and on-site nephrologist support. Typically used to support patients with no self-care ability and high acuities.
Incidence	The number of new cases of a condition occurring within a given population over a certain period of time.
Indigenous Health Worker	Provide primary health care to Aboriginal and Torres Strait Islander individuals, families and communities.
Inpatient	Health services provided to an individual who is admitted (for the day or overnight) to a hospital or health service facility.
Late Referral	Those patients that are referred to nephrology care less than three month before first commencing Renal Replacement Therapy.

Nephrologist	A medical doctor who specialises in kidney function and the treatment of kidney diseases.
Nephrology	Study of the function and diseases of the kidney.
Nurse Practitioner	A registered nurse with specialised primary care training enabling them to perform some of the tasks customarily conducted by a general practitioner.
Outpatient	A non-admitted health service provided or accessed by an individual at either a hospital or health service facility.
Peritoneal Dialysis	A treatment where blood cleansing and waste removal occurs internally, using the body's own peritoneal membrane as a filter.
Pre-emptive Transplant	Kidney transplantation that occurs prior to the commencement of dialysis.
Prevalence	The proportion of a population living with a defined condition at a certain period of time.
Primary Health Care	General health care focused on the point at which an individual makes their first contact with the health system. Usually delivered by general practitioners, nurses and Indigenous health workers.
Primary Renal Disease	Attributing cause of End Stage Kidney Disease.
Proteinuria	The presence of protein in the urine.
Opportunistic Screening	Medical testing conducted to detect disease symptoms among high-risk populations or individuals during planned or unplanned interaction with primary care services.
Quality Adjusted Years of Life	Quality Adjusted Life Years (QALYs) are a multidimensional outcome measure used in health economics. This economic index of outcome combines patient survival with an adjustment for the quality of life, where the adjustment is based on an interval scale from 0 (worst health) to 1 (full health).
Renal	Used interchangeably with the words 'kidney' or 'kidneys'.
Renal Replacement Therapy	Encompasses treatments for End Stage Kidney Disease including dialysis and kidney transplantation.
Satellite Dialysis	Haemodialysis provided in a non-tertiary or secondary hospital or health facility. Patients may have some self-care abilities.
Self-Care Dialysis	Dialysis that this managed by a patient and their carer following

	extensive training and with support from a dialysis centre.
Spoke	Services supported by specialised hubs that may or may not provide satellite dialysis, patient education, self-care training and support.
Transplantation (Kidney)	A surgical procedure where by a healthy kidney from a deceased or living donor is placed in a recipient who has severely reduced kidney function. The transplanted kidney is joined to the recipient's vascular system and bladder enabling the kidney to function.
Vascular Access	A necessary surgical procedure that connects an artery and vein in order for dialysis to take place. Access points may be located in the upper or lower arm for haemodialysis and abdomen for peritoneal dialysis.
Vascular Disease	Disease of the blood vessels.

ACRONYMS

ABS	Australian Bureau of Statistics
ACR	Albumin Creatinine Ratio
ANZDATA	Australian and New Zealand Dialysis and Transplantation Registry
ATSI	Aboriginal and Torres Strait Islander
CAPD	Continuous Ambulatory Peritoneal Dialysis
CKD	Chronic Kidney Disease
DHHS	Department of Health and Human Services (Tasmania)
EN	Enrolled Nurse
ERP	Estimated Residential Population
ESKD	End Stage Kidney Disease
FTE	Full Time Equivalent
GP	General Practitioner
GRF	Glomerular Filtration Rate
HD	Haemodialysis
KPI	Key Performance Indicators
KHA	Kidney Health Australia
MBS	Medicare Benefit Schedule
LGA	Local Government Areas
LGH	Launceston General Hospital
NGO	Non Government Organisations
NT	Northern Territory
PBS	Pharmaceutical Benefit Schedule
PD	Peritoneal Dialysis
PPP	Public Private Partnership
PPT	Price Per Treatment
RN	Registered Nurses
RRT	Renal Replacement Therapy
RHH	Royal Hobart Hospital
SA	South Australia
MDS	Minimum Data Set
NSW	New South Wales
NWRU	North West Renal Unit
WA	Western Australia

GLOSSARY

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Corporatisation	Describes a partnership where private providers deliver dialysis services with clinical governance provided by the public sector.
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Glomerular Filtration Rate	The rate at which urine is filtered through the kidneys.
Glomerulonephritis	A painless inflammation of the kidney which can lead to high blood pressure and progressive loss of kidney function.
Haematuria	The presence of blood in the urine.
Haemodialysis	A treatment where blood is pumped from a patient into an artificial kidney machine (called a dialyser) and back.
Home Dialysis	Dialysis that is performed in a patient's home often with the assistance of a carer.
Hub	Provides full-time nephrological and specialist nursing staff and may or may not have service functions in relation to service spokes including the provision of outreach clinics.
Hypertension	High blood pressure.
Incremental Cost Effectiveness Ratio	The ratio of the change in costs as a result of a clinical intervention (compared to an alternative, such as doing nothing or using best available treatments) to the change in effects of the intervention.
In-Centre Dialysis	Predominately haemodialysis delivered in a tertiary hospital with the assistance of specialised nurses and on-site nephrologist support. Typically used to support patients with no self-care ability and high acuities.
Incidence	The number of new cases of a condition occurring within a given population over a certain period of time.
Indigenous Health Worker	Provide primary health care to Aboriginal and Torres Strait Islander individuals, families and communities.
Inpatient	Health services provided to an individual who is admitted (for the day or overnight) to a hospital or health service facility.
Late Referral	Those patients that are referred to nephrology care less than three month before first commencing Renal Replacement Therapy.

Nephrologist	A medical doctor who specialises in kidney function and the treatment of kidney diseases.
Nephrology	Study of the function and diseases of the kidney.
Nurse Practitioner	A registered nurse with specialised primary care training enabling them to perform some of the tasks customarily conducted by a general practitioner.
Outpatient	A non-admitted health service provided or accessed by an individual at either a hospital or health service facility.
Peritoneal Dialysis	A treatment where blood cleansing and waste removal occurs internally, using the body's own peritoneal membrane as a filter.
Pre-emptive Transplant	Kidney transplantation that occurs prior to the commencement of dialysis.
Prevalence	The proportion of a population living with a defined condition at a certain period of time.
Primary Health Care	General health care focused on the point at which an individual makes their first contact with the health system. Usually delivered by general practitioners, nurses and Indigenous health workers.
Primary Renal Disease	Attributing cause of End Stage Kidney Disease.
Proteinuria	The presence of protein in the urine.
Opportunistic Screening	Medical testing conducted to detect disease symptoms among high-risk populations or individuals during planned or unplanned interaction with primary care services.
Quality Adjusted Years of Life	Quality Adjusted Life Years (QALYs) are a multidimensional outcome measure used in health economics. This economic index of outcome combines patient survival with an adjustment for the quality of life, where the adjustment is based on an interval scale from 0 (worst health) to 1 (full health).
Renal	Used interchangeably with the words 'kidney' or 'kidneys'.
Renal Replacement Therapy	Encompasses treatments for End Stage Kidney Disease including dialysis and kidney transplantation.
Satellite Dialysis	Haemodialysis provided in a non-tertiary or secondary hospital or health facility. Patients may have some self-care abilities.
Self-Care Dialysis	Dialysis that this managed by a patient and their carer following

	extensive training and with support from a dialysis centre.
Spoke	Services supported by specialised hubs that may or may not provide satellite dialysis, patient education, self-care training and support.
Transplantation (Kidney)	A surgical procedure where by a healthy kidney from a deceased or living donor is placed in a recipient who has severely reduced kidney function. The transplanted kidney is joined to the recipient's vascular system and bladder enabling the kidney to function.
Vascular Access	A necessary surgical procedure that connects an artery and vein in order for dialysis to take place. Access points may be located in the upper or lower arm for haemodialysis and abdomen for peritoneal dialysis.
Vascular Disease	Disease of the blood vessels.

ACRONYMS

ABS	Australian Bureau of Statistics
ACR	Albumin Creatinine Ratio
ANZDATA	Australian and New Zealand Dialysis and Transplantation Registry
ATSI	Aboriginal and Torres Strait Islander
CAPD	Continuous Ambulatory Peritoneal Dialysis
CKD	Chronic Kidney Disease
DHHS	Department of Health and Human Services (Tasmania)
EN	Enrolled Nurse
ERP	Estimated Residential Population
ESKD	End Stage Kidney Disease
FTE	Full Time Equivalent
GP	General Practitioner
GRF	Glomerular Filtration Rate
HD	Haemodialysis
KPI	Key Performance Indicators
KHA	Kidney Health Australia
MBS	Medicare Benefit Schedule
LGA	Local Government Areas
LGH	Launceston General Hospital
NGO	Non Government Organisations
NT	Northern Territory
PBS	Pharmaceutical Benefit Schedule
PD	Peritoneal Dialysis
PPP	Public Private Partnership
PPT	Price Per Treatment
RN	Registered Nurses
RRT	Renal Replacement Therapy
RHH	Royal Hobart Hospital
SA	South Australia
MDS	Minimum Data Set
NSW	New South Wales
NWRU	North West Renal Unit
WA	Western Australia

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