

The Treatment of Kidney Failure in New Zealand

Editors: Kelvin Lynn with Adrian Buttimore, Peter Hatfield, Martin Wallace



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Foreword

Around 2008, Kelvin Lynn and Adrian Buttimore had the idea of writing a history of the treatment of kidney failure in New Zealand. Little progress ensued until after they retired from clinical practice. Peter Hatfield in the 1990's had interviewed Neil Turnbull and J Verney Cable to record their place New Zealand nephrology history. Peter Hatfield and Martin Wallace joined the project in 2013. In our various professional roles we have experienced the impact of kidney failure on patients and their families. From the earliest days, we saw the effects of the new treatments of dialysis and of transplantation.

We recognised the need to document the work of the pioneers of the specialty of renal medicine or nephrology over the past 50 years in New Zealand. We wished to acknowledge the contribution of our teachers, mentors and colleagues, as well as the patients and their families who contributed so much to the development of comprehensive services for people with kidney failure.

The story of the modern treatment of kidney failure in this country encompasses remarkable experiences of patients and their families and the contributions made by dedicated health professionals. It also reveals the challenges and ethics of meeting an ever-increasing demand for treatment. Social and political changes in our country since the 1950s have critically influenced the development of treatment services for New Zealanders with kidney failure.

The project has taken much longer than we would have hoped for. Encouraging and cajoling contributors is a delicate task and we are aware of the many competing demands we all have for our time. We are dependent on others for a complete version of history of the treatment of kidney failure in New Zealand. For a variety of reasons, this document is incomplete: there are sections yet to be written. The editors decided that an online publication at this stage would keep faith with those who have already provided their contribution and encourage others to help address the gaps. It will also enable us to rapidly address any corrections of fact and keep costs to a minimum.

Fortunately, many of the key players in this history were still alive when we started this project and were able to tell their story. Sadly, Martin Wallace died in October 2017.

We are grateful to the many people who have provided archival material, agreed to be interviewed or have written sections themselves. We hope that this publication will be of interest to patients and their families, health professionals, medical historians, sociologists and others, such as students and journalists who may wish to learn more about the history of the treatment of kidney disease and the context of its development in New Zealand.

Kelvin Lynn, Peter Hatfield and Adrian Buttimore

Table of contents

Chapter 1	Introduction	7
Chapter 2	Development of renal services (1960 to 2000).....	11
	Beginnings 1950-1960	
	The first renal units 1961-70	
	Meeting the demand 1971-80 (including Transplantation)	
	Clinical, ethical and funding challenges 1981-1990	
	Renal services in the time of the Health Reforms1991-2000	
	Recent developments 2001 to present	
Chapter 3	Home haemodialysis.....	47
Chapter 4	Treatment of children and adolescents.....	60
Chapter 5	Renal nursing in New Zealand	65
Chapter 6	Dialysis technician to clinical physiologist-dialysis	70
Chapter 7	National & regional planning of renal services in New Zealand	81
	Clinician led national service planning	
	The West Report	
	National Technical Committee on Renal Dialysis and Transplant	
	New Zealand Chapter of the Australian and New Zealand Society of Nephrology	
	Attempts to define core renal services	
	Effects of the 1990s Health Reforms	
	The National Renal Advisory Board	
Chapter 8	Kidney Health New Zealand and Kidney Societies.....	89
Chapter 9	Statistics and trends for the treatment of kidney failure in New Zealand.....	97
Chapter 10	The future of dialysis	99
Conclusion	108
The editors	109
Chapter authors	111
Appendices.....		113
.		
Appendix A	Report of Committee on Renal Dialysis and Transplantation to the Hospitals Advisory Council June 1977. Committee members.	
Appendix B	The Management of End-stage Renal Failure Consensus Development Conference 1992. Committee members.	
Appendix C	New Zealand nephrologists, physicians and surgeons 1960-2000	
Appendix D	New Zealand Nephrology Units 2018	
Glossary of kidney disease terms		118

The Treatment of Kidney Failure in New Zealand

Abbreviations and acronyms

Area Health Board	AHB
Arteriovenous	AV
Australia and New Zealand Dialysis and Transplant Registry	ANZDATA
Australian and New Zealand Society of Nephrology	ANZSN
Automated Peritoneal Dialysis	APD
Chronic Kidney Disease	CKD
Continuous Ambulatory Peritoneal Dialysis	CAPD
Crown Health Enterprise	CHE
District Health Board	DHB
Endstage Kidney Disease	ESKD
Haemodialysis	HD
Home Haemodialysis	HHD
Intensive Care Unit	ICU
Kidney Health Australia	KHA
Kidney Health New Zealand	KHNZ
Peritoneal Dialysis	PD
Multiple Artificial Kidney System	MAKS
National Kidney Foundation of New Zealand	NKF
National Renal Advisory Board	NRAB
New Zealand Board of Dialysis Practice	NZBDP
Renal Society of Australasia	RSA
Regional Health Authorities	RHA

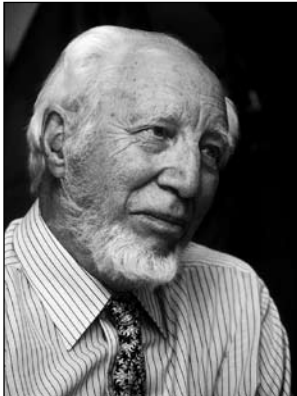
Introduction

Martin Wallace and Peter Hatfield

The kidney is the first organ where function was successfully replaced by mechanical means. It was an Italian anatomist Giovanni Morgagni (1682-1771), who first recognised that an illness could be due to an organ failure.¹ At Guy's Hospital in London, in the 1820s and 1830s, Richard Bright (1789-1858), established the connection between dropsy (oedema) with albumin in the urine and changes in the kidney. He was the first to associate the symptoms with organ failure. In 1827 John Bostock (1773-1846), working with Bright, was able to measure urea and found it elevated in the blood of a patient with kidney disease and diminished in the urine.²

The ability to manage the failure of a body organ must begin with a full understanding of the organ's function. Many physiologists were involved in determining the purpose of kidney function, including Claude Bernard (1813-1878) with his concept of *le milieu interieure*. 'The stability of the internal environment is the condition for the free and independent life,' he said.³

Being able to manage the internal environment was dependent on two vital discoveries: osmosis and dialysis. The French naturalist, Rene Dutrochet (1776-1847), discovered and named osmosis and was able to measure osmotic pressure.⁴ He also proposed that the kidneys made urine by a process of chemical filtration. The Scottish chemist, Thomas Graham (1805-1869), evolved the laws of diffusion of gases and described the separation of substances across membranes, which he defined as dialysis.⁵ John Abel (1857-1938) and his colleagues at Johns Hopkins Hospital in Baltimore in 1913 carried out the first *in vivo* dialysis of rabbit's blood, prompting *The Times* of London to coin the term 'artificial kidney'.⁶ Homer Smith (1895-1962) and others further defined the mechanisms of kidney function. It seemed inevitable that the possibility of an artificial kidney would be explored for those with kidney failure.



Willem Kolff

In 1943, in the German occupied Netherlands, Willem Kolff (1911-2009), performed the first haemodialysis (HD) treatment on a human.⁷ Kolff said however, it was not until 1945 that he used HD to save a human life. He used borrowed technology, such as cellophane tubing as a dialysis membrane. The tubing was developed in Chicago in the 1920s as a casing for sausages. He was also able to use standardised heparin developed in Toronto in the 1930s.

At this time HD treatment was only possible for acute reversible

¹ Morgagni Giovanni. De sedibus et causis morborum per anatomen indagatis libri quinque. Venice 1761.

² Bright R. Reports of medical cases selected with a view of illustrating disease with a reference to morbid anatomy. Longman, Rees, Orme, Brown and Green, London, 1827: 84.

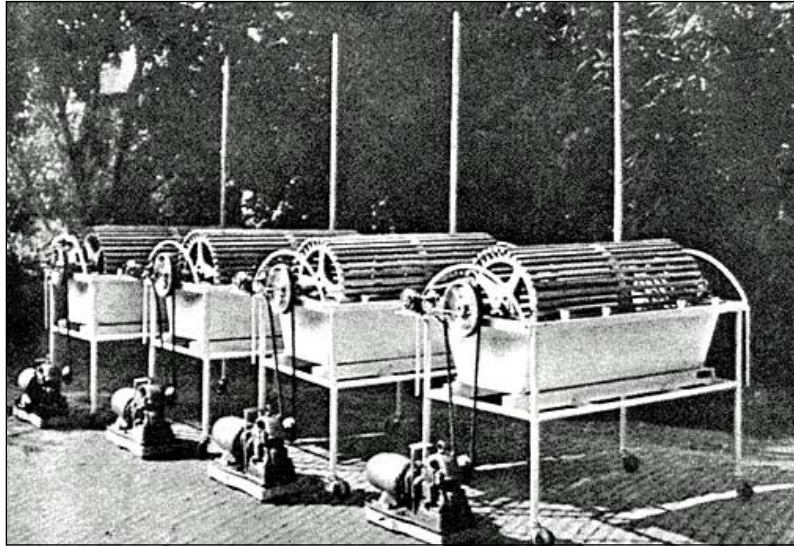
³ Bernard C. Lectures on the phenomena common to animals and plants. Trans Hoff H E, Guillemin L, Springfield JL: Charles L Thomas 1974.

⁴ Dutrochet RJH. Nouvelles recherches sur l'endosmose et l'exosmose etc. J-B Balliere, Paris, 1828.

⁵ Graham T. Liquid diffusion applied to analysis. Philos Trans R Soc Lond 1861; 151: 183-224.

⁶ Abel JJ, Rowntree IG, Turner BB. On the removal of diffusible substances from the circulating blood by dialysis. Trans Assoc Am Physicians 1913; 58: 51-4.

⁷ Kolff WJ. First clinical experience with the artificial kidney. Ann Intern Med 1965; 62: 608-19.



Kolff's original artificial kidneys

kidney failure because long-term access to the circulation was not practicable. Kolff used glass cannulas and rubber tubing for temporary access to the circulation. In 1946 he noted that 'In cases of chronic (irreversible) uraemia there is no general indication for treatment with the artificial kidney.'

In 1946, Nils Alwall (1904-1986), a Swedish pioneer in HD, modified a Kolff machine to make ultrafiltration possible. In 1948 he also invented arteriovenous (AV) shunts but found that clotting was an insurmountable problem.⁸

It was Belding Scribner (1921-2003), in Seattle in 1960, who first used a Teflon cannula as an external AV shunt for permanent circulatory access.⁹ He was unaware of Alwall's unsuccessful attempts 12 years earlier. This led Scribner to say: 'If I had known it would be so much trouble, I would never have attempted it'.

The shunt was further improved by Quinton (1921-2015) by again using borrowed technology in the form of silicone rubber which at that time was being used as improved insulation for electrical wiring. Suddenly the barrier to unlimited dialysis was broken and treatment of chronic kidney failure became feasible. Another important advance occurred in 1966 with the creation by Brescia and Cimino in New York of the AV fistula which made external shunts obsolete.¹⁰

Peritoneal dialysis (PD) treatment for acute kidney failure was established in the 1950s. English physiologist Ernest Henry Starling (1866-1927), famous for his studies on fluid exchange in capillaries and cardiac function, used Graham's work on diffusion to study the details of fluid exchange in the peritoneal cavity.¹¹

In 1960 the first patient with endstage kidney disease (ESKD) began long-term intermittent PD treatment in Seattle. However, it was only in 1968 with the development of the Tenckhoff catheter, which reduced the high incidence of infection, that long-term PD became practicable.¹² With the advent of Continuous Ambulatory Peritoneal Dialysis (CAPD) in 1975, home treatment was possible and it was enthusiastically adopted in New

⁸ Alwall N. Arteriovenous shunt for repeated treatments of animals and men in the 1940s. *Dial Transplant* 1979; 8: 272.

⁹ Quinton W, Dillard D, Scribner BH. Cannulation of blood vessels for prolonged hemodialysis. *Trans ASAIO* 1960; 6: 104-13.

¹⁰ Brescia MJ, Cimino JE, Appel K, Hurwich BH. Chronic hemodialysis using venepuncture and surgically created arteriovenous fistula. *N Eng J Med* 1966; 275: 1089-92.

¹¹ Starling EH, Tubby AH. On absorption from and secretion into the serous cavities. *J Physiol* 1894; 16: 140-8.

¹² Tenckhoff H, Schechter H. A bacteriologically safe peritoneal dialysis access device. *Trans ASAIO* 1968; 14: 181-3.

Zealand.¹³ Later in the 1980s and 1990s, machines were introduced to perform Continuous Cycling Peritoneal Dialysis (CCPD) and Automated Peritoneal Dialysis (APD).

None of these events occurred in isolation. They were part of the remorseless development of the science of medicine and the outcome of the work of thousands over many years. Advances also occurred by accident, by good luck, through the exigencies of war, and by the frequent use of borrowed technology. Initial results were often poor, sometimes disastrous, but the pioneers persisted with a dogged determination, often in an atmosphere of opposition or indifference. If only a purely scientific approach had been adopted, firstly to identify the uraemic toxins and then find the most effective way to remove them we would not be dialysing patients today. The so-called 'uraemic toxins' have still not been identified definitively.

The treatment of kidney failure was new and immediately presented problems. The treatment did not restore all the functions of the failed kidneys, it was not curative and it was a life-long treatment. It was expensive in both materials and staff, which had a huge effect on hospital budgets especially when the on-going costs of increased patient numbers were calculated. Successful maintenance HD meant more costs, not fewer! Choices had to be made which publically occasioned both ethical and social debates. Committees were sometimes set up to choose the lucky few. (This also applied to kidney transplantation after the first successful transplant in Boston in 1954 by John Merrill (1917-1984) and Joseph Murray (1919-2012).¹⁴

Renal physicians in New Zealand initially learned of these changes through publications in medical journals. Auckland's Derek North drove the development of treatment of kidney disease in New Zealand aided by supportive hospital administrators, such as John Meade in Waikato Hospital. By 1970 there were four renal units established throughout the country. The new specialty of nephrology was created, the name chosen to establish equal standing with other branches of specialist care: cardiology, gastroenterology, neurology and urology. The main drivers of the new specialty were artificial kidney treatment and kidney needle biopsy.

The first full-time renal physicians appointed in New Zealand were Peter Doak in Auckland, Martin Wallace in the Waikato, Bruce Morrison in Wellington and Peter Little in Christchurch.

Soon the personal experiences of returning post-graduate medical students from the UK and the USA drove new clinical endeavours, though this experience was sometimes not directly applicable here. Our much smaller population was widespread. Also, the Maori population, measuring 15% of the total population, had a higher incidence of ESKD secondary to both diabetes and glomerulonephritis. This particularly affected the Waikato renal unit where Maori were 16.5% of the total Waikato and Bay of Plenty population in 1966.

In the late 1960s, New Zealand developed clinical guidelines for offering treatment to nephrology patients. In the next decade, national planning came in the form of the West Report.¹⁵ The acceptance criteria for maintenance HD in 1968 were to be:

1. between 15 and 50 years only
2. a suitable transplant candidate
3. without a systemic disease¹⁶

¹³ Popovich RP, Moncrief JW, Decherd JF, Bomar JB, Pyle WK. The definition of a novel portable/wearable equilibrium dialysis technique. *Trans ASAIO* 1976; 5: 64.

¹⁴ Merrill JP, Murray JE, Harrison JH, Guild WR. Successful homotransplantation of the human kidney between identical twins. *JAMA* 1956; 160: 277-282.

¹⁵ Report of Committee on Renal Dialysis and Transplantation to the Hospitals Advisory Council 1977. West Report.

¹⁶ Report of a meeting of Heads of Renal Units in Auckland on 26 July 1968.

The first patients were treated with HD on an outpatient basis for six hours, three times a week with access initially through an implanted silastic-teflon shunt. Later surgeons were able to create an AV fistula with the resulting dilated veins allowing repeated needle access. Training for home haemodialysis (HHD) began in Auckland 1968, Christchurch in 1969, Wellington in 1975 and Waikato in 1976. The training took eight to 12 weeks. CAPD, after a shorter training period (two to four weeks) was carried out at home through a surgically implanted silastic Tenckhoff catheter inserted into the peritoneal cavity through the skin of the abdominal wall. In 1978, the Waikato unit was the first to have patients treated at home, followed by the Wellington unit the same year. Auckland and Christchurch were next in 1979.

In 1965, eleven years after the first kidney transplant in Boston, surgeons in Auckland performed the first transplant in New Zealand. Surgeons in Wellington followed in 1969, Christchurch in 1972 and Waikato and Dunedin in 1974. By the 1970s the development of ideas and machinery saw dialysis completely established. Although the methodology improved, new complications with long-term dialysis arose and kept arising. The acceptance criteria changed radically from 1968 and the acceptance of younger and older patients with medical complications, posed additional problems. There has been a huge increase in the transplant waiting list even though many dialysis patients are no longer medically suitable to be put on the list.

In all units in New Zealand the close co-operation of medical, surgical, nursing, technical and management staff, plus patients and their families, was mandatory and evident from the very beginning. The driver was to save lives and make them productive and enjoyable. Prolongation of a comfortable and fulfilling life was a rewarding experience for everyone in the team.

The aim of this book is to record the history of the treatment of kidney failure in New Zealand from the beginnings in the 1950s and to acknowledge those people who made it possible. The authors either established treatments themselves or worked with the individuals who first treated kidney disease in New Zealand. They also met and discussed treatment with the pioneers in Europe and the USA – people who had carried out the first successful dialysis and transplants in humans: the Kolffs, the Scribners, the Merrills, the Ciminos and the Tenckhoffs. We do not want to lose this history.

2

The Development of Renal Services

Kelvin Lynn, Adrian Buttimore, Peter Hatfield and Martin Wallace

Beginnings 1950-1960

Long before the advent of nephrologists and departments of renal medicine, general physicians at Wellington Hospital were treating patients with kidney failure. A trainee general physician at Wellington Hospital performed the first peritoneal dialysis (PD) in New Zealand.¹⁷ Dr Neil Turnbull was a medical registrar in 1954 when he admitted a pale, vomiting, dehydrated 24-year-old woman who had not passed urine for the past nine days. Fifteen days before admission she had tried to terminate an unwanted pregnancy by infusing a Dettol solution into her cervical canal. In spite of rehydration with blood and five per cent glucose she became comatose. Turnbull inserted a very recently acquired polythene catheter into the superior vena cava by way of a vein in the left elbow so that he could infuse 30 per cent glucose. However, she remained unconscious and was not making any urine. It was then that pathology registrar, Dr Dave Reid, suggested trying peritoneal dialysis, which he had recently read about in the *New England Journal of Medicine*.¹⁸

After mixing 20 litres of a glucose solution in sterilised glass bottles they had to stop as the solution had caramelised. They supposed the autoclave (steriliser) had been too hot and were proved right when after the autoclave temperature was reduced the new glucose solution remained clear. This was not the end of their technical problems, however, for after running two litres of the solution through the polythene tube that they had inserted into the right iliac fossa with a trocar and cannula, there was no drainage. Undeterred, they pulled the tube out and established good drainage by pricking holes in the tubing with a hot 22-gauge needle. After three days of peritoneal dialysis the patient began passing increasing volumes of urine and then regained consciousness. When last seen by Turnbull in 1992, she had normal renal function.



Turnbull (left) flew in the Royal Navy Fleet Air Arm during the Second World War and returned to New Zealand to study medicine. Turnbull celebrated his 95th birthday in May 2018.

¹⁷ Turnbull AN. Acute Renal Shutdown. *N Z Med J* 1955; 54: 647-50.

¹⁸ Legrain M., J.P. Merrill. Short-Term Continuous Transperitoneal Dialysis – A Simplified Technic. *N Eng J Med* 1953; 248: 125-29.



Dr J Verney Cable

Dr J Verney Cable used peritoneal dialysis in 1955 at Wellington Hospital on a woman who worked as a dry cleaner and was thought to have acute kidney failure secondary to carbon tetrachloride poisoning. Technically, there were no dialysis problems but her renal function did not recover.

Cable gained the Anatomy Medal at the Otago Medical School where his degree was awarded with distinction. After serving as a Lt. Colonel in the 2nd New Zealand Field Hospital in Italy, he returned to Wellington in 1946.

Cable was an innovator with far-sighted ideas and a penetrating wit. He performed the first cardiac catheter procedure in 1953 and with Dr Ian Prior pioneered percutaneous renal biopsies.

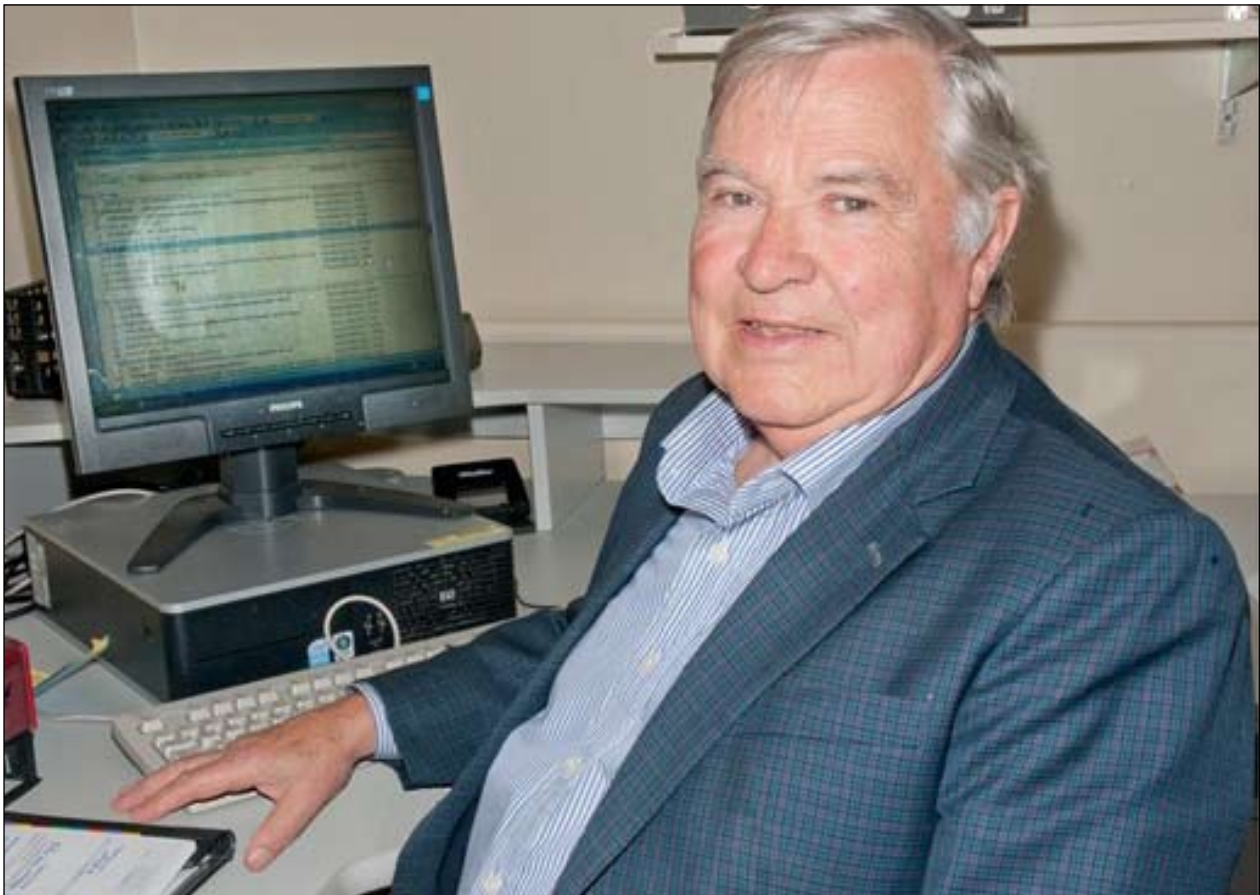
While the resident physician in Wellington he acquired a Kolff kidney to treat kidney failure and in 1958 with the help of Sister Jean Fraser, he performed the first haemodialysis (HD) in New Zealand. Following this, patients from other centres were referred to Wellington for haemodialysis.



Sister Jean Fraser managing the first haemodialysis with a Kolff kidney in New Zealand at Wellington Hospital 1958

Dr John Morton, later to become a vascular and renal transplant surgeon at Christchurch Hospital, was a Resident at Wellington Hospital between 1962 and 1964. He recalls:

The first patient that I saw with end-stage kidney disease (ESKD) worked as a radiographer at the hospital and Dr Verney Cable, a general physician, treated her with a low protein diet. This was my first experience of chronic, irrecoverable ESKD, and the patient wasted away and died from her disease (glomerulonephritis).¹⁹



Professor John Morton

The first renal units 1961-70

During the 1960s, renal units were established in Auckland, Waikato, Wellington, Christchurch and Dunedin, the first nephrologists appointed and a national framework for ESKD services developed.

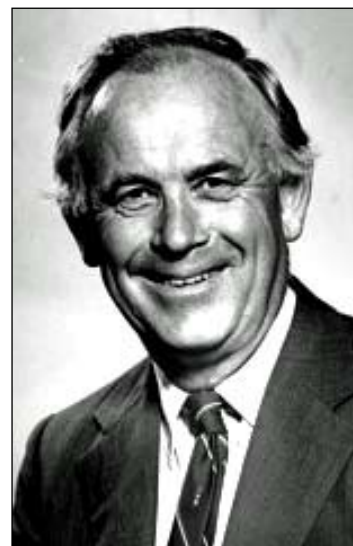
Auckland Renal Unit

Professor Derek North established the first comprehensive services for the treatment of ESKD in New Zealand. He trained at the Otago University Medical School and, after graduation in 1950, spent two-and-a-half years at Oxford University as a Rhodes Scholar and further time at the Postgraduate Medical School at Hammersmith Hospital. He returned to New Zealand in 1956 as medical tutor at Auckland Hospital and in April 1959 he was appointed physician in charge of the newly established Medical Unit at Auckland Hospital. Shirley Cooper, who had been the charge nurse of the Renal and Metabolic Unit at Hammersmith Hospital, was appointed as charge nurse of the Medical Unit.

¹⁹ Personal communication John Morton

Dr Robin (later Sir Robin) Irvine was appointed as a Research Fellow in the Medical Unit laboratory in 1961. He had studied renal medicine at the Middlesex and Hammersmith Hospitals in London and returned to Auckland as a medical tutor. 'At about that time (1961), North made the decision that would shape the unit's future directions. ...to develop the Unit as a centre for excellence in renal disease.'²⁰ Robin Irvine wrote that he and Derek North were the only New Zealand physicians in the early 1960s that could be described as nephrologists.²¹ In 1963, Irvine moved to Dunedin where he was involved with the establishment of renal services there.

In 1961, North approached Sir Ernest Davis, a wealthy businessman and philanthropist, regarding a donation towards the purchase of an artificial kidney and the unit was given a cheque for £1,500. This money enabled the purchase of a Kolff twin coil artificial kidney which was stored on a balcony on the second floor of the old Main Block at Auckland Hospital.²²



Professor Derek North

[The Kolff kidney was rather] ... like a stainless-steel washing machine holding 100 litres of dialysate. Exchange of biochemical components of blood and dialysate occurred across the membrane of a large coiled tube of cuprophan inserted into the centre of the tank as the patient's blood cycled through it. Water had to be piped to the machine via a hose through a window. The Kolff kidneys required that the dialysate be changed every two hours. In the early days, the fluid was mixed on the spot. The various chemical components were weighed out, thrown into the Kolff tank and the water needed added via the hose. With each exchange of dialysate staff had to hold up the dialysis for ten minutes while [John] Pybus²³ checked that the chemistry of the patient's blood and the composition of the dialysis fluid (dialysate) were within acceptable limits. The patients being dialysed at that time all had acute renal failure.²⁴ [T]he first three patients with acute kidney failure recovered following dialysis.

The Kolff/Travenol Twin Coil artificial kidney was the first disposable dialyser available commercially. It was launched on October 30, 1956, by the Travenol Division of Baxter Laboratories, Inc., in the USA. The machine was a result of the efforts of the Dutch nephrologist, Dr Willem Kolff and William B Graham, CEO of Baxter. The coil had to be primed with 1200 to 1400 mL of blood for each treatment. Renal registrar, now Auckland nephrologist, Dr Laurie Williams, recalled that by about 1976 the replacement fluid was mixed from just two bags of pre-weighed chemicals. He often had to operate the Kolff kidney to relieve the dialysis nurse to allow her to have a lunch break. Some patients with acute kidney failure were treated on the ward with peritoneal dialysis using fluid from glass bottles and a catheter placed blindly into the abdomen. The bottles were warmed in a water-bath. Williams noted that every patient developed peritonitis by the third day of treatment.

²⁰ Richmond DE, Miller TE and Murphy J. In the beginning. A history of the Medical Unit at Auckland Hospital and the formative years of the Department of Medicine, The University of Auckland. 2013 p.20.

²¹ Letter from Robin Irvine to Kelvin Lynn 7 June 1990.

²² These machines had been invented by Dutch nephrologist Willem Kolff during and after World War II.

²³ John Pybus, biochemist, was appointed as the first Scientific Officer to the Medical Unit in 1960. He developed early assays for cholesterol and calcium. Pybus provided the first reliable assay for aluminium in New Zealand that proved very useful in diagnosis and prevention of aluminium-induced dialysis dementia.

²⁴ Richmond DE, Miller TE and Murphy J. In the beginning, p.23



Travenol Twin Coil dialyser used with the Kolff artificial kidney.

Peter Doak was the first renal physician in Auckland to be trained specifically in dialysis and renal transplantation. With North's encouragement, he trained with Professors Stanley Peart and Roy Calne at St Mary's Hospital, London,



Peter Doak

from 1961 to 1964 and with John Merrill and Joseph Murray at the Peter Bent Brigham Hospital, Boston, until mid-1965.²⁵ In Boston, Doak was a clinical fellow in the Renal Service where dialysis was being undertaken using Kolff/Travenol Twin Coil artificial kidneys.²⁶ Doak returned to New Zealand in 1965 and was integral to the establishment of the maintenance dialysis and transplant programmes in Auckland. Colleague David Richmond wrote that '[Doak's] contribution to the development and running of the clinical, dialysis and transplant programmes in the Unit from 1965 can scarcely be overestimated.'²⁷

A dialysis patient who first met Doak in the mid-1960s wrote at the time of his retirement that he was 'A superman, a caring, devoted, dedicated knight working behind a shield of semi-detached gruff.'

In 1965 and 1966, while waiting for a transplant, four or five young patients started on twice-weekly haemodialysis using Kolff/Travenol Twin Coil artificial kidneys in a side room in Ward 18.

²⁵ John Merrill and Joseph Murray led the team that carried out the first successful kidney transplant in 1954 and Roy Calne pioneered the use of azathioprine as the first effective antirejection medication for kidney transplantation. Joseph Murray was awarded Nobel Prize in Medicine in 1990.

²⁶ McBride P. *Genesis of the Artificial Kidney*. Baxter Healthcare, 1979, pp.45–6.

²⁷ Richmond DE, Miller TE and Murphy J. *In the beginning*, p.28.



Iris McLeod (née Le Comte) on dialysis using the Multiple Artificial System (MAKS) – forearm shunt and Kiil dialyser. Auckland Hospital c1968

Following a visit by Derek North to Dr Belding Scribner in Seattle in 1965, a Dialysis Centre was set up in Ward 22C in the basement of the Infectious Diseases building at Auckland Hospital. A Multiple Artificial Kidney System (MAKS) from Bio/Systems Inc of Santa Monica, California was installed. A local effort to design and build a central dialysis supply system had failed, although during a later breakdown of the MAKS a subsequent attempt was successful. The MAKS became operational in 1967 and allowed maintenance dialysis to be carried out for six to eight patients at the one time.

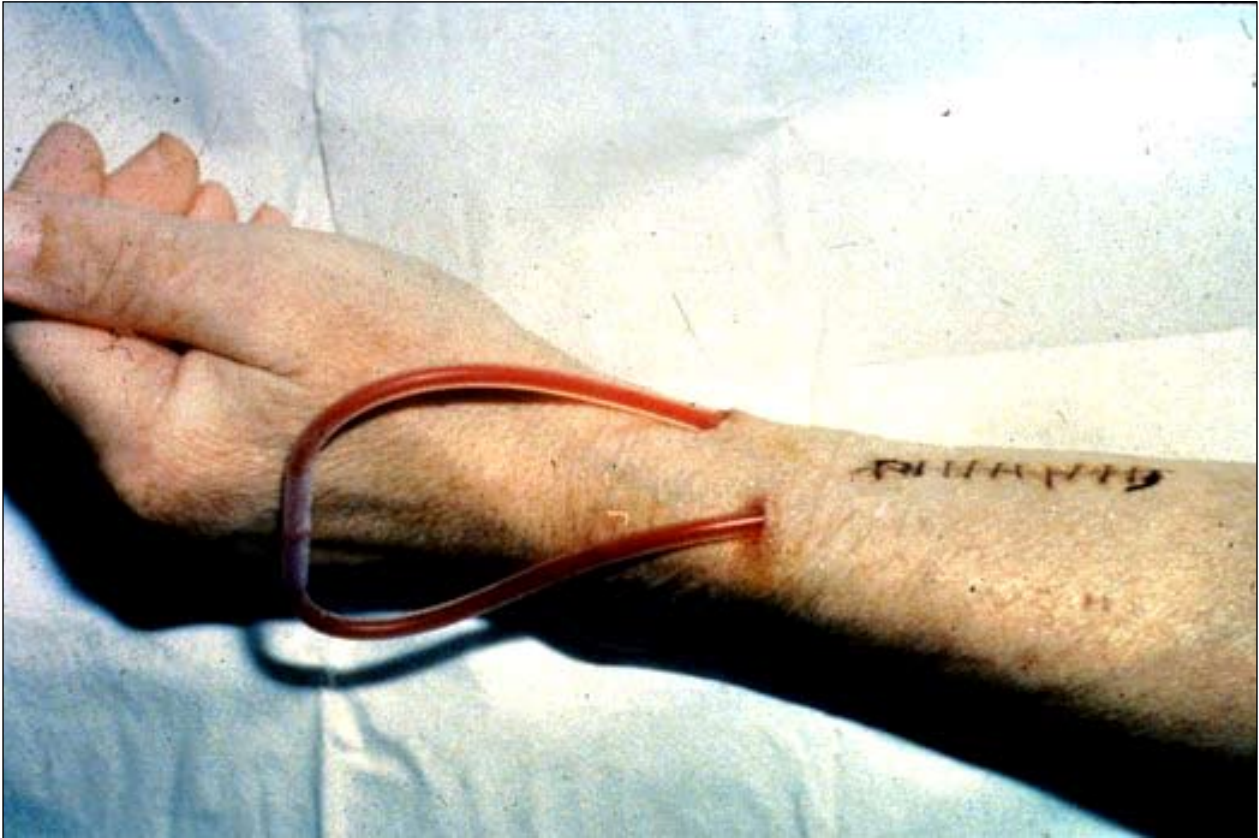
Dialysis was for four to five hours, two or three times a week, during the day/evening and up to ten hours twice a week overnight for those who were working. Kiil flat plate dialysers comprising layered plastic boards built in Norway and Cuprophan™ membranes were used. Grooves in the boards directed the blood between the layers of membrane — and the dialysate outside the membrane envelope — in opposite directions from one end of the boards to the other. A major advantage over the twin coil machines was a priming blood volume of less than 300 mL which could be provided from the patient's circulation. Excess fluid was removed by the use of negative pressure in the dialysate effluent line. The Kolff machine was still used for acute dialyses in the Critical Care department, and the MAKS (v.i.) was used for maintenance dialysis.²⁸

The AV shunt (often called a Scribner shunt), developed by Quinton and Scribner in Seattle enabled maintenance dialysis to become a reality. Doak recalled that 'The shunts that were used were new to New Zealand at the time and [were] an early form of a design that, over time, underwent a number of important improvements.'²⁹

Teflon tips were inserted into an artery and a nearby vein at the ankle or forearm so that blood could go out from the artery into a Silastic tube passed through the skin to the tubing leading to the coil, through the coil, and back into the patient via the vein. Once dialysis had been completed they were disconnected and the ends of the arterial and venous shunts were joined up again. However, in the early Auckland experience the shunts remained

²⁸ Kiil F. Development of parallel-flow artificial kidney. *Acta Chir Scand.* 1960; Suppl 253:142–150.

²⁹ Richmond DE, Miller TE and Murphy J. In the beginning. p.162.



Newly inserted radiocephalic arteriovenous shunt. Note the bridge join at the left.

patent (open) for only a few weeks, depending on the quality of the patient's arteries and veins. In the early days, there was no intention that the patients would be on long-term dialysis: all were awaiting a transplant. The AV shunt was superseded by the AV fistula developed by Brescia and Cimino in the USA.

Dr John Montgomerie oversaw the dialysis unit after his return to Auckland in 1966. From 1967, the Auckland Dialysis Unit was dialysing 20 patients up to thrice weekly in six beds using the MAKES machine. The MAKES delivered dialysis fluid to six stations in a long dark ward. Kiil dialysers were used. Two or three six-hour shifts were worked each day to treat 18 to 20 patients every week. Montgomerie returned to the USA in 1969 to a successful career as an infectious disease physician and the programme was taken over by Dr Elizabeth Bowie until her retirement in 1983. During that time Bowie guided the dialysis programme through many challenges. In 1963, one of the early Medical Unit registrars, Maurice Orpin, was appointed to a physician post at Whangarei Hospital where he supervised the first acute haemodialysis at that hospital.

The MAKES system together with Kiil dialysers and AV shunts had several advantages over the Kolff kidney. There was no need for a mechanical pump to circulate a patient's blood through the membranes. This was now being achieved by the patient's own blood pressure. Another advantage was that the blood flow through the shunt was lower than that when a pump was used to circulate blood and this was thought to reduce shunt deterioration. A drawback, not then fully considered, was that the blood flow was seldom measured and much under-dialysis probably went unrecognised. Another downside was the potential for serious incidents of infection when the dialysate became contaminated and everyone hooked up to the system at the time would be infected. In 1968 over a four months period 22 per cent of the dialysis treatments in the 18 patients in the dialysis unit were complicated by fever, rigors and low blood pressure. Bowie identified the problem as

being caused by residual, dead bacteria in the blood compartment of the dialyser that had not been removed by the usual saline wash. She described the investigation and ultimate solution in a paper in the *British Medical Journal*.³⁰



Dr Elizabeth Bowie with Sister Melville in the first Auckland Hospital Dialysis Unit

Wellington Renal Unit

The Wellington Renal Unit was established in 1964, headed by Cable with Dr Jack McCreanor as assistant. Dr Bruce Morrison, however, was the first appointed full-time renal physician in Wellington and became Head of Department in 1966. At this time, bewildered colleagues and confused hospital boards had doubts about the new concept of renal medicine and Morrison was a key player in the acceptance of the discipline. While studying at the Otago Medical School in the 1950s he excelled in both academic and sporting fields. In fact, he used his willowy build and height to such advantage that a fellow student and later All Black, Hugh Burry, persuaded Bruce that his future really lay in locking the university scrum. But after winning the Ardagh Memorial Prize for the top sixth-year student in Christchurch, where he completed his house surgeon and registrar years, he returned to Dunedin in 1959 to study hypertension with Sir Horace Smirk and Dr Garth McQueen. There he saw patients dying of kidney failure, especially young women with obstetric complications. It was when he attended a meeting of the Royal Australasian College of Physicians (RACP) in Dunedin in 1959 and saw Cable unravelling 32 feet of fibreglass supported dialysis membrane on the floor of the lecture theatre like a rhythmic dancer, that he was introduced to dialysis.

1960 Morrison won the RACP Travelling Scholarship in Medicine to study in London, first at University College Hospital and then in 1961 at the Postgraduate Medical School, Hammersmith. He worked with Dr Oliver Wrong and Dr Malcolm Milne who were at that time two of a very small band of kidney enthusiasts struggling to create renal medicine as a specialty. Haemodialysis meant two nurses and two doctors being shut in a room for seven to eight hours with a very sick patient. It was a hazardous procedure, as catastrophic

³⁰ Bowie EA. Pyrexia in dialysis. *BMJ* 1971, April 3;2(5752) 44-5.

blood loss from ruptured dialysis membranes was a common event. In 1962 Morrison was able to develop his lifelong interest in renal physiology when he went to work with Dr Bud Relman in Boston, where they had pioneered renal transplantation in 1954. It was an exciting place for a young renal physician.



Bruce Morrison, Peter Hatfield and Alastair Macdonald 1975

John Morton recalls working with Morrison in the early 1960s:

When a patient was admitted from Nelson with acute kidney failure complicating a crush injury (between railway carriages) I met Dr Bruce Morrison, the recently appointed nephrologist, and the Kolff twin coil kidney machine that he introduced to Wellington. Alan (Joe) Pullar, the resident surgeon was asked to provide access to the patient's circulation for dialysis and I was his assistant. Access devices siphon blood from the patient to the machine for waste removal (dialysis) and then return blood to the patient. We inserted a tube (the arterial cannula) into an artery in the thigh (the superficial femoral artery) to withdraw blood, and another tube (the venous catheter) into a thigh vein (the saphenous vein), for its return to the circulation after passage through the kidney machine. Two dialyses over two days were accomplished before the coil of the kidney clotted irretrievably and access to the circulation was lost. When we were cannulating the other leg, I remarked to Joe that since we only have two legs, dialysis by this route did not promise durability, but after one more dialysis,

voluminous urine production (diuresis) started and the patient made a complete recovery from his kidney failure, although I never saw him again to know whether he experienced the pain in the calf on walking that can happen when a significant blood supply to the leg is interrupted. My interest in circulatory access developed from this small beginning into a lasting commitment.

In 1968 part of Ward 22 in the Seddon Block at Wellington Hospital was set up for chronic dialysis with three Kolff/Travenol machines using disposable coil dialysers. Sister Wendy Couchman, the first charge nurse in the renal ward, also supervised the new hospital dialysis unit. There were no renal technicians so the machines were serviced by Don McCallum, the cardiothoracic technician who had an office and workshop nearby. At first AV shunts were used for access until Mr Clive Stevenson from the Department of Vascular Surgery began creating AV fistulae in 1971.

Waikato Renal Unit

The 1953 appointment of John Meade as Medical Superintendent of Waikato Hospital proved important in the eventual development of the Hamilton renal unit in 1968. Meade had been a medical officer on a hospital ship during the war and spent some time subsequently in the Department of Health. In 1956, the Department while approving the appointment of an assistant surgeon with thoracic surgery experience, warned: 'Such approval was not to be construed as support to start a thoracic surgery unit.' In 1960, a suggestion by John Meade that Waikato Hospital be made a branch faculty of the Otago University Medical School was roundly rejected by the then Dean. In his annual report to the Hospital Board in 1961 Meade wrote: 'NZ units should be designed not as blocks containing a certain number of beds, but as a series of units with a precise definition of the function that each is to fit.' Again, in 1964 he wrote: 'We treat more and more patients each succeeding year with techniques becoming increasingly complex and time consuming, with the same number of medical officers.' Yet again, in 1967: 'If a hospital board's budget is based on expenditure in past years, then obviously there can be no provision whatsoever for any hospital services in rapidly developing parts of the country, nor is there any provision for shifting populations.'

Meade carried out a series of staff appointments resulting in the formation of specialist units, without Department of Health involvement. These included the appointment of Jim Gray as urologist in 1966 and renal physician Martin Wallace in 1968. There was no initial special Department of Health funding and costs were met from the general hospital expenses. The specialist appointee was expected to have additional general responsibilities in medicine or surgery, at least initially. Perhaps listing the appointee as a generalist would disguise the nature of the changes. This might have led to the initial omission of the Waikato Renal Unit from the 1979 meeting to set up the National Technical Standing Committee on Dialysis and Transplantation (see page 82).

Gray started maintenance haemodialysis at Waikato Hospital in late in 1966. He trained as a urology registrar at Leeds and saw haemodialysers being used in the management of acute kidney failure. In 1966, he was at a conference in Canberra where he saw the application of haemodialysis for the management of ESKD. He obtained a mini-coil dialyser but found that he faced difficulties with blood flow. He persuaded the hospital to purchase a Kolff dialysis machine and was able to accept patients in late 1966 for maintenance haemodialysis.

Dr Anna Holmes, part-time medical registrar, was appointed to run dialysis sessions between 1967 and 1968, working for three days a week. In February 1968 Wallace was

appointed as both a general and renal physician. He introduced peritoneal dialysis for the treatment of acute kidney failure, as was usual at the Hammersmith Hospital where he had trained. Also, in 1968, Geoff Allen, cardiovascular surgeon, made Wallace aware of the development of the AV fistula and fashioned the first AV fistula for haemodialysis in New Zealand.³¹ In 1971, patients began to use AV fistulae rather than AV shunts for maintenance haemodialysis in Christchurch and Wellington and by the late 70s few patients were using shunts.

Jenny Robinson was a full-time haemodialysis nurse, and her ability and rapid learning made a major contribution to establishing the programme. John Stewart from Sydney visited the hospital and wrote that Waikato Hospital had ‘a renal unit whose standard of clinical care and clinical research, would command respect in any part of the world.’



Radiocephalic AV fistula. Small scabs show the needle cannulation sites

Before the establishment of a renal unit at Christchurch Hospital, Dr Errol Hannah, a general physician and cardiologist, had “provided medical opinion and advice on patients with renal disease” between 1961 and 1967.³² Urologists Mr Norman Greenslade and Mr William (Bill) Utley usually made referrals regarding their patients in Ward 11 at Christchurch Hospital. In addition, Hannah gave an annual course of lectures on renal medicine to the medical registrars.

Between 1961 and 1963, Hannah was visiting physician to Burwood Hospital, Christchurch. During that time, a woman with kidney failure and anaemia was admitted to the acute medical ward and Hannah attempted peritoneal dialysis using improvised equipment ‘in an attempt to buy time to investigate the cause of the renal failure.’ There were technical difficulties and the patient died soon after admission.

³¹ Wallace MR, Allen G. Arteriovenous fistulae for maintenance haemodialysis. N Z Med J. 1969; 70:165-68.

³² Personal communication, EE Hannah

Christchurch Renal Unit

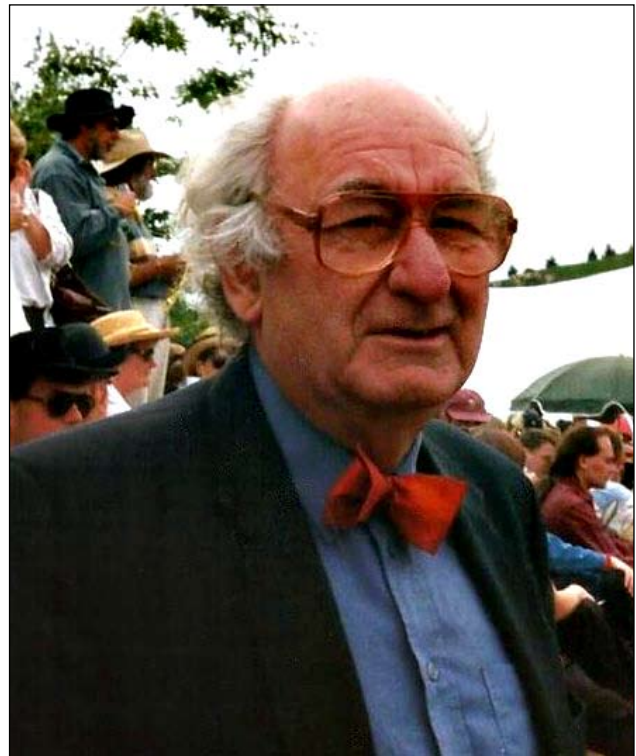
In 1966, Dr Peter Little was appointed as Canterbury's first nephrologist and was to set up a renal unit at Christchurch Hospital. Little recalled that his becoming a nephrologist was a "magnificent coincidence". In 1960 he had been working as a locum medical registrar for Professor Hugh de Wardener, a pioneer of nephrology, at the Fulham Hospital in London. Little decided to become a nephrologist at a time when the subspecialty was just emerging following the establishment of the feasibility of maintenance dialysis. During these early days of dialysis in the United Kingdom, Little was involved with the care of people with ESKD receiving dialysis using the Kiil dialyser and became proficient in percutaneous kidney biopsy.

Early on, Little, like North and others, visited Seattle to see Dr Belding Scribner's haemodialysis programme for long-term treatment for people with ESKD. Little recognised that the hospital service would never have the resources to meet the demands for dialysis treatment. He decided that he would offer only home dialysis and return patients to the care of their general practitioner and he persuaded the North Canterbury Hospital Board (NCHB) to fund this new programme.

In 1967, before his visit to Seattle, Little sent a report to the NCHB on the treatment of ESKD. He commented that:

The necessity for this programme is evident because 20–25 young people die each year among the population cared for by this hospital. Almost all these people can be restored to good health. ... The establishment of facilities for home haemodialysis (HHD) of patients suffering from renal failure who are unsuitable for transplantation can be considered at a later date. ... Treatment of patients above the age of 55 is complicated by the high incidence of vascular abnormalities in this group. It is generally assumed that the presence of a generalised disease such as diabetes ... makes a patient unsuitable for treatment.³³

It was clear that initial plans were to provide dialysis for those who could receive a kidney transplant in the near future. It was assumed in 1967 that each year there would be about 20 patients aged between 15 and 50 years, and one or two children, with ESKD who would benefit from treatment. In this report Little estimated the cost of equipment would be \$36,000 for a centre dialysis unit based on a Multiple Artificial Kidney System/300 central system (MAKS) and nine Model 32-220 Kiil-Western dialysers. This would allow for six dialysis stations with a capacity to treat 18 patients. The cost of consumables per dialysis was estimated at \$14 or \$27,000 annually for 18 patients (dialysing twice weekly).³⁴



Dr Peter Little

³³ Little PJ. A report outlining the requirements for the treatment of renal failure in Canterbury, 1967.

³⁴ Ibid.

Dunedin Renal Unit

In the early 1960s, Professor Garth McQueen was the first to treat Dunedin patients with acute kidney failure. Steve Dixon recalled that McQueen undertook early acute haemodialysis for patients with kidney failure caused by drug overdoses or poisonings. At that time, McQueen was working as a senior lecturer in clinical pharmacology and was not involved with the later establishment of maintenance dialysis in Dunedin. He was appointed as Professor of Pharmacology in 1971.

Robin Irvine moved from Auckland to the Otago Medical School as a lecturer in 1963 and took over clinical responsibilities for kidney patients.

The Minister of Health approved the establishment of a renal dialysis unit in Dunedin in May 1968. Steve Dixon was Irvine's registrar and Nephrology Research Fellow in 1968-69 and remembers occasionally doing intermittent peritoneal dialysis and haemodialysis using a Kolff kidney. Steve remembers a story from one of the assistants that they had forgotten to add salt to the bath brew on one occasion and caused haemolysis (breakdown of red blood cells) to occur. Maree McDonald, later Charge Nurse, recalls the treatment of acute and chronic kidney failure with dialysis she saw as a student nurse at Dunedin Hospital in the mid-1960s.



Professor Sir Robin Irvine

Meeting the demand 1971-80

Once maintenance dialysis had been established, Doak and others realised that there was a challenge in determining how many patients with ESKD could be accepted for treatment. The first patients treated with dialysis were individuals who were going on to have a transplant. There were not enough kidney donors and many patients were dying from ESKD. Local and international experience confirmed that individuals in the 15 to 45 years age group were doing quite well on dialysis and Doak considered it right to try to acquire the resources to deal with a much wider age group. Surgeons and physicians in regional centres without renal units provided an important role in supporting similar expansion of ESKD treatment programmes throughout New Zealand. (See Appendix C). Services for renal transplantation and HHD were developed in the 1970s to cope with an increasing demand for treatment as centre dialysis facilities inevitably became overloaded. The introduction of CAPD in the late 1970s alleviated the problem somewhat but a scarcity of donor organs meant, that for most patients, dialysis was the only available treatment option. Matching needs to resources continues to be a challenge.

The Report of the Committee on Renal Dialysis and Transplantation to the Hospitals Advisory Committee (The West Report) in 1977 provides a good summary of the situation for ESKD treatment services in New Zealand in the 1970s. (See p.82).

Kidney Transplantation: the Auckland experience

The early nephrologists and hospital administrators saw dialysis as a bridging treatment while patients waited for a transplant. Dialysis services for ESKD would not have been possible without kidney transplants being available in New Zealand. As is the case now, in the early days a successful transplant offered a much superior survival and quality of life. North was again critical to renal transplantation getting started in New Zealand. In 1962, Professor Stan Peart from St Mary's Hospital in London was a visiting professor in the Medical Unit at Auckland Hospital. St Mary's Hospital had been doing kidney transplants for a couple of years under the leadership of Professor Roy Calne.³⁵



Auckland Hospital 1961 :Back row (L-R) Ken Melvin, John Montgomerie, Derek North, Robin Irvine, Doug Wilson; Front row (L-R) Prof Stanley Peart, Shirley Cooper

North arranged for Peter Doak to train in clinical transplantation in London and Boston and recruited general surgeon Campbell Maclaurin and urologist Athol Duke to the Auckland team.³⁶ In June 1965 these two surgeons carried out the first kidney transplant in New Zealand with the donor and recipient being identical twins.³⁷ Doak reported that 'the operation was a complete success'. All transplant surgery took place in Auckland until units in Wellington (1969), Christchurch (1972) and Waikato (1974) started their own programmes. A deceased donor (then called cadaver donor) transplant programme was started in 1966. North encouraged the Auckland Blood Transfusion Service to set up a tissue typing service funded by a grant from the Auckland Savings Bank.³⁸

³⁵ Calne was to become famous for pioneering the use of the two most important anti-rejection drug – azathioprine and cyclosporin.

³⁶ Duke sadly died in his early 40s from hepatitis likely caught from a patient during surgery.

³⁷ Maclaurin CH, Duke AJ, Richmond DE, Macky WJ and North JDK. Renal transplantation in identical twins. *NZ Med J* 1966; 65: 152-58.

³⁸ Richmond DE, Miller TE and Murphy J. In the beginning, p.33.

Wellington Hospital doctor, Ray Fong, was the first medical person in New Zealand to become interested in tissue typing. In 1970 he spent time in Aarhus, Denmark, studying immunohaematology with Professor Kissmeyer-Nielsen, a pioneer of tissue typing. Transplant technology to date had been limited by the availability of donor organs – how could brain death be determined? In 1968, New Zealand adopted the Harvard Medical School Committee's definition of brain death.

The criteria for acceptance on the Auckland transplant programme were restrictive by today's standards. The recipients were to be aged 15-45 years, have no other serious health problems and absolutely no diabetes. In the first two years of the transplant programme 35 patients received 44 transplants; only four from living donors.³⁹ All out of town patients, often with their families, would have to move to Auckland, to have haemodialysis at Auckland Hospital while they waited, often months, for a donor kidney. Betty Aldridge's story is typical. Betty, who lived in Ashburton, began dialysis treatment aged 26 years on 22 July 1968 at Christchurch Hospital and soon after moved to Auckland with her husband Jim where she received her transplant on 10 May 1969. Jim worked as a gardener in The Auckland Domain during their stay. Their two children stayed in Ashburton and were cared for by Betty's parents. Betty and Jim made lifelong friendships with other kidney patients and their families. For almost 34 of Betty's 61 years of life this transplant functioned with hardly a hiccup.



Patients' hostel, 20 View Road, Auckland c1968

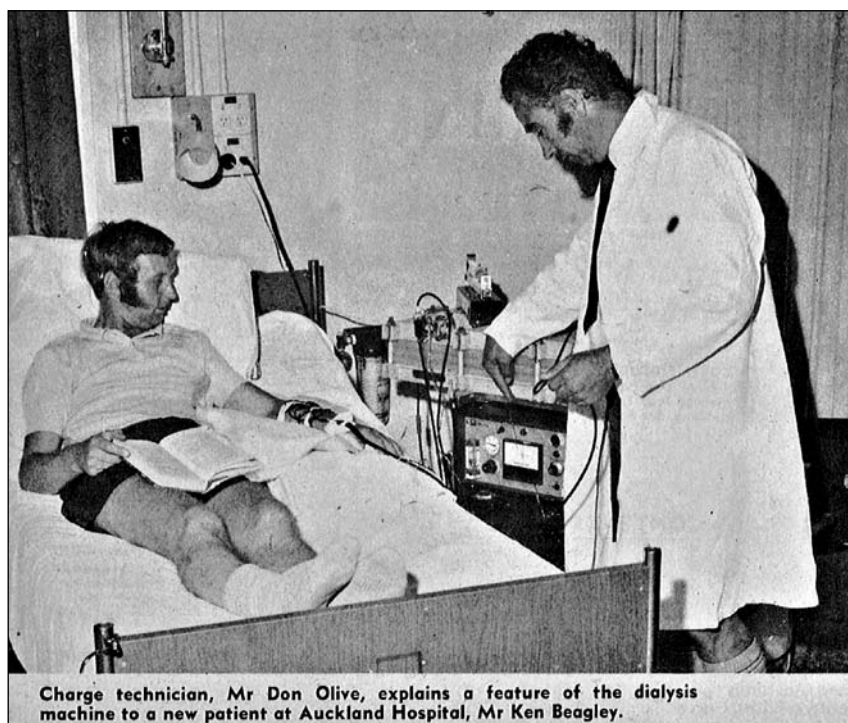
The MAKES was used during this period, latterly with a variety of plate and hollow fibre kidneys, before a move was made towards individual dialysis machines and hollow fibre artificial kidneys. This type of dialysis had the marked advantage of isolating patients from contact with one another during dialysis and thus reducing the chances of cross-infection. The newer dialysers developed blood leaks far less often. Nevertheless, technicians expected to assemble several extra Kiil dialysers for a shift as more than one would fail the pressure test before use. These dialysers had greater biochemical efficiency and by permitting negative pressure in their rigid casings they made fluid removal from the patient much easier.

In the early 1970s the unit at Auckland Hospital was struggling to cope with the number

³⁹ Doak PB, Duke AJ, Maclaurin CH, Montgomerie JZ, North JD. Two years' experience with renal transplantation. NZ Med J 1968; 68: 221-27.

of people requiring maintenance dialysis while waiting for a deceased donor transplant. An article in the *New Zealand Women's Weekly* on 14 May 1973 reported that: 'About 70 people in New Zealand suffering from kidney disease are hoping for a renewal of normal life with a donated kidney'. (see picture below)

Don Olive had gone to Christchurch to train in HHD in the early 1970s and the photo is



Charge technician, Mr Don Olive, explains a feature of the dialysis machine to a new patient at Auckland Hospital, Mr Ken Beagley.

clearly very early in the history of Auckland home dialysis. The machine in the picture is a Drake Willock 4011.

An article in the *New Zealand Herald* on 31 December 1974 reports the concerns of the medical staff about the precarious nature of the unit's staffing. In the article Professor North said: 'The continuous clinical demands of the dialysis unit are such that a major crisis could develop if either Dr Doak or Dr Bowie resigned or fell ill for any length of time.' This problem was not easily resolved and on 10 December 1979 the Herald reported that patients on dialysis in the hospital centre had had their treatment reduced from three times to twice a week because of inadequate funding for the service.

The early kidney transplant programme in Wellington

Mr Don Urquhart-Hay (right) and Mr John McIlwaine carried out the first deceased donor kidney transplant in Wellington in April 1969. Willie, a 36-year-old power station worker was the recipient and featured on the front page of The Evening Post newspaper together with a nursing graduation photograph of the donor. Urquhart-Hay studied at the London Institute of Urology but was also involved in transplant rejection research on greyhounds at Hammersmith Hospital.

When he returned to Wellington in 1966 there were no dogs available for him to carry on this research, so he chose instead to use sheep at the Agricultural Research Station at Wallaceville. Every Saturday morning, he



would travel out to Wallaceville and practise his vascular surgery on sheep by doing a bilateral nephrectomy and then an auto transplant to the pelvic vessels. One morning Urquhart-Hay asked the farm manager how the sheep from last week was faring. 'She's just grazing over there', replied the manager. Thereupon the said sheep fell over dead. At the post mortem researchers found that the auto transplanted kidney was completely infarcted and hadn't functioned for a week. New Zealand sheep are obviously programmed to eat until the moment of death.

Christchurch's first kidney transplants

Mr William (Bill) Utley, urologist and member of the Hospital Board, carried out the first kidney transplant in the Christchurch unit in 1972. He had learnt the transplant operation by practising on animals. Peter Little was in the operating theatre for the first transplant and perfused the donated kidney before transplantation. This was the first and only time that he attended a transplant operation.

Ross Bailey was Little's first renal registrar and also trained with Hugh de Wardener at Charing Cross Hospital in London before working with Adam Linton in London, Ontario, where he gained experience in kidney transplantation. Ross Bailey returned to Christchurch in 1972 and became responsible for post-surgery care of transplant recipients.



Dr Ross Bailey

The transplant team was completed in 1974 with the appointment of Professor John Morton, who had trained in transplant surgery in Edinburgh. Morton also assumed responsibility for the provision of dialysis vascular access. Three of his students subsequently became transplant surgeons and Professors of Surgery – Adrian Hibberd (Newcastle, Australia), Justin Roake (Christchurch) and Stephen Munn (Auckland). The transplant programme proved very successful with the second and third patients living for nearly 40 years with functioning transplants.

The Waikato Unit cares for transplant patients

In 1970, the Waikato unit began to provide ongoing care for patients who had received transplants elsewhere. In 1974, David Mee carried out the first renal transplant in Hamilton. Waikato Hospital continued to provide a full renal transplant service until 2001 when Auckland City Hospital took over renal transplantation operative services for the Midland region. Between 1974 and 2000, 231 renal transplants were carried out at Waikato Hospital.

The Dunedin and Christchurch's Renal Units co-operate

For a short time, the Dunedin unit also did deceased donor transplants but the volume was small and after agreement between the two South Island units all kidney transplants were done in Christchurch with patients returning to Dunedin after they had recovered from surgery, usually within two weeks. This was an early precedent for regional co-operation between services, initiated by Dunedin surgeon Mr Stephen Packer, who had already undertaken kidney transplants in Christchurch. He clearly recognised the need for ongoing experience with adequate numbers to maintain expertise and hence the focus on a single centre for the South Island. This has been continued successfully to the present, with a co-operative South Island-based renal replacement service that also continues to function well.

Developments in Wellington

Dr Peter Hatfield, who had been Morrison's registrar, returned in 1974 from Guy's Hospital where he had been working with Dr Stewart Cameron and Dr Chisholm Ogg. Cameron came as a visiting lecturer to New Zealand in 1977 and Ogg worked in Wellington in 1979 when he and Hatfield swapped jobs for eight months. With the establishment of the Wellington School of Medicine in 1976, Dr Joe McEvoy became the first academic appointment to the renal department. McEvoy came from Belfast where his experience in treating acute kidney failure at that time was second to none. He resigned in 1978 and was succeeded by Dr Alastair Macdonald, who since 1976 had been working in the unit as a senior registrar.

Mr Peter Meech, a Wellington-trained surgeon, had been asked by Wellington Hospital in 1978 to spend a year working in the Princess Alexandra Hospital in Brisbane with Mr Gordon Clunie and Dr Jim Petrie. His return was eagerly awaited in 1979 for he was trained to do all the transplant surgery (including paediatric transplants), create AV fistulae and insert Tenckhoff PD catheters. In the meanwhile, Mr John Nacey from the urology department had begun inserting Tenckhoff catheters in 1978. Some acute kidney failure in the 1960s and 1970s had been treated by intermittent PD using straight catheters but with the advent of the Tenckhoff catheter, CAPD became possible.

CAPD was first used to treat ESKD in Wellington in 1978. Ailsa Jacobson and Kathy Faircloth were the first renal nurses and in 1980 they set up CAPD home training, firstly in Ward 22 and then at 38 Owen St. Like HHD training, this was also under the supervision of Community Health. In the first three years, 76 patients were accepted for CAPD of whom 68 completed their training and returned home. Peritonitis was the most common complication with a mean frequency then of one episode per 6.8 patient months (compared with a later incidence in 2012 of one episode per 26.8 patient months).

From its inception in 1964, the Wellington unit provided a supra-regional service for the central area of New Zealand extending from New Plymouth and Wairoa in the north to Nelson and Marlborough in the south. By 1976, nearly one million people lived in this area, including a large Polynesian population. One third of patients were Polynesian, in whom renal disease had three times the incidence of the Caucasian population. With the help

of local physicians and senior nursing staff the unit set up clinics throughout the regions: Hawke's Bay, Palmerston North, Wanganui, Lower Hutt, Keneperu, Blenheim, and Nelson. This meant a large amount of travelling time for both staff and patients. Nursing staff visited all home dialysis patients regularly.

A home dialysis patient in outback Taranaki, 40 km from the nearest town had an appointment to be seen by a visiting English physician. She and her parents had to leave their farm very early in the morning for their midday appointment in Wellington. Five kilometres from the family farm they were stopped in the dark by a large landslip completely blocking the only road. Dad drove back to get his front-end-loader, Mother went to the nearby neighbour's farm for help. Soon there was a front-end-loader working either side of the slip clearing the way to Wellington. They arrived a whole hour late for their appointment. Country people on home dialysis need to and can cope with nearly everything. Mary, a farmer's wife in the Wairarapa, lost a lot of blood coming off haemodialysis early one morning. As her husband was already working out the back of the farm a neighbour drove her to the station to catch the railcar to Wellington. By the time she arrived in Masterton she was feeling very weak, so the railway staff rushed her to Wairarapa Hospital. After a blood transfusion she continued her journey by train to Wellington.

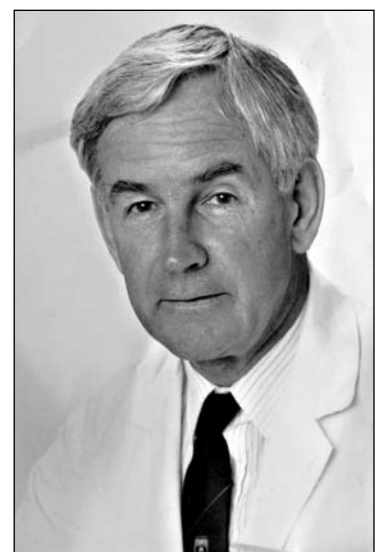
Before the advent of automatic telephone exchanges and mobile phones, manual telephone exchanges performed a role that the newer ones could not match. Barry had a busy working and social life while on HHD in Taihape. The on-call renal unit staff were distressed one evening when they couldn't find him to tell him to come to Wellington for a transplant. 'Don't worry,' said the operator on duty at the Taihape manual exchange, 'We'll find him.' And they did. It was always a great joy to telephone a patient and tell them there was a kidney match for him or her. This had to be followed by the injunction to drive down carefully but better still 'find someone else to drive you down.' In spite of this advice Neville was stopped driving down from Hastings by the police in Levin for speeding at 110 kph. When the police heard the reason for his haste they drove him the rest of the way to Wellington in a police car with flashing lights and screaming siren at 160 kph.

Developments in Christchurch

Professor W (Bill) Macbeth, the Foundation Professor of Surgery at the new Christchurch Clinical School of Medicine, gave Little support for the development of renal services. Little managed to get a one-tenth appointment for Mr Alan Chirside to insert and carry out the then necessary frequent revisions of the AV shunts that were used in the early days of dialysis.

In 1971 Alan Chirside (right) created the first subcutaneous AV fistula in Christchurch in a 26-year-old woman from Southland. Nevertheless, in the 1970s there were still patients whose ESKD was treated initially with intermittent peritoneal dialysis while they were waiting for the establishment of permanent vascular access.

Together with urology colleagues Greenslade, Utley and Colin McRae, Little established the only combined urology/nephrology ward in New Zealand. This arrangement benefited both dialysis and transplant patients and the staff working at Christchurch Hospital over many years. Little and colleagues created an environment where staff felt supported and encouraged and patients and their families would be heard and the best possible done for their health care.





Peter Little, daughters Harriet and Pennie and Sister Marie Price serving Christmas dinner in Ward XI, Christchurch Hospital 1973

Most acute kidney failure was treated with peritoneal dialysis in the early days. Providing vascular or peritoneal access for treatment of both acute and chronic renal failure was problematic, with the only options being intermittent peritoneal dialysis using a straight, inflexible catheter or the placement of an AV shunt, usually in the ankle. The advent of temporary vascular catheters in the 1970s resulted in most patients with acute kidney failure being treated with haemodialysis.

The first live donor transplantation was carried out in December 1974,⁴⁰ while the first live donor transplant from a non-directed or altruistic donor in Australia and New Zealand was done in 1998.⁴¹ By mid-2016, a total of 835 transplants – 518 from deceased donors and 317 from living donors – had been carried out by the Christchurch renal unit.

From the early 1970s, the Christchurch Unit was providing nephrology services for the whole of the South Island apart from Nelson/Marlborough. Little and Bailey ran regular clinics in Timaru, Ashburton and Greymouth. With both being harness racing fans, the team often arranged the clinics to coincide with a local race meeting. Kelvin Lynn remembers as a registrar that these trips were educational not only in a professional sense. What modern clinics start with lunch at the local hotel and end with the collection of frozen whitebait from a grateful patient?

Patients living in Otago and Southland travelled to Christchurch for clinics and hospital care before the establishment of the Dunedin Unit in 1974. The success of this regional service was due in no small way to the excellent support provided by local physicians and nurses in the regions.

Inevitably, patients with more complex clinical problems started to be treated and the case-mix of dialysis patients changed. In October 1973, the first patient with diabetes

⁴⁰ Mantha M, Morton JB, Bailey RR, Robson RA, and Lynn KL. Living related transplantation: the Christchurch experience. *N Z Med J.* 1996; 109:417-19.

⁴¹ Tong A, Craig JC, Wong G, Morton J, Armstrong S, Schollum J, Cross N "It was just an unconditional gift." Self reflections of non-directed living kidney donors. *Clin Transplant* 2012; 26:589-99.



100th renal transplant at Christchurch Hospital 1980
Professor John Morton (surgeon) Antony Hearn (recipient), Marie Wilde née Price,
(Charge Nurse) and Ross Bailey

was trained for HHD. He was a 35-year-old blind man, Dougal McPhee. He was trained with the aid of his wife and with suitably modified equipment. His Kiil dialyser was keyed to ensure that it could only be assembled correctly and a Drake-Willock machine was modified with tactile buttons to enable him to identify and correct alarm conditions. His wife was trained to cannulate his AV fistula. He remained on HHD until receiving a deceased donor kidney transplant in 1984. This was still functioning at the time of his death in March 1997.

As older patients were accepted for dialysis treatment the challenges of establishing and supporting them at home became more pressing. From 1973 the unit provided a select

number of patients with assistance in the home for their dialysis – either total management of the treatment by a nurse or the assistance of a paid helper. This programme, now outsourced to the Nurse Maude District Nursing Association, continues to this day.

The evolution of CAPD led to its introduction in Christchurch in July 1979. Within ten years it accounted for half of all home dialysis and enabled the home-based treatment of patients thought to be unsuited for HHD, including the elderly and those with significant co-morbidities.

Of note, the first stand-alone haemofiltration treatments in Australasia were carried out in 1979 and 1980 using locally developed equipment. Although successful, it was thought neither suitable nor technically feasible for home treatment.

Peter Little was the first New Zealander to be elected President of the Australasian Society of Nephrology (now the Australian and New Zealand Society of Nephrology). Little left Christchurch in 1979 to establish and head a renal unit in Saudi Arabia and subsequently worked in Baghdad, where he developed a large, successful living donor kidney transplant programme. Ross Bailey succeeded him as head of department. Although Bailey's main interests were urinary tract infection and clinical transplantation, he was a strong supporter of the home dialysis programme in Christchurch.

The Waikato Unit introduces innovations

In 1976, Bernard Hyne was appointed as a second renal physician at Waikato Hospital and was responsible for setting up HHD training at a time when 42 patients had started hospital dialysis.

In 1978, following a visit by Wallace to Vancouver, the Waikato Unit started the first New Zealand patient on CAPD. The success of this treatment modality at the Waikato Unit depended on the dedication of the nursing staff involved in training the patients, especially at the outset. Their flexibility allowed them to make the most of the many technical changes which occurred over the subsequent 35 years. These included the change from glass bottles to plastic bags, disconnect systems, swan-neck catheters, pre-sternal catheter placement (of importance with obese patients), "flush before fill", changes in fluid solutes (such as the use of icodextrin) and the use of automatic cyclers.

The Dunedin Unit gets approval from the Minister of Health

The Minister of Health approved the establishment of a renal dialysis unit in Dunedin in May 1968. Maintenance haemodialysis started on 9 July 1970, when the unit opened. Situated in the ground floor of the old Dunedin Hospital the unit remains the only purpose-built dialysis unit in the city. It was a five-bed station, one being in an isolation room. It also had a kitchen, lounge, staff changing room, store room, treatment room, technician's room and a room to build and sterilise the plate dialysers. For the first dialysis, the unit's staff comprised the physician responsible for renal services Dr Winston McKean, staff nurse Deborah Bell, technicians Ray Parker (previously a hospital technician) and Christine Walker, who was a Christchurch technician in Dunedin to assist.

From late 1971, Margaret Donaldson took over from Bell as the staff nurse in the unit. Initially staff used Kiil dialysers and Drake Willock proportionating machines for dialysing patients. The dialysis schedule at that time was for ten hours, three times weekly. This meant that Bell and Parker worked ten to 12 hours on Mondays, Wednesdays and Fridays and spent the other weekdays maintaining the equipment. Dialysis staff treated patients requiring intermittent peritoneal dialysis in the Intensive Care Unit (ICU) of the hospital.

On Steve Dixon's return to Dunedin from training at the Royal Children's Hospital in Melbourne in 1971, he was the renal physician until 1974. During the early 1970s, surgeon

Mr John Black, placed AV shunts and developed AV fistulae. Dr Tony Hocken, a British-trained nephrologist, was appointed in 1974. At this time the Dunedin unit had 'five beds staffed by two registered nurses, three registered community nurses and two technicians'.⁴² HHD training for the South Island was being provided by the unit in Christchurch.

In June 1974, the Hospitals Advisory Council asked Doak and Dr John Boyd, Assistant Director of Hospital Division, Department of Health, to look at whether the Dunedin Unit should take over home dialysis training for the "South Island south of the Waitaki River".⁴³ The report, known as the Doak Boyd Report, commented:

The appointment of a Nephrologist (Dr A.G. Hocken) to the Dunedin renal dialysis unit is an established fact and the unit is providing renal dialysis facilities at present including a hospital-based regular dialysis programme for patients with chronic renal failure.⁴⁴

After interviewing clinical staff and management in Christchurch and Dunedin, Boyd and Doak recommended that a home dialysis training unit be set up in Dunedin. Once established, this unit provided dialysis training for a highly selected patient population based in Otago. There was little or no provision of renal replacement therapy for Southland. Only the occasional person was referred to Christchurch for consideration of dialysis.

The Middlemore Unit shares renal care in Auckland

Opened in 1947, Middlemore Hospital became part of the Auckland Hospital Board (AHB) group of hospitals principally to service the then sparse but increasing population of South Auckland. Ian Simpson, who held a whole-time nephrologist post at the Auckland Hospital Renal Unit that serviced North Shore and Middlemore Hospitals as well, was appointed as a senior lecturer in medicine at Middlemore in 1978. He was the first academic physician at the Middlemore Hospital Academic Unit. In this position he provided half-time clinical service to the then Auckland Hospital Board (AHB) in general medicine and provided a nephrology referral service to Middlemore Hospital. Simpson's move released other renal physicians in Auckland Hospital from responsibility for Middlemore Hospital. Ward referrals, outpatient services for renal patients and renal biopsy and other diagnostic procedures were thereafter provided at Middlemore. Acute kidney injury requiring haemodialysis and ESKD were still managed at Auckland Hospital, although physicians performed an occasional acute peritoneal dialysis using a stab catheter at Middlemore Hospital.

Renal services at Whangarei Hospital

In 1978, general physician Dr Maurice Orpin established the renal service at Whangarei Hospital. He was the senior clinician. The lead dialysis nurse was a midwife who had had extensive haemodialysis experience in South Africa. The first patients treated by dialysis at Whangarei Hospital had acute kidney failure and included some with multiple trauma from road accidents. Ellen (Mo) Atkinson (née White), who had had experience of dialysis at Wellington Hospital in 1972, was working at Whangarei Hospital in 1978 when a road accident victim required urgent bilateral lower limb amputations and urgent treatment for acute kidney failure. He was treated with both HD and PD before he could be transferred to Auckland. The patient was still alive in 2013. Atkinson still today works at Whangarei Hospital as a clinical nurse specialist.

⁴² Report of Drs Doak and Boyd to the Hospitals Advisory Committee June 1974.

⁴³ Ibid.

⁴⁴ Ibid.

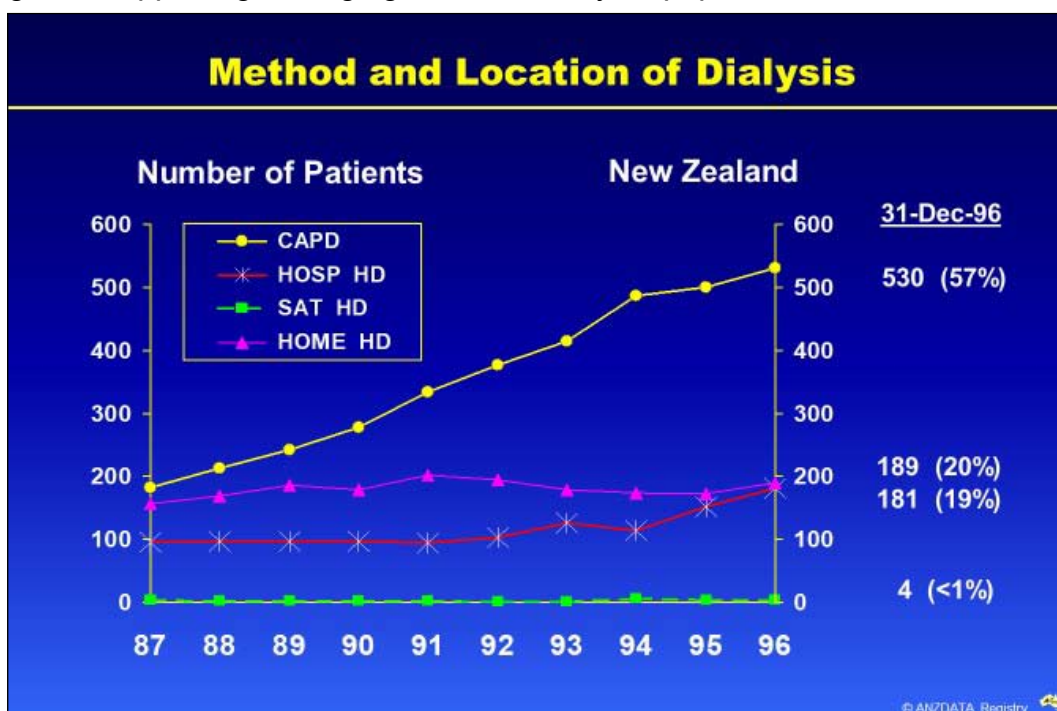
The local management of problems with dialysis access for patients was variable because of the limited availability of local surgical services, and often necessitated the patient's return to Auckland for review of their access sites. Some patients found it difficult to travel to Auckland for treatment. Orpin recalls:

Our first chronic dialysis patient was a young lady with renal failure secondary to chronic [vesicoureteric] reflux. She started the chronic programme in Auckland but after a few months firmly stated she wished to return to Whangarei for chronic dialysis. Considerable correspondence and discussion followed and she returned home in 1980 to begin chronic dialysis, (using) a machine 'on loan' from the dialysis unit in Auckland. She remained the only chronic dialysis (patient) over the next three to four years, mainly related to the very restricted admission criteria to the programme.⁴⁵

Clinical, ethical and funding challenges 1981-1990

During this decade the number of patients starting dialysis treatment each year approximately doubled. A significant and increasing number of patients with diabetes began dialysis and the average age of new patients increased from 36 to just over 46 years. At the end of 1990 there were 557 people on dialysis. From the graph below, one can see that there was a large increase in the number of patients on PD with the numbers on other forms of dialysis being unchanged.⁴⁶

While the majority of patients were still on home dialysis, 60 per cent were now on PD rather than HHD. Acceptance criteria for treating ESKD had become more liberal. Patients were older and some were children. Diabetics were no longer excluded and patients with vascular disease were accepted. More patients had mobility and dexterity problems and their support people at home were older or had died. Reasons for the increase in PD patients included insufficient hospital dialysis stations, the challenges in training and supporting the aging, a sicker dialysis population on HHD and the relative



From the 20th Report of the Australia and New Zealand Dialysis and Transplant Registry

⁴⁵ Menefy, Diana. Whangarei Hospital: A Century of Service 1901-2001 (2001). p.129.

⁴⁶ www.anzdata.org.au

ease with which a patient could be trained for CAPD. There were some improvements in haemodialysis technology – machines with better ultrafiltration control and bicarbonate, rather than acetate-based dialysate.

Auckland

In Auckland, Elizabeth Bowie retired in 1983 from her role of nephrologist in charge of dialysis and two new nephrologists were appointed in the early 1980s: Laurie Williams (1981) and John Collins (1984). Collins would oversee a major expansion in CAPD treatment for Auckland patients. Despite the establishment of the renal unit at Middlemore Hospital in the late 1980s the Auckland Unit continued to struggle to manage the increasing number of patients requiring hospital dialysis.

Wellington

In Wellington, Dr James (Jim) Neale was appointed Senior Lecturer in Medicine at the Wellington School of Medicine in 1980. He had been a distinguished student at the University of Otago and commenced his renal training at Christchurch. He won a research scholarship to work with Dr Curtis Wilson at the Scripps Institute in La Jolla, California, where he studied the immune mechanisms causing renal disease.



Jim Neale 1976

He continued this research in Wellington with major Health Research Council grants leading to the publication of more than one hundred scientific papers. In 1992 the University of Otago appointed Neale to a personal chair in Medicine (Nephrology).

Neale was an excellent teacher and many undergraduate students and postgraduate research students flourished under his supervision. He was a devoted runner and on the committee of the Wellington Marathon Clinic. Neale died while out on a Sunday run in 1994.

In the years 1981 to 1987, 100 patients had been trained for HHD and 184 patients for home CAPD at Wellington Hospital. By December 1987 there were 52 HD and 48 CAPD patients at home compared with the 16 patients being haemodialysed in hospital. 145 transplant patients were attending the Wellington and regional clinics. From 1969 to 1987, 360 transplant operations were performed, 54 of which were from live donors. The number of live donor transplants had increased significantly with the arrival of Peter Meech in 1979. Mr Peter Johnston, a Wellington trained surgeon, received a training grant from the National Kidney Foundation to work at Professor Roy Calne's transplant unit in Cambridge, UK, before returning to Wellington in 1989. In 2015 members of the Wellington Unit publicly celebrated with Susan, who has the longest surviving transplanted kidney in New Zealand. She received her deceased donor transplant in Wellington in 1970, 45 years earlier.

In 1984, Hatfield proposed a satellite unit to cope with the growing number of patients who could not be managed with HHD or CAPD. In spite of a very favourable financial report it could not be funded. It was not until 2001 that a satellite unit, The Porirua Community Dialysis Centre, with eight dialysis stations, was commissioned in Wrightson House, a commercial building in Porirua.

Morrison and Hatfield had for many years envisaged a ward which the renal and urology departments could share to their mutual benefit, as was the case in Christchurch. This didn't happen and for many years renal and cardiology shared Ward 22 in the Seddon Block where the nursing staff had to cope with two new intrusions: a coronary care unit and a renal dialysis unit. This happy association ended in May 1988 when the Governor-General, His Excellency Sir Paul Reeves, opened a new Department of Renal Medicine in the Ward Support Block. Jasmine Plimmer was the charge nurse of Ward 40 with 14 renal beds and Nick Polaschek, the charge nurse for the eight new HD stations (plus an isolation unit for patients with hepatitis B).

Hatfield succeeded Morrison as head of department in 1988. Morrison continued as a very active renal physician until he died at home in 1992 from the complications of oesophageal carcinoma.



Sir Paul Reeves, Governor-General, opening the Department of Renal Medicine, Ward 40, Wellington Hospital May 1988

Waikato

In the early 1980s, dialysis dementia from aluminium toxicity became an important clinical problem in New Zealand. Patients with ESKD are exposed to aluminium in the water used for HD or from aluminium-containing medicines. Dialysis does not remove aluminium and so it accumulates in dialysis patients and may cause neurological problems, bone disease and anaemia. Waikato Unit's Wallace and Auckland scientist John Pybus showed that stopping aluminium-containing phosphate binders in a group of haemodialysis patients was associated with a fall in their blood aluminium concentrations.^{47,48}

During these years, the Waikato Unit established and staffed outpatient clinics for new referrals, and follow-up transplant and dialysis patients at Tokoroa, Taupo, Rotorua, Tauranga and Whakatane hospitals. This was in response to the wide-spread nature of the population served. Transplant surgeon Mee resigned in 1981 and Bill Wright was appointed to manage transplant surgery.

Middlemore

Ian Simpson moved back to Auckland Hospital in 1982 and was replaced by David Richmond, who provided the same referral services until he moved to the new North Shore Hospital in Takapuna in 1984 specialising in the emergent field of geriatrics. Both Simpson and Richmond identified the unmet need for treatment of ESKD in South Auckland and with an increasing number of patients requiring HD lobbied for a separate renal service there. Doak, Director of Nephrology, led the clinical planning for an HHD training centre at Middlemore Hospital, in old wards across the railway line from the hospital.⁴⁹ This centre was completed in 1981 but was not commissioned until the spring of 1983 at which time Val Bentley was appointed as a full-time technician manager, along with a charge nurse, Pam Martin, and Sharon Kletchko. Kletchko came with a Canadian physician's qualification (FRCPC) with a sub-specialty in nephrology following postgraduate training at the Ottawa General Hospital and the University of Ottawa.

The Home Dialysis Training Unit was completed by the winter of 1984 and accepted its first cohort of patients for HHD training soon after. The unit subsequently trained all HHD patients for the top of the North Island. Patients were from as far south as Taupo, as far east as Gisborne, as far west as Taranaki and as far north as Whangarei and included all patients living in Auckland. By 1985, a multidisciplinary team from the unit was managing a total of 124 HD patients. The team, led by Kletchko, consisted of the head of technology, a charge nurse, the renal dietitian, the renal social worker and a patient advocate who was a member of the Auckland District Kidney Society.

Improvements in home dialysis technology at this time included the introduction of bicarbonate dialysate, new, larger dialysers and haemofiltration for better solute (waste) clearance. The choice of types of dialysis treatment were also expanded to include CAPD and a total of 34 patients were on CAPD during the first year from 1984 to 1985. Auckland Hospital continued to undertake vascular access and kidney transplant procedures.

The nephrologist position was part-time with Kletchko also working in the Middlemore Hospital ICU. It was at this time that Continuous Arterio-Venous Haemofiltration (CAVH) was employed, meaning that patients with acute renal failure no longer needed to be transferred to Auckland. CAVH was an ideal form of dialysis for treating very sick patients

⁴⁷ Wallace MR. Correction of high serum aluminium in a patient on maintenance haemodialysis. N Z Med J 1981; 93: 335-37.

⁴⁸ Wallace MR, Pybus J. Plasma aluminium levels in patients on maintenance haemodialysis fall when oral aluminium hydroxide is withdrawn. N Z Med J. 1983; 96: 793-95.

⁴⁹ The Report to the Hospitals Advisory Committee 1977 had recommended that a second renal unit be established by the Auckland Hospital Board.

in ICU as it could be used for an extended time. A small blood filter with a membrane highly permeable to water is used and the patient's blood pressure is sufficient to move the blood through the extracorporeal circuit.

In 1986, due to the workload and Kletchko's preference to move to full-time intensive care as Director of Intensive Care at Middlemore Hospital, Dr Martin Searle was appointed from the UK to be a full-time renal physician and to start a full South Auckland renal service based at Middlemore Hospital. Searle was a graduate of the University of Southampton. His first exposure to nephrology was as a house surgeon to Professor Roy Calne at Addenbrooke's Hospital, Cambridge and then as senior house surgeon with Professor John Walls in Leicester. He undertook his advanced training in nephrology and general medicine with Professor H A Lee at the Wessex Nephrology/Dialysis Centre in Portsmouth and Dr J R Dathan in Southampton.

When Searle started work at Middlemore in March 1987, the hospital was part of the Auckland AHB, Searle recollecting that the ward charge nurse, Denise Beechey, provided welcome support to him as a new consultant. All nephrology and dialysis care was still based at Auckland City Hospital, except for the HHD training unit at Middlemore Hospital that trained about 12-15 HHD patients each year. There were no inpatient nephrology beds and no nephrology clinics, other than HHD follow-up clinics.

After Searle arrived, the growth of the service at Middlemore Hospital was immediate and rapid. CAPD training expanded partly due to an expansion in the number of patients with ESKD who were previously unable to access HD due to the strict access criteria. The Auckland Unit was doing about 30 transplants annually.

Within a year one third of the Auckland region's dialysis patients and one third of in-centre patients were managed by the unit at Middlemore Hospital, staffed by one nephrologist with no dedicated resident medical staff. The unit at Auckland City Hospital had three nephrologists – Doak, Laurie Williams and John Collins. There was a one-in-four nephrologists' roster covering both hospitals. The nephrology inpatient beds at Middlemore were in Ward 8; the other consultants on the ward were Drs David Scott and Pam Brown, a gastroenterologist. Shortly after his arrival at Middlemore, Searle volunteered to assist Brown with her acute general medicine and this led to the nephrologists running a general medicine team until 1998. According to Searle, 'The contract (for nephrology services) with Auckland Hospital Board was rather vague as to the details of clinical responsibility and was not accompanied in those days by a formal job description'.

Whangarei

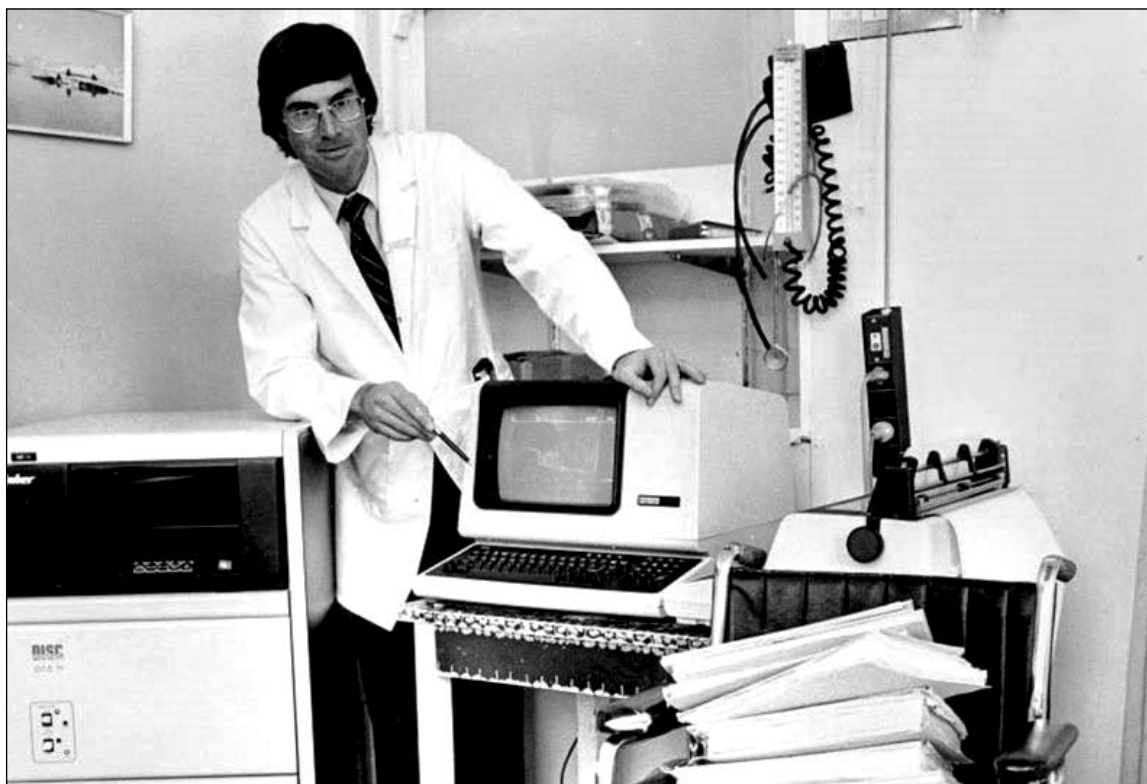
For several years, access to the dialysis programme at Auckland Hospital for Northland patients remained restricted. Many were excluded by criteria such as being under 50 years and not having associated malignant disease or other potentially life-threatening illnesses. Patients with ESKD presenting to Whangarei Hospital in an unstable clinical state were treated with acute HD via a central venous line and when stabilised they were transferred to Auckland for assessment for admission to the maintenance dialysis programme. ESKD patients needed to be capable of managing dialysis independently and with few exceptions were offered only PD rather than HD.

Orpin and his team regularly questioned these exclusion criteria, particularly those of associated diseases. He attended several regional meetings in Auckland to discuss the admission criteria. The committee comprised the Auckland renal physicians, nursing representatives, administrators and an ethics advisor (Ron Paterson, who later became the Health and Disability Commissioner). This group questioned the ethics of such restricted access but acknowledged the costs of widening the entry criteria. These exclusion criteria

were gradually eased and the number of patients accepted onto the dialysis programme steadily increased. The first dialysis nurses were overseas trained and as demand slowly increased, local nurses were trained at Middlemore.

Christchurch

The Christchurch Unit continued to espouse the principle of universal home dialysis for all ESKD patients. This meant that for some patients struggling to master their treatment technique, HHD and CAPD training could be prolonged. Hospital dialysis was reserved for early dialysis before the start of HHD training and support for patients on HHD. Kelvin Lynn returned as a second nephrologist following Little's departure to work in Saudi Arabia. Lynn and Jim Neale had been registrars together in the mid-1970s before continuing their training in the United Kingdom and the USA, respectively.



Kelvin Lynn with a DEC PDP11 processor and visual display unit in 1985. The wheelchair contains the notes of one long-term patient.

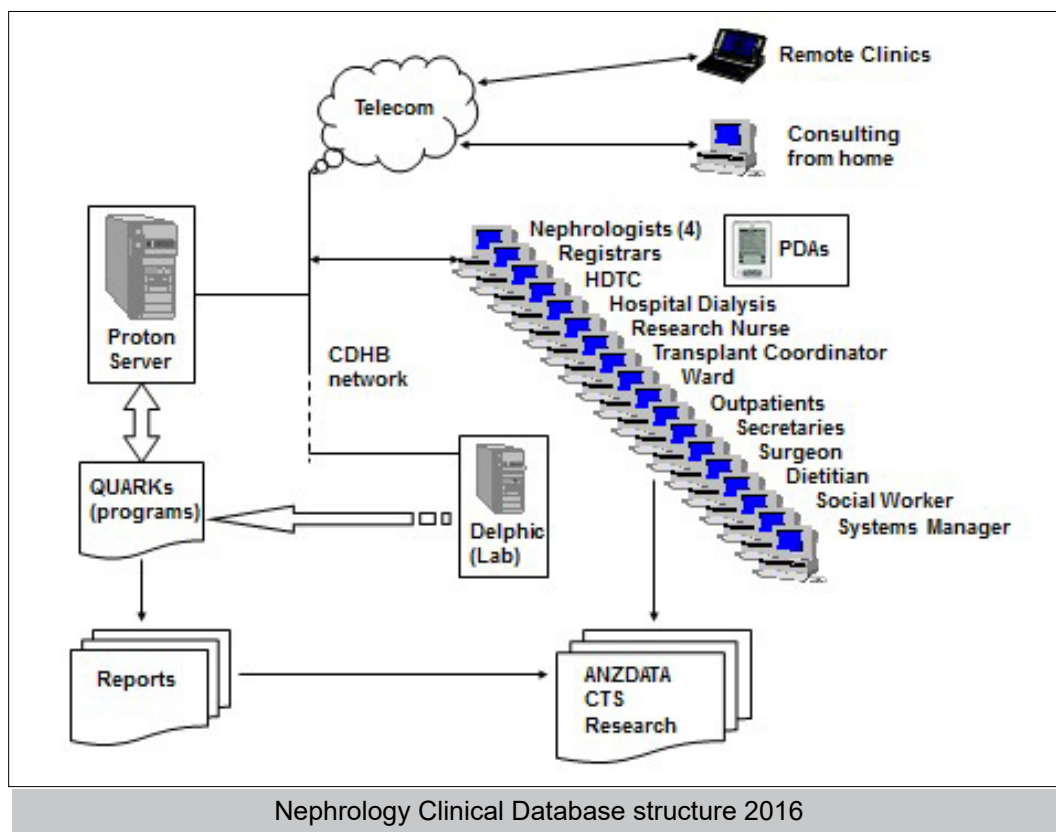
Charles Swainson, a nephrologist from Edinburgh, joined Lynn and Bailey in 1982 and returned to Scotland in 1986. Richard Robson, who had trained in the department as a registrar and then completed his PhD in Adelaide, was appointed to replace him.

The care of patients with kidney disease requires frequent laboratory testing and over time patients can generate large numbers of test results. It is common practice to enter these results into a timeline to follow trends such as disease progress or the effects of treatment. Traditionally, these timelines were large paper-based spreadsheets maintained by the junior doctors in a clinical team. When Lynn was undergoing postgraduate training at Charing Cross Hospital in London in 1977, he was asked to join a team of researchers under Professor Hugh de Wardener who were developing a computerised database to support the management of patients with kidney disease and do away with the traditional cumbersome paper spreadsheet. The London researchers established a company, Clinical Computing Ltd, to sell their computer programme called Clinical Data System (CDS).

In 1983, Bailey, Lynn and Adrian Buttimore were able to trial the system successfully in

the Nephrology Department at Christchurch Hospital. By 1985, Judith Inkster was employed as Systems Manager and a DEC PDP/11 computer costing \$50,000 and visual display units had been purchased. The funding of the project was only possible with the support of the Medical Superintendent in Chief, Dr Ross Fairgray, the Medical Superintendent of Christchurch Hospital, Dr David Andrews and the generous donation of \$25,000 from the Christchurch Kidney Society, the local patient support group. Later, an improved CCL programme, PROTON, was introduced and is still being used in 2018.

The PROTON system was linked to the Canterbury DHB laboratory in 1994 so that patients' test results could be automatically loaded into their electronic file. Additional interfaces have been constructed with clinical data from other sources for automatic data entry. PROTON has become integral to the clinical service with terminals and later PCs in all clinical areas and remote access to the system for on-call clinicians. It is a fast and robust system, fully customisable with inbuilt auditing. The tool is a core part of individual patient



management in Christchurch and has proved invaluable for clinical research, teaching and audit. The system has over 16,400 patients' files dating back to 1985 of whom, 2,443 are currently being cared for by the unit.

Dunedin

Hocken retired as renal physician in 1988 and Dr (later Professor) Rob Walker was appointed in April 1989 to head the unit. Dixon provided the continuity of service during this time between appointments. He also provided nephrology cover during the early 1990s until the appointment of Dr John Stewart.

At the time of Walker's arrival, access to kidney replacement therapy was limited. The service had only 16 patients on dialysis and the training unit was based in a four-bed unit in the surgical ward. The only type of dialysis available was HHD with strict selection criteria applied. Patients had to be under the age of 50 and those with diabetes were not

offered dialysis. This changed rapidly under Walker's influence. He introduced CAPD and acceptance criteria that no longer excluded diabetics or people over 50 years of age. In collaboration with Southland-based Dr Charles Renner, Walker initiated the setting up of a regional service incorporating Southland. Renner who provided the diabetes service for Southland had also, by default, cared for patients with chronic kidney disease.

The dialysis unit relocated to a more purpose-designed area, set up for acute dialysis, home dialysis (HD and PD) training. In 1989, the dialysis nursing staff were Dawne McPhee (Charge Nurse), Maree McDonald, Liz Edwards and Beneta Barton. The Otago-Southland Renal Unit expanded rapidly in size with over 130 patients on home dialysis in 2013. Of these approximately 60 per cent of patients were on HHD and 40 per cent on CAPD.

Renal services in the time of the Health Reforms 1991-2000

The whole health system was affected by the Health Reforms of the Fourth National Government of New Zealand (1990-99), and in particular, services for people with ESKD. The system of democratically elected Area Health Boards was abolished and replaced with Crown Health Enterprises (CHEs), which were run according to the prevailing new public management ethos that created an internal market for the provision of hospital services. CHEs were required to make a profit. During this time the number of patients on dialysis in New Zealand grew on average by 7.2 per cent per annum. The main drivers of this demand were:

- Improved survival (especially cardiovascular) of the general population
- Type II diabetes epidemic
- Greater acceptance of and demand for dialysis services from Māori and Pacific Island peoples
- Greater acceptance of and demand for dialysis services from elderly patients Greater expectation for dialysis services from the medically frail, who previously would either not have been offered, or would not have taken up an offer of dialysis.⁵⁰

At the same time, the government was trying to rein in health spending and establish a system of core services and health rationing. By the mid-1990s, increasing clinical demand was putting pressure on dialysis units because the lack of resources did not allow for the expansion of 'dialysis beds' and staff to cope with the increasing number of patients. The effects were felt most in regions with high proportions of Māori and Pacific Island peoples, such as Northland and South Auckland.

Most patients with ESKD develop anaemia due to not having enough erythropoietin, a hormone made by the healthy kidney. The introduction of human recombinant (artificial) erythropoietin for the treatment of renal anaemia proved to be both a major boon for kidney failure patients in the 1990s and a funding headache for health funders.

Auckland

Dialysis services were particularly affected by under resourcing of in-hospital dialysis beds and surgical support services. Attempts by Auckland hospital authorities to restrict staffing resulted in a number of articles in the New Zealand Herald. In the 29 October 1995 issue headlined "Deaths if staff cut", Drs Doak, Richmond, Simpson and Bowie warned that the move to reduce the dialysis unit's nursing staff from eight to five would mean "that patients would certainly die". Under pressure from a local (opposition) MP, Air Commodore TF

⁵⁰ Adrian Field. Scoping paper. New Zealand's Renal Services: Towards a national strategic plan National Renal Advisory Board, 14 September 2006

Gill, the Board issued a denial soon afterwards.⁵¹

Although there was a new renal unit at Middlemore, the demand for treatment was also high in South Auckland. The Greenlane satellite unit opened in December 1997 and the Carrington satellite in 2001. Greenlane was always full self-care with no nurses working on site but staffed by two dialysis technicians at a 1:6 ratio, which helped to keep the treatment costs down. The Carrington Unit had both assisted care (patients are still trained and set up their machines but dialysis technicians do most of the dialysis) and full self-care. More recently it has become entirely assisted care. The staff ratio is 1:4 for dialysis technicians and part-time nurse case-managers are on site. Subsequently, the Waitakere satellite was opened in 2014. At the end of 1997 there were 211 dialysis under care at Auckland Hospital and 185 at Middlemore.

Ian Dittmer (1998) and Helen Pilmore (1999) joined the staff at Auckland Hospital in 2014 and became the first transplantation nephrologists in New Zealand.

Wellington

In Wellington, Dr Alastair Macdonald was appointed in 1991. Before coming back to the unit he had first been appointed to in 1976, he had worked in Nelson, Baghdad and Kenepuru. He retired from renal medicine in 2014 but carried on working in the hospital as a medical ethicist. In 1994, Dr Nicky Hay returned to Wellington from Sydney, where she had completed her renal training. Ailsa Jacobson, who had pioneered CAPD training in Wellington, became manager of the department in 1995. Dr Grant Pidgeon, who trained in Christchurch where he also completed his MD, was appointed to a university/hospital position in 1996. He succeeded Hatfield as clinical leader in 2001 when he accepted a full-time hospital position.

Waikato

In 1993, the Waikato Unit managed the first successful pregnancy of a dialysis patient in New Zealand. The patient was on HD when she became pregnant and was managed by dialysis six times a week by unit staff. The baby was delivered by Caesarean section at 26 weeks and survived into healthy adulthood.

Also in 1993, the HHD and CAPD units, as well as in-centre haemodialysis were all moved into a renovated area, the Ryburn building, on the hospital campus. The founder of the unit, Martin Wallace, retired in 2000.

Middlemore

In the early 1990s South Auckland Health was established as a separate hospital board. By then there were three nephrologists at Middlemore: Searle, Walter van der Merwe and David Voss. The South Auckland nephrologists were no longer involved in an Auckland-wide on-call roster. This was the age of the Funder/Provider split to encourage competition between CHEs. North Health contracted with CHEs as to what services they should provide and as to numbers to be treated. North Health had specified that dialysis services were not a priority area and that dialysis patient numbers should not grow. If they did, they would not be funded.

To achieve stability of patient numbers at that time would have involved declining one in every four or five new kidney failure patients. There was also a perception that the rapid growth in patient numbers in South Auckland was related to physician practice rather than population demographics. At Middlemore Hospital an increasing number of patients were dialysing 'in-centre' and receiving two dialyses a week, contrary to clinical practice guidelines. The 'McKeown' affair brought these issues to public attention. Searle writes:

⁵¹ Gill commissioned the West Report in 1977 as then Minister of Health.

Mr McKeown was in his mid-seventies and developed end stage renal failure. He lived alone but was supported by a son. After discussions with him and his son it was clear that he would not manage either form of home dialysis and would inevitably become an in-centre patient. Given the pressure from the funder, we decided that we could not offer him dialysis therapy and indeed, if I recall correctly, a North Health person came and wrote in his notes supporting our decision. This quite naturally led to vigorous objection from Mr McKeown's son to whom we explained the situation and referred him to the hospital patient advocate (a ministerial employee).

The next development was an invitation to me to appear on The Holmes Show with the Minister of Health, Jenny Shipley, to discuss the matter. I declined. The Minister stated clearly that "rationing" was not the cause of Mr McKeown being declined dialysis. It was due to his other medical conditions which included heart disease and prostate cancer. I immediately knew that the Minister had access to his clinical record as his heart disease and prostate cancer were clearly stated on his problem list but were currently not an issue.

The statement by the Minister led others to make a complaint to the Privacy Commissioner, who subsequently rebuked the Minister. For the next two weeks my life was dominated by phone calls from the media from seven am till midnight. Something of a highlight was an appearance on the Kim Hill Show on Radio New Zealand, which ran quite an extensive debate between me and the Minister on the issues at hand. The core of my argument was that if an informed society and government choose to restrict any area of healthcare then as a state employee it was my duty to comply with that. However, such a decision should not be justified on false clinical grounds.

I think I stated that I was prepared to accept Mr McKeown being denied dialysis but not by a Minister and society 'hiding behind my white coat'. During this storm the CEO of South Auckland Health, Lester Levy, was on vacation and on his return, I believe he took legal advice and ordered us to take Mr McKeown on the dialysis programme. Mr McKeown received centre haemodialysis for about 18 months (as we had predicted). I heard subsequently he passed away at home watching an All Blacks game. I think I can say clearly that following the McKeown affair, the pressure from North Health to restrict dialysis patient numbers dissolved.⁵²

Christchurch

In Christchurch, Lynn took over as head of department in 1991 from Bailey and held this post until 2000, when he was appointed the first Chief of Medicine for the Canterbury DHB. One of the reasons for the change in leadership was Bailey's increasingly active role in international nephrology. He had become only the second New Zealander to be elected President of the Australian and New Zealand Society of Nephrology in 1986. In 1996 he became the first New Zealander to be elected a Councillor of the International Society of Nephrology. While attending a meeting of the Council of the Society, Bailey drowned on 3 April 1997 while swimming in the ocean near Sri Lanka. His funeral in Christchurch Cathedral was attended by several hundred people including many kidney patients. Martin Searle moved from Middlemore in 1998 to take up a position as clinical nephrologist at Christchurch Hospital.

Whangarei

Prior to 1980, Auckland renal physicians conducted outpatient clinics in Whangarei for

⁵² Personal communication, Martin Searle,

Northland patients with ESKD who required dialysis and who were being managed locally. With the increasing demand, Doak visited monthly from the mid-1990s until 1997 when Dr Jenny Walker, Whangarei's first trained nephrologist, was appointed. At this time there were about 40 patients on the chronic programme. Orpin provided service to the renal unit on an irregular basis until he retired three years later.

In 1997, an in-house nurse renal training programme started that eliminated the need for nurses to travel to Auckland or Hamilton for training. Now Cheryle Kiwi and Regional Nurse specialist, Tafale Maddren, train Northland nurses locally. Maddren recalled:

By December 2000 numbers had grown to such an extent that we had seven haemodialysis machines dialysing patients in two shifts Monday to Friday and still we couldn't keep up with increasing numbers of renal failure patients requiring haemodialysis.⁵³

Palmerston North

A renal outpatient clinic was established by Bruce Morrison at Palmerston North Hospital in 1970. This was done at the invitation of Murray Kirk, a very busy physician who also ran the Coronary Care Unit and the ICU. The Manawatu countryside is characterised by long straight roads, speeding vehicles and frequent traffic accidents. In this situation Kirk saw many acute kidney failure cases which were initially dialysed in Wellington then in later years in the ICU in Palmerston North.

Richard Wigley, a general physician and rheumatologist with a very active research interest, shared many of the renal outpatient clinic's patients. When Ross Hayton, a gastroenterologist, arrived in the 1980s he took over the local supervision of the kidney patients. Hayton visited all the hospitals in the central North Island in a bid to increase donor awareness.

John Coutts, a general surgeon in Palmerston North, did the deceased kidney donor operations with such speed and skill that the transplant surgeons in Wellington always commented that his donor kidneys were the best prepared kidneys they ever received. David Dunlop, a Palmerston North vascular surgeon, was able to create AV fistulae for the local patients before they were home trained in Wellington.

Pat Perkins organized the very busy outpatient clinics, now held for two days each month. Pene Pratt and Anne de Bres attended the Wellington Nurse Training Programme one day each week for a year, enabling a satellite unit with six HD stations to be set up in Palmerston North Hospital.

For the first time, Palmerston North had a resident renal physician when Peter Sizeland arrived in 1994. He established an HHD and CAPD training programme very rapidly with Pratt, de Bres and Cathy Harte. In the next five years they trained 90 HHD and 240 CAPD patients. It was interesting to note that it was Richard Coutts, the son of John Coutts, who was inserting Tenckhoff PD catheters. In 2000, when Sizeland transferred to the Waikato it was Peter Little who succeeded him as a locum until the arrival of Norman Panlilio.

Recent developments 2001 to present

Since 2000, renal units have been set up in Hawke's Bay, Taranaki and Waitemata. A list of the current renal units can be found in Appendix D.

⁵³ Menefy, Diana. Whangarei Hospital, p.130.

Hawkes Bay

In the early 1970s, Bruce Morrison established a renal outpatient clinic in the Hawkes Bay. General physicians, Peter Fleischel in Napier and Ian McPherson in Hastings organised and attended these clinics. Because of the large Māori population and McPherson's interest in diabetes, diabetic kidney disease was much in attendance at these clinics. After 1978, Hatfield joined Morrison, alternating to spend two days each month at the outpatient clinics. Regional politics demanded that the visiting Wellington physicians spend their time equally at Napier and Hastings Hospitals and not publicly display a preference for one or the other. If you accepted fresh fish in Napier you also had to accept fresh fruit in Hastings. Napier did have the very small advantage of a great view across the Bay from the windows of the outpatient clinic.

Richard Meech, a physician with an interest in infectious disease, joined the Napier clinics in the 1980s while Ted Ward, an anaesthetist, joined the Hastings clinic at the same time. Later in the 1990s, Ward who ran the ICU in Hastings, began dialysing acute kidney failure patients. This was followed by the establishment of a Hospital Haemodialysis Unit to treat ESKD.

Dr Drew Henderson, Scottish trained nephrologist, moved to Hastings Memorial Hospital to set up a renal unit for the region. Currently the unit has two renal physicians, Drs Colin Hutchinson and Andy McNally, who with two nurse practitioners, were managing 130 dialysis and 84 transplant patients at the end of 2016.

Waitemata

From the late 1960s, treatment for people with kidney disease living in the large area from Waitakere to Rodney (now the area served by the Waitemata DHB) was provided by the kidney unit at Auckland City Hospital. For some patients with ESKD treatment involved travel over long distances three times a week, for four to six-hour dialysis sessions.

In 2002, at a time of increased demand for in-centre dialysis at Auckland City Hospital, the Auckland DHB advised the Waitemata DHB that there would be a need for it to develop its own kidney services, particularly dialysis services, for the 500,000 people in its region. A new \$9.2 million North Shore Dialysis Centre was opened at North Shore Hospital by the Minister of Health, Tony Ryall, in July 2011. The centre is part of a comprehensive renal service being developed at Waitemata DHB and provides dialysis services for people with ESKD. The Waitemata service also includes a satellite dialysis unit and clinics at Waitakere Hospital. Dr Janak de Zoysa is the Clinical Director and there are five other nephrologists on the staff. At the end of 2016 the unit was caring for 278 patients and 187 transplant recipients.

Taranaki

In 1972, Bruce Morrison, head of the Renal Medicine Department at Wellington, established a renal outpatient clinic in Whanganui, at the invitation of Dr Richard Stone. Morrison attended one day every three months: usually the day following his Palmerston North clinics. Because of the location of the Whanganui clinic he was often referred patients from Taranaki and with the advent of home dialysis training in Wellington in 1975, these numbers increased. By 1986 there were six patients in Taranaki and one in Whanganui on HHD and four patients in Taranaki and three in Whanganui on CAPD. As the result of increased patient load, Shona Barlow was appointed as a home visit nurse for CAPD patients throughout Taranaki. Shona was the first renal nurse in Taranaki. She recalls that:

The first peritoneal dialysis trained nurse in New Plymouth was trained through the Wellington renal unit around the early to mid-nineteen eighties. This nurse was the

charge nurse of the outpatient department and the training was given so she could treat and advise, as required, the peritoneal dialysis patients in the local district. At that time, there were only 2 or 3 patients. If any patient needed urgent treatment, (peritonitis, exit site inflammation or overload of fluids, etc.) they would be hospitalised and/or flown back to Wellington Hospital, which at that time was the only provider who had patients in Taranaki.

Following some discussions, the units agreed to transfer current patients and refer new patients to the care of the Middlemore hospital Renal Unit. This proved to be an excellent arrangement for Taranaki patients, and the hospital finances, as Dr Searle, who was at that time the only visiting physician from Middlemore, put a lot of time and effort into amalgamating the Taranaki patients under the Middlemore “umbrella”.

Until 2001, Taranaki patients requiring treatment for kidney disease were referred to the Renal Department at Middlemore Hospital and managed by local physicians with backup from the Middlemore renal physicians who visited New Plymouth to run renal clinics. Dr Krishan Madhan, then the newly appointed Head of Department at Middlemore Hospital became involved in the setup of the renal unit at Taranaki in October 2001. There had been earlier discussions between the Taranaki Base Hospital management and Dr Walter van der Merwe, the previous Head of the Renal Department at Middlemore Hospital, regarding a local renal unit. A haemodialysis unit was set up with support from visiting renal physicians from Middlemore Hospital on a weekly rotating roster. Most dialysis patients who required inpatient management were transferred to Middlemore Hospital. The opening of the haemodialysis unit, six haemodialysis chairs and a dedicated PD training room in October 2001 allowed some patients to return to New Plymouth from the Palmerston North dialysis unit and new local patients to get dialysis treatment without having to travel out of the area.

After about 12 months, doctors and nurses of the transplant team from Auckland Hospital started clinics for patients wanting to have transplants. That was a great bonus for patients as it meant they did not have to travel to Auckland for their “workup” towards transplant. In 2003, Madhan took up a permanent position as physician/nephrologist at the Taranaki Base Hospital. This allowed further expansion of renal services in the region and the development of support services for patients with ESKD. The dialysis unit was expanded to ten stations and the capacity of the renal unit was enhanced to deliver all types of dialysis treatment. This included in-centre and HHD, and peritoneal dialysis. The new unit was fortunate in having the services of a general/vascular surgeon Dr Damien Mosquera. Besides providing vascular access locally, he also placed peritoneal dialysis catheters thus making the unit self-sufficient in providing dialysis access.

A local interventional radiologist, Dr Mark McCullough, together with Madhan, developed the capacity for the placement of semi-permanent vascular access by indwelling catheters, obtaining kidney biopsies and dealing with problems related to AV fistulae. Over the ensuing five years, the renal service at Taranaki became self-sufficient in providing all aspects of treatment of kidney diseases except for acute transplantation care. The development of renal service was not limited to provision of dialysis and management of general kidney disease. Several nursing initiatives were also supported resulting in the development of specialist nurse clinics, case management and establishment of nurse coordinator role. The resulting increase in academic and research activity provided the basis for establishment of Renal Advanced Training in Renal Medicine for physician trainees at Taranaki. In 2008, Dr Emad Maher was the unit’s first Advanced Trainee in Renal Medicine.

3

Home Haemodialysis

Kelvin Lynn, Adrian Buttimore and Peter Hatfield

New Zealand was one of the first countries to start home haemodialysis (HHD) and remains a world leader. In 1970, 20 per cent of New Zealand kidney failure patients were on HHD and by 1980, 55 percent were.

The early dialysis equipment developed for hospital dialysis was not suitable for patients to manage dialysis at home. The introduction of the Drake Willock dialysis machines and Kiil dialysers meant there was affordable, relatively simple technology that could be mastered by patients. With this equipment patients could be trained to carry out overnight dialysis at home. Using spare parts he found in his basement, Charlie Willock, a design engineer in Oregon, created his home dialysis machine in 1964, assisted by Dr Richard Drake, a local nephrologist. A few months later, the first machine was used on a patient at the Good Samaritan Hospital in Portland, Oregon. Drake and Willock founded the Drake Willock Company to build the machines. The company sold five hundred machines during its first year of operation. Peter Little from Christchurch heard of these machines on a visit to Seattle and purchased one on behalf of a Timaru farmer, together with a Kiil dialyser and supplies.



Drake-Willock Model 4011, 1972

The first HHD training unit was established in Christchurch in 1969 and until the establishment of similar training programmes in Auckland, Wellington and Dunedin, the unit provided home dialysis training and support for patients from throughout the country, e.g. Tauranga, Palmerston North, Hastings, Wairoa and Nelson. Sixty-three patients had commenced training by the end of 1973. Training time for HHD averaged 15 weeks with a range of seven to 28 weeks.

In 1970, Little reported that the cost of equipment for a home dialysis patient using a Kiil dialyser and a Drake-Willock dialysis machine was \$3,455 and the monthly cost per home dialysis patient for consumables was \$154.23. Patients were encouraged to dialyse in their bedrooms overnight. The cost of home modifications was on average \$100. He persuaded the North Canterbury Hospital Board (NCHB) and its Medical Superintendent-in-Chief, Dr Lyn Berry, to fund this new programme by arguing that the purchase and operating costs for a dialysis machine (in the late 1960s) were approximately the same as for a motor car.

Key elements of the training programme, that were also taken up by the Wellington HHD training unit, were: training patients in a building separate from the hospital, reintegration of the patient back into the community to manage their own care and close liaison with their general practitioners, local hospital, laboratory, pharmacy, employers and schools.⁵⁴

The Christchurch unit was staffed initially by a nursing sister, Ms Jamieson, and a dialysis technician, Christine Walker, who was recruited from Auckland. In early 1970, a second nursing sister, Anna Stokes, was appointed, as was a second technician, Adrian Buttimore, also recruited from Auckland. Buttimore was appointed chief technician in 1971, then Officer-in-charge, Dialysis Services in 1976 and lastly Clinical Manager, Dialysis Services in 1991, a position he held until his retirement in 2012. As other home dialysis training units were set up around New Zealand, Buttimore helped train their staff.



The first Christchurch Home Dialysis Training Unit, 510 Hagley Avenue. Now the site of Canterbury Health Laboratories

⁵⁴ McGregor D, Buttimore A, Robson R, Little P, Morton J, et al. Thirty years of universal home dialysis in Christchurch. N Z Med J 2000; 113: 27-9

In Auckland, a home dialysis programme was started in 1970 following an outbreak of hepatitis in the hospital unit. Between 1967 and 1970 five sporadic cases of hepatitis occurred in dialysis patients but in May 1970, when hepatitis developed in a transplanted patient and a dialysis nurse, it was apparent that the Auckland unit had an epidemic. This was a major concern. Similar epidemics had occurred overseas, notably in Edinburgh, and some patients and staff had died. Testing for the Australia antigen⁵⁵ was done weekly. Over a 16-month period, 12 out of 37 patients developed hepatitis. Three of the unit's 23 staff were infected and surgeon Athol Duke later died of liver cirrhosis.

The transplant programme was stopped for five months. The epidemic was the stimulus to introduce AV fistulae and vein grafts and to develop home dialysis. When nurses resigned they were replaced with technical staff to do dialysis. All patients were trained in home dialysis using Drake Willock machines and Kiil dialysers. A "clean" dialysis unit was opened in October 1971 alongside the smaller 'infectious' unit. Dr Elizabeth Bowie, nephrologist-in-charge of the dialysis unit, commented that this experience led to a change to disposable dialysers, an emphasis on home dialysis and the demise of the AV shunt in favour of the fistula.

In Christchurch, a patient infected with what is now called hepatitis B was trained for HHD in her home because of the risk of cross infection in the home dialysis training unit. The success of this led to a second patient training in his own home with a view to introducing such in-home training as a norm. However, this mode of training proved to be very staff intensive and was not continued.

There were no other hepatitis outbreaks in New Zealand dialysis units following the introduction of universal precautions and regular checks for asymptomatic carriers of hepatitis viruses. The large proportion of patients dialysing at home in the early days reduced the risk of cross infection. Patients with hepatitis B and C (formerly known as 'non A, non B hepatitis') acquired before their kidneys failed, have been started on dialysis with no subsequent cases of patient-to-patient or patient-to-staff viral transfer.

Following Drs Doak and Boyd's 1974 report on renal services at Dunedin Hospital, home dialysis training started in Dunedin. Initially, few patients were treated and numbers did not increase until after the appointment of nephrologist Rob Walker. Despite this, the Australia and New Zealand Dialysis and Transplant Registry Report (ANZDATA) for 1997 records only 12 patients on HHD in Otago/Southland.



Home Haemodialysis Training Unit 62 Owen Street, Wellington

⁵⁵ A protein found in an Australian Aboriginal patient subsequently shown to be part of the hepatitis B virus.

From the beginning in Wellington, it was emphasised that HHD training would start in a community centre and then continue at home until that person with ESKD was integrated back into their own community. In 1974, Peter Hatfield and Wellington Community Health set up a residential HHD training unit in Wellington at 62 Owen Street, a suburban house near the hospital. Significantly, this was part of Community Health under the wise and protective wing of Pauline McInnes.

Margaret Woodbridge, lured back from the very good training unit at Guy's Hospital, London, was the first charge nurse but she and her nursing colleagues, Alison Morris and Sue Holloway, were employed as district nurses. These nurses followed the Guy's training programme, took people home when they had completed their first part of their training and talked to the patients' general practitioners and to other health and community services. Woodbridge commented that initially it was very difficult for patients on home dialysis to get acceptance and support from their local communities. The Wellington unit, like Christchurch, invited general practitioners, district nurses and employers to spend some time in the training unit before the patient went home. This helped, but it was not until they were seen to be people capable of living a near normal life that the patients became part of their community again.



Cartoon by the wife of a home haemodialysis patient. About to go home.

This experience in Wellington was in stark contrast to Hatfield's experience in London during the coalminers' strikes in the 1970s when there were power cuts. Having a dialysis machine nearby meant the local authorities could not cut off your power, so haemodialysis patients were actively encouraged to be at home to protect their neighbours from such power cuts.

Wellington patients learnt to use Drake-Willock machines and disposable plate dialysers. Initially, Christchurch's Adrian Buttimore and Martin Bourke gave technical support and advice until Andy May arrived from Sheffield in 1976. Bryn Williams, the head technician in 2015, had his first introduction to dialysis as a young boy in 1976. His mother, Janet,

was employed as a cook in the home training unit where the importance of nutrition in the treatment of chronic kidney disease was emphasised.

The training time in the Wellington unit averaged six to eight weeks with a range of three to 18 weeks. In those early days, the patients were also teachers. Mavis, a new arrival declared that she was unteachable as her electronic knowledge was nil and that she couldn't even change a light bulb. How could she compare with Alan, a fellow trainee who had the advantage of being an electronic engineer? With Mavis therefore, the training staff had to begin at the beginning and she took three weeks to complete her training while Alan took eighteen weeks because his teachers did not begin at the beginning. Mastering the electronics was a challenging task for all but learning to cannulate their fistulae was even harder. Bill, who was the leader of his local Black Power Gang, said: 'Doc, I have been winged by a point 223 calibre bullet and blasted with a sawn-off shotgun but both are nothing compared to cannulating this bloody fistula.'



Cartoon by the wife of a home haemodialysis patient. After three months at home.

Patients' fistulae were their lifelines and had to be protected at all costs. Ben, who dialysed himself overnight at home, did woodwork for a hobby and one day caught his forearm in a circular saw. The medical officer at the hospital emergency department was confronted by a very pale man, too weak to stand, holding a heavily blood-stained towel to his forearm yelling, 'My fistula, my fistula, I missed my fistula, my fistula is OK.'

Home patients needed to record their daily weight so they could calculate how much fluid to remove at each dialysis session. Patients' trainers frowned upon any excessive weight gain because it indicated that the patient had taken in too much fluid. When Bob sent in his records he tried to avoid a feared rebuke by explaining his excessive weight

gain was due to his wearing “winter pyjamas”.

Ideally, the HHD was done during the night when patients were asleep. This meant they could work or go to school during the day. In 1980 Hatfield proudly presented a paper at a renal meeting in Germany showing that 80 per cent of Wellington’s HHD patients were working. He was floored at question time when a German physician asked, ‘Is New Zealand such a poor country that even dialysis patients have to work? Germany is a caring country and we have a special sickness fund for our dialysis patients.’

The goal of the training was to enable people on home dialysis to be normal people leading normal lives in their own communities. Hatfield commented that he felt this was achieved by most patients. It was not until many years later, however, that he became aware of some of the long-term unintended effects of home dialysis training. Hatfield recounts the story of Graeme who had been on home dialysis for 16 good years and then received a transplant which functioned immediately. Six weeks later at the transplant outpatient clinic his wife in another room asked if it was still necessary for Graeme to dialyse three nights each week. Even with a good transplant he wasn’t going to give up something that had kept him alive, well and working for sixteen “normal” years. He had become dependent on dialysis and had to be gradually weaned off the treatment.

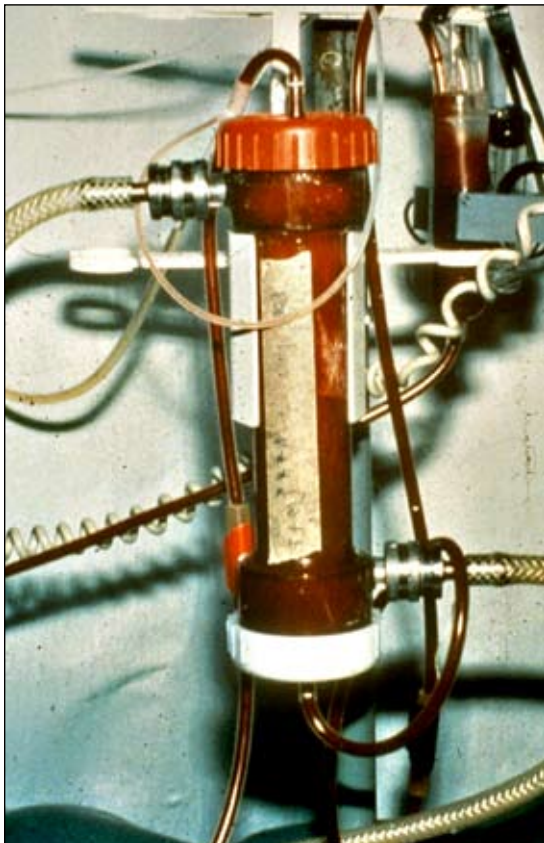
Kathy had a transplant after 14 “normal” years on HHD. After six months of good transplant function she became depressed and attempted suicide. Kathy said that this was not a steroid side-effect but was because she was now treated as a normal person with a transplant and not as someone “special” on home dialysis.

In the first six years the Wellington unit trained 82 HHD patients 70 of whom were alive and well in 1982. Bill Geange, a teacher at New Plymouth Boys High School began HD treatment in 1974 when he had just started studying for his arts degree at Victoria University. He was the Hawkes Bay junior tennis champion. His mother came down from Napier to a Hutt Valley motor camp to live and train to be his helper. Apart from seven years with a functioning transplant, he has remained well on HHD for 41 years.

In 1976, Bernard Hyne was appointed as a second renal physician at Waikato and was responsible for setting up HHD training. The first patients were trained in a hospital ward. Six patients were established on HHD by 1980. Special nurses were trained to teach patients, and a full-time administrator and a full-time biotechnician were part of the team. In March 1980, the unit was relocated with three training machines to a residential house at 3 Ohaupo Road, Hamilton. Patients lived in the house while training. Patients were aged from 12 to 65 years and most of them had chronic glomerulonephritis. They were taught to be self-sufficient (no mandatory helper), the training taking eight to 10 weeks. Most patients were working, attended school, or were full-time house-keepers. Patients dialysed in the evening or overnight to allow for full employment. Dialysis times were from five to eight hours three times a week.

In the early 1980s, Scribner AV shunts were used for vascular access. Later, AV fistulae, saphenous vein loop grafts and Teflon loop vein grafts were used. Once on HHD, patients had routine six-monthly home visits from staff. In the early days in rural areas with septic tanks, the home owner had to provide additional soak holes on their property to dispose of used dialysate that contained formalin.

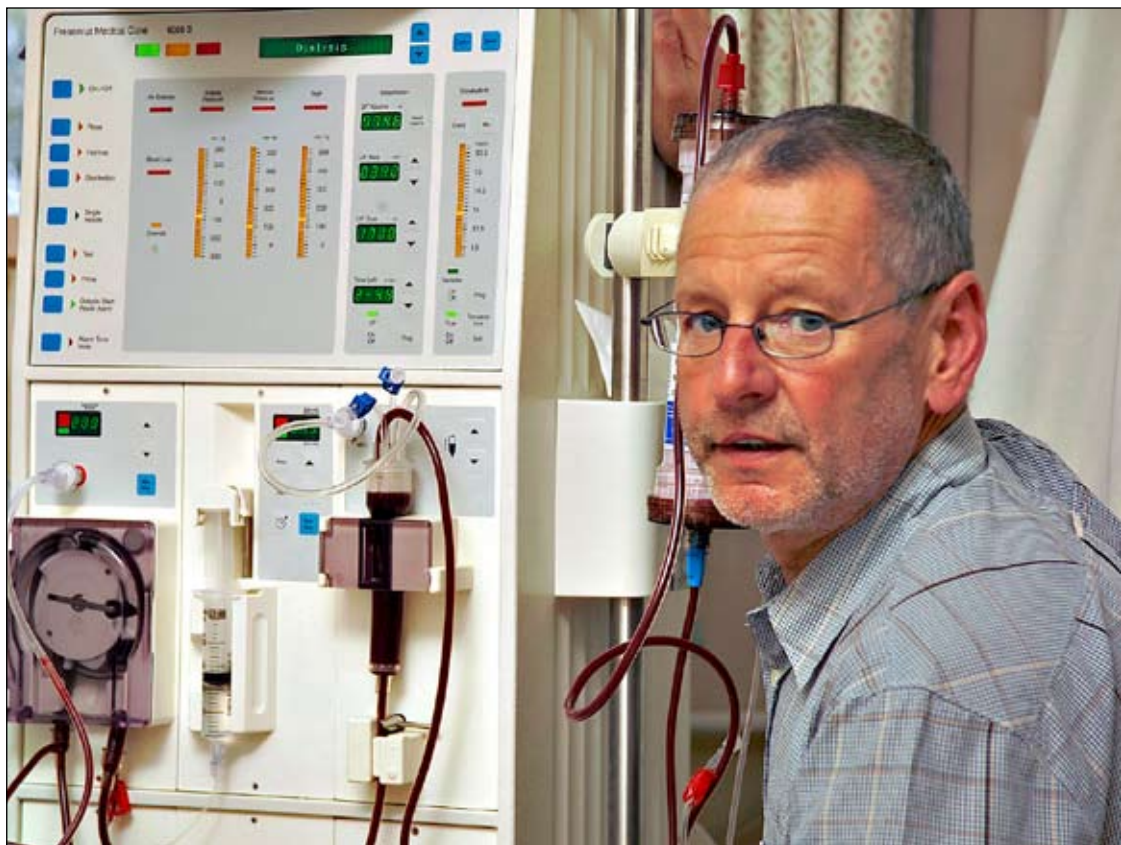
The different units used a number of dialysis machines at first, e.g. Gambro AK10, Drake-Willock 4011,4215, Cobe C2, and Fresenius 2000 and 4000. The dialysers were Kiil or mini-Kiil flat plates initially, and then a variety of disposable plate and hollow fibre dialysers.



Early Cordis-Dow hollow fibre dialyser



Cobe C2 dialysis machine in the Home Dialysis Training Unit in Christchurch



Adrian Buttimore with a Fresenius 4000B dialysis machine

Home dialysis patients and their families were incredibly resilient. Many lived far from their local hospital, let alone the kidney unit. Gloria Herrick began HHD in Orepuki near Te Waewae Bay in Southland in 1972. Her husband Neil was a local mechanic. Alan Dudfield, a neighbour, recalls that the community and the Tuatapere Lions Club raised money for the costs of the alterations of the Herrick's house. Alan remembers a scrap metal drive with contributions from local farmers being loaded on the train for transfer to Invercargill.

When Gloria's AV shunt clotted, she and husband Neil, would face a 1,250 km round trip by road to Christchurch Hospital to have the shunt 'declotted'.



Neil and Gloria Herrick. Home dialysis Orepuki 1972
Left leg AV shunt, Mini-Kiil dialyser and Drake Willock 4011 machine

In the 1980s, Bernie Lange, a dairy farmer on HHD in Harihari, South Westland, would make the round trip of 640 km to Christchurch for his dialysis review on the same day. He declined the offer of accommodation and a dialysis treatment in Christchurch to ensure he got home in time to milk his cows.

Lorna Maxwell, a farmer's wife from Methven, began HHD training in late 1992 aged 52 years. Many members of her family had developed kidney failure from an inherited kidney disease. She wrote the following poem for the staff at the dialysis unit about her experience of starting dialysis, after a year at home with the machine. Her optimism about the future was characteristic of patients who succeeded with home dialysis.

*Doctors decision, It is the time
To plug me into dialysis line.
This was something I really dreaded
But then I felt so lightheaded
I really didn't have a say
And trusted I would be OK.*

*My fistula was young and rather slow
The blood didn't have a very good blood flow.
Adrian (Buttimore) tried his very best
But still it didn't stand the test.
Grant then put in a neckline
To use in the meantime...*

*But there is another issue
I needed fluid out of my tissue
This done it was a delight
To see thin ankles and feel so light....*

*In a few weeks I'll be feeling great
And I hope that I won't hesitate
To leave the Christchurch dialysis team
And return to my husband will be a dream
To fulfil my role as farm partner and wife
And settle down to a normal life.*

Rob Brydon began HHD on 31 August 1976 just after getting married. After two failed transplants, the second from his brother Nev, he remains on HHD over 40 years later.⁵⁶



Rob Brydon with Kelvin Lynn 2017

⁵⁶ See Rob tell his story at <https://www.youtube.com/watch?v=JMXnyZyuVz4>

Most of this time, he worked full-time as an Automotive Parts Rep. for Wrightcars and Cable Price. Following redundancy in 1993, he started his own painting business which he ran for ten years until he had both legs amputated below the knee, bringing this to an end. Rob had a profound anaemia as the result of having both his kidneys removed to control his high blood pressure. He built his own house while his haemoglobin concentration was only 40 to 50 g/L, and subsequently Rob was one of the first patients in New Zealand to benefit from erythropoietin treatment for renal anaemia.

Rob remembers the burden of having to reuse dialysers and blood lines and the unpleasantness of using formalin for sterilisation. As with many successful long-term patients, Rob has found himself increasingly isolated from the kidney unit, due to his success on dialysis and changes in technology. When he started HHD, he was in frequent contact with the staff of the unit when he visited to pick up supplies. He enjoyed the chats that they had and if he needed some supplies urgently, he could access the home training unit after hours. His advice to other dialysis patients is to “try to keep your life as normal as possible.”



Mary Callander and partner Ian at home

Mary Callander from Alexandra started HHD on 4 Feb 1981 and now does nine hours dialysis overnight on alternate nights and works 20 hours a week as a caregiver. When asked her reaction to learning that she had kidney failure, Callander said: ‘That was a real crushing blow to what I was doing at the time. I was a land girl and I was engaged to be married. It was pretty devastating and I didn’t know how to cope with it.’ Callander’s marriage did not survive her going onto dialysis but she says that her family and friends were great:

Things were hard but I am very lucky where I am now [in her current relationship].

[The experience] developed you mentally and makes you more resilient. I was brought up to always have a very positive feeling about life. I always tried to feel that there was something better to come.

Callander’s advice to anybody going on dialysis is ‘Accept that you do need dialysis to

stay alive and be well. Live your life as good as you can get it. Keep a positive mind. Rely on your support and talk to them. Take in information.'

Before a national centre for the treatment of children and adolescents was established in Auckland in the early 1980s, children with kidney failure were treated by their local units. Anita Lloyd (née Jackson) now married and working full-time remembers the challenges of having treatment for kidney failure:



Anita Lloyd

My experience with kidney disease started on 15 June 1981 – a date I won't forget and a year that changed my life. As a "tired" 12-year-old living in Queenstown with my parents and brother I had a history of bed wetting and cramps and various other health issues. One day I went to school and couldn't focus on the blackboard. It turned out my blood pressure was so high that it had burst the vessels behind my eyes.

I spent a month in Invercargill Hospital and then was transferred to Christchurch Hospital under the care of Drs Bailey and Lynn. Long story short – my kidneys had failed due to reflux nephropathy and I started dialysis. We dialysed on the old Drake-Willock machines which, compared to today's machines, were archaic. You had to put formalin through the lines to sterilise them and if you spilt it you nearly had to evacuate the unit. Lines were used up to 21 times and the artificial kidney was used up to a week. Unheard of today. Dialysis was the pits – needles were so big and so painful.

However, the highlight I can remember was morning tea in the dialysis unit on the balcony near Ward 10 where we were served cheese toasties (still my favourite today). It seemed that once you managed to get those damned needles in that you would be starving, and these toasties always hit the spot.

My mother, who was my caregiver, spent over nine months under the supervision and care of the Christchurch unit learning all the ins and outs of dialysis and kidney disease before we returned to Queenstown. I received my first short-lived transplant during this time. We were taught in the Home Dialysis Unit which at that time was in an old house at 510 Hagley Avenue. The training staff were all extremely experienced and fun to have around in what was an extremely stressful situation.

Over the last 37 years I have spent time back on dialysis in Dunedin under the watchful eyes of Maree McDonald, Dawne McPhee and Liz Edwards – yet another awesome team. I am still in close contact with these wonderful people today because the rapport you have with them lasts for life. I have been so very fortunate to have received four transplants, all at Christchurch Hospital. 1981 (2 months); 1983 (2 years); 1987 (28 years) and 2015 (3 years and still going). While I wouldn't wish kidney disease on anyone, the friendships you make along the way are wonderful and have been a huge comfort to me over the last 37 years. I wonder where I would be now if it wasn't for the fabulous teams

in both Christchurch and Dunedin. Thank you is never enough.

Carlene Dalzell was another patient who started HHD at a young age. Carlene was nine years old when she became unwell on Christmas Day 1977 at home on the West Coast. She had severe hypertension from reflux nephropathy and started HD using an AV shunt in her leg at Christchurch soon afterwards. Carlene says that the only clues to her underlying condition were her short stature and history of bed wetting. 'No one thought to take my blood pressure.' Carlene remembers that some of the hardest things to adjust to were the fluid and salt restriction. A kidney transplant from her father in 1978 lasted 18 months and then Carlene and her parents trained for HHD back on the Coast. Carlene remembers that because of her size the dialysis lines were shortened. She remembers her father on the telephone to Kieran Smith, dialysis technician at Christchurch Hospital,



Carlene Dalzell (standing) and family

discussing solutions to machine problems. Sometimes a replacement part would arrive on the bus or Kieran would travel to the Coast to deal with more difficult problems. Carlene says she always coped with dialysis well. 'We just fitted life around dialysis.' Carlene parents managed her dialysis – five to six hours, three times a week – and she attended school full-time. She remembers enjoying fishing and swimming with the family and friends. Carlene had a deceased donor transplant in 1985 and the family moved to live in North Canterbury. This transplant lasted until she was in the sixth form. Carlene has been on HHD since then. She had a vein transplanted from her leg to her left arm (vein graft) for vascular access that lasted 30 years. Carlene now manages her own dialysis at home and works 35 hours a week as an administration clerk. The big improvements in treatment that she remembers were the change from reusing dialysis equipment to using disposable items and having access to erythropoietin. Carlene says that she has always managed well on dialysis and credits her family's support for a lot of this. When asked how

she has managed on HD for so long she said, 'I either do dialysis or I die.'

Her advice to other dialysis patients is:

- Do your hours
- Keep your drinks and salt under control
- Have your blood tests

At first, home dialysis meant dialysis in a patient's home but some patients did not have a suitable home or did not live in a traditional home. The Auckland District Kidney Society addressed this issue in South Auckland by providing community homes. (See p.93).

Eighty-nine-year-old Ken wanted to have HHD for his kidney failure. Keith and his wife Joy lived in a motor home and did not want to move into a residence. With the help of Dave Lilley, dialysis technician at Auckland DHB, and Frontier Motor Homes they were set



Ken and Joy in their motor home

up for dialysis on the road. Another patient living on a yacht also had a dialysis machine installed for his treatment.

Globally, there is a resurgence of interest in home dialysis, driven by the identifiable benefits and also the need for containing costs. In New Zealand there is still a consensus amongst health professionals that where clinically appropriate, dialysis at home is preferred to dialysis at medical facilities. There are significant medical and social barriers to increasing the rates of home dialysis. Recent studies have shown that although HHD can be disruptive for families, measures of general and psychological health and the likelihood of employment are superior when compared with centre or satellite dialysis. In recent years the number of people on HHD has remained stable with the growth in home dialysis being in patients on PD. In 2016, 47 per cent of all dialysis patients were on home dialysis – 486 on HHD and 823 on PD. New dialysis technology will likely make dialysis at home more achievable and necessary.⁵⁷

⁵⁷ Lynn KL and Buttimore AL. Future of home haemodialysis in Australia and New Zealand *Nephrology* 2005;10, 231–233.

4

Chronic Dialysis Treatment of Children and Young People in New Zealand

Max Morris and William Wong

Chronic dialysis in children and young people began in several leading renal centres in the USA, Europe, and the UK in the 1960s. The chronic intermittent haemodialysis (HD) programmes in Christchurch, Wellington, Hamilton and Auckland first treated older teenagers and then younger teenagers by the early 1970s. At that time, vascular access was often by arteriovenous (AV) shunt rather than AV fistula, and so access difficulties, like shunt clotting and infection, limited HD treatment in younger, smaller, and lighter teenagers or children. Dialysis access by AVF was also more difficult to establish in these smaller individuals.

In 1982, Christchurch Hospital's Department of Nephrology reported the first published account in New Zealand of the treatment of children with 'end-stage renal failure'.⁵⁸ This study noted that of 12 children started on HD, nine were aged 13-15 years, but there were also three younger children: two aged nine years, and one aged seven years. Subsequently, all received successful transplants.

In 1980, Max Morris established the paediatric dialysis and transplant programme in Princess Mary Hospital for Children, on the Auckland Hospital campus.

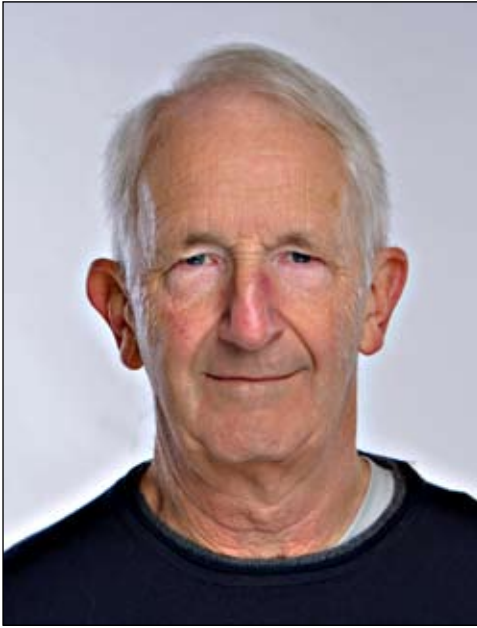
Both CAPD and chronic centre haemodialysis were offered, but not home HD. Morris had learned how to supervise both methods of treatment during his training in Vancouver (1974-76), and at Guy's Hospital in London (1978-80). Chronic HD in adults was established in Vancouver in 1964. When paediatric nephrologist, Dr David Lirenman, joined the Department of Pediatrics in the Health Center for Children at Vancouver General Hospital in 1966, teenagers down to about 15 years old were on the adult programme.

In 1968, the Seattle development and description of the Tenckhoff catheter for peritoneal access revolutionised the management of younger teenagers and children with ESKD. In the same year, Lirenman started a chronic peritoneal dialysis (PD) programme for children that required patients to be admitted to hospital for intermittent PD twice a week. The first session began after school on a Tuesday afternoon through to Wednesday morning, and the second from Friday after school through to Sunday morning. This allowed the children to attend school five days a week and also have some time at home with their families during the weekend.

Morris worked in the Vancouver paediatric renal service as a senior resident for four months during a rotating residency and then as a Renal Fellow, gaining extensive experience in the management of these patients. He also worked with a number of older teenagers who were on chronic intermittent haemodialysis, mostly with AV shunts, and so gained experience in this type of treatment as well.

After Morris's training in Vancouver, he returned to the Princess Mary Hospital for Children as a lecturer in the Department of Paediatrics at the University of Auckland's School of Medicine, and as a consultant paediatrician with a special interest in nephrology in the hospital. In addition to accepting renal referrals from other paediatricians around Auckland

⁵⁸ King, SY, Buttimore, A, Lynn, KL and Bailey, RR. Active treatment of children with end-stage renal failure. N Z Med J 1982; 95:763-66.



Max Morris

and beyond, he was invited to supervise the chronic HD treatment of a small number of young people, who had been transferred to the adult service at the time of kidney transplants.

In 1978, Morris was awarded a Commonwealth Medical Fellowship, enabling him to undertake further training in paediatric nephrology at Guy's Hospital. Guy's had large adult and paediatric HD and kidney transplant programmes, but no chronic PD programme for either adults or children. Initially, the children and young people on chronic HD were managed in the hospital's dialysis centre, but then some were transferred to a well-established large paediatric home haemodialysis programme. Morris's role as senior registrar was to supervise all the paediatric patients on both centre

and home haemodialysis (HDD), as well as the paediatric kidney transplant patients. At around this time, Dr Rosemary Baillod introduced CAPD for children at the Royal Free Hospital in London.

When Morris returned to Auckland in March 1980 as a paediatric nephrologist and general paediatrician, an adult CAPD programme had already been established. The first adult patient was treated in late 1978 by Dr Elizabeth Bowie and Staff Nurse Geraldine McLean. The programme was later managed by Dr John O'Connor, senior renal registrar, supervised by nephrologist Dr Martin Gregory. The number of patients on CAPD grew rapidly and by August 1985 there were 66 adults and four child patients in the programme.

The Auckland Paediatric Dialysis and Transplant Service

The philosophy of management of ESKD in children was to keep the period of pre-transplant dialysis as brief as possible before proceeding to living related donor (LD) kidney transplantation if available. Most children with ESKD did not have other major comorbidities and could be considered suitable for kidney transplantation. The first patient treated in 1980 was a nine-year-old boy, who had four weeks of haemodialysis before receiving an LD transplant from his father on the boy's tenth birthday. The second patient that year was a ten-year-old boy who also had four weeks of haemodialysis before receiving a transplant from his father.

In 1982, the third child entering the programme, a nine-year-old girl, was on HD for seven months before her treatment was changed to CAPD. This had the great advantage of its being a home treatment, allowing her and her parents to return to their home in Whangarei after they had stayed in Auckland for the previous seven months. Her schooling was continued during this time. The success of CAPD in this child, the first to be so managed in the paediatric programme, encouraged the subsequent use of CAPD as the first type of dialysis offered to children from Auckland and other centres further away. To quote Geraldine McLean:

The paediatric programme was small but extremely rewarding. Incredible patient S who at nine years and 21 kg learnt to change her own bags and by so doing built up

her self-esteem tenfold. Her mum and dad worked so hard to keep her peritonitis-free up until the day she was transplanted. She, as well as every other patient and all nurses, knew why the tops MUST be put back on the bottles because a nine-year-old



A pre-school age child having a peritoneal dialysis exchange on the back of a utility vehicle shows flexibility and allows a relatively normal lifestyle

told us 'the flies sit on them.' The next two children on the paediatric programme with their bags and tubes barely missed a beat.

In April 1982, the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA) reported that two per cent of all patients on dialysis in New Zealand were using CAPD, compared with 19 per cent in Australia. From the outset in 1980, the St Mary's Hospital paediatric renal service served the greater Auckland region and Northland, but child patients were also referred from other North Island paediatric centres. The first transplanted patient was referred from the Bay of Plenty via a senior Princess Mary paediatrician. Referrals continued from paediatric centres both in the North Island and the South Island, especially Christchurch, over the first ten years of the service.

A major stimulus to the development of the Paediatric Nephrology unit at Starship Children's Hospital as the recognised national referral centre was co-ordinating work done by the Paediatric Society of New Zealand. The Society established over 30 national working groups to comment on and make recommendations for the future development in New Zealand of all the paediatric medical specialties, including paediatric surgery and paediatric urology.

This process resulted in the publication of the report *Through the Eyes of a Child* in 1998.⁵⁹ The report proposed a 'hub and spoke' structure for paediatric nephrology in New Zealand, designating Starship Children's Hospital as the national centre for specialised renal care. This would include acute and chronic dialysis and paediatric transplantation.

⁵⁹ <http://www.moh.govt.nz/notebook/nbbooks.nsf/0/B3686799E759224A4C2568D100777FBB>

Local centres would develop liaison paediatricians with a special interest and develop expertise in the management of children with kidney disease. Of course, this had already occurred informally in several of the larger metropolitan and regional centres. The report also led to the establishment of outreach clinics by the Starship Children's Hospital's paediatric nephrologists to the various metropolitan and regional centres. The local centres' paediatricians nominated which specialties they most wished to visit in this way (and for which their hospital could pay). The paediatric renal clinics were prioritised by most centres leading to a rapid expansion of the outreach programme to all of the larger and most of the smaller centres in New Zealand.

Over the first decade 1980-89, 19 children started on chronic dialysis with the intention of proceeding to kidney transplantation. Of these, two presented in kidney failure so advanced that emergency acute PD by stab intraperitoneal catheter was required before they started chronic dialysis. In addition, in 1986, one child had a pre-emptive kidney transplant (no preceding dialysis). Of the 19 children, three did not get a transplant. Two children developed other serious health problems (progressive bronchiectasis in one, and a progressive cardiomyopathy of uncertain cause in the other) and other dialysis complications. It was gratifying that there were no deaths in the transplanted group and excellent graft survival. At first the lower age limit for acceptance into the programme was five years, but with increasing nursing and medical experience and confidence the age limit was lowered to two years in 1987.

Dialysing younger children brought new challenges: the ability to provide adequate nutritional support for rapidly growing young children, the prevention of peritoneal infections, and the provision of adequate solute and water clearance (dialysis efficiency). The conventional 'four times per day' exchanges of dialysis fluid used in adolescents and adults were soon recognised to be unsuitable for younger children who have higher nutritional requirements and absorb glucose from the dialysis fluid more rapidly. Waste products that accumulate in the blood of children with kidney failure also pass through their thinner and more porous peritoneal membrane more rapidly than in those of adults. To be efficient, this requires the dialysis dwell time to be shorter and makes standard CAPD less suitable as a treatment for children, especially younger children.

This prompted paediatric nephrologists to experiment with more frequent, shorter dialysis exchanges, and led to the development of automated dialysis machines for children where the treatment could be conducted overnight with very short dwell times while the child slept. This left the child free to attend education and other structured programmes during daylight hours.

Automated Peritoneal Dialysis (APD) machines were introduced in 1981 by USA doctors in Charlotte and Houston. They soon came to be regarded as essential equipment for chronic paediatric PD. The introduction of APD to the New Zealand paediatric dialysis programme did not occur until the early 1990s as it was felt by the health authorities to be an unaffordable luxury. The first child in New Zealand was started on APD in 1995. His family and the local community had to undertake a fundraising campaign in order to pay for the automated cyclers themselves. The access to cyclers continued to remain problematic until the turn of the 21st century when it was accepted by health authorities that APD was the best form of paediatric PD. Since then APD machines have become better customised for dialysing young children and even infants.

The importance of optimal nutritional support has been long recognized to be crucial to the success of caring for children with ESKD. The use of gastrostomy feeding tubes in paediatric patients on PD was first reported by doctors from The Hospital for Sick Children in Toronto in 1999. These experts cautioned about the use of gastrostomy feeding in PD

patients because of an observed increase in the frequency of fungal peritoneal infections associated with it. In a recent study from the Starship Children's Hospital unit, this was shown to be a safe method of nutritional support in PD children without a significant increase in peritonitis.⁶⁰

The commonest type of chronic dialysis used in the Starship programme has been PD, with fewer children on chronic HD. One of the reasons for this is that the HD facility was under the umbrella of the adult HD service and up until 2003, children requiring chronic HD were cared for in an adult outpatient HD facility, mostly in a specially designed separate child-friendly room. Since then, paediatric HD has taken place mostly at Starship, although children have still had to be dialysed in the adult acute unit on many occasions. At Starship, long-term dialysis in newborn infants remains a rare occurrence with one case occurring every three to four years. This is a highly specialised field and local success in this area has been variable. There are national guidelines to assist neonatologists in making decisions about whether a newborn child should be considered for chronic dialysis.

⁶⁰ Prestidge C, Ronaldson J, Wong W, Stack M, Kara T. Infectious outcomes following gastrostomy in children receiving peritoneal dialysis. *Pediatr Nephrol* 2015; 30:849-54.

5

Renal Nursing in New Zealand

Ailsa Jacobson, Nick Polaschek, Miranda Walker, Kelvin Lynn

The essential role that nurses played in the development of services for people with kidney disease in New Zealand is illustrated by these accounts from Wellington and other centres. Nurses, usually with no previous experience, were important members of the first clinical teams that started dialysis treatment in the main centres. In the regions where there were no nephrologists, local nurses, trained by the early renal units, provided essential local care for patients in areas such as Taranaki and Whangarei.

Renal nursing at Wellington Hospital

A small group of nurses worked with the first renal physicians to establish the Wellington Department of Renal Medicine. While the first acute dialysis treatments were carried out by senior medical staff assisted by nurses, expansion of dialysis services to manage a growing group of chronic patients was dependent upon a group of skilled nurses who could carry out the treatments on their own and train patients to treat themselves.

Nurses working during the 1960s and 70s acquired a widening range of new knowledge and clinical skills to meet the needs of patients using the new treatments that were becoming available for end stage kidney disease (ESKD). In developing their clinical practice, these nurses helped establish what gradually came to be known as the new speciality of renal nursing. Working as a nurse in the renal service was attractive in the early years and many remained for a long time. Wendy Clarke comments:

I first heard about renal nursing from a couple of friends who were working in the field. They shared similar qualities – a great sense of humour, hard workers and intelligence. But perhaps most importantly in my eyes they were independent thinkers who enjoyed trying new things and working outside the staid nursing mould we had been exposed to as student nurses. This was enough for me to be intensely interested in the renal field and on entering the unit I realised that I had found my niche. The ability to work autonomously surrounded by highly capable and experienced senior nurses who were used to making clinical decisions based on their observations and knowledge made for a work environment that was hard to beat.

For some nurses, the requirements of the work were intimidating and they soon moved on, but for others it offered an ongoing challenge to develop new skills and use them autonomously in a context where learning and practice were supported by the renal team, in particular the renal physician group. Marilyn Odnot writes:

This environment, overseen by medical staff who actively supported and encouraged nursing input in clinical decisions and all aspects of care planning, led to the introduction of continuous ambulatory peritoneal dialysis (CAPD) following my visit to a conference in Australia where a paper was presented describing the process and

its implementation. On return from the conference I approached the renal physicians to talk about CAPD and heard they were already considering the introduction of the treatment and I think my youthful enthusiasm helped to persuade them that this was a viable and indeed very necessary step to take.

Team work was the key to expansion of the renal service. In an era when hospital services were typically hierarchical, both between and within the various professional health disciplines, the Wellington department had a team approach well before this had become accepted as a way of working in health. Nurses in the department were recognised as having a distinct professional role in patient care, based on their specific expertise: just as did medical staff, dietitians and social workers. Ailsa Jacobson notes:

The physicians were unwavering in their support of the nursing work we were doing – our contributions in ward rounds were always listened to respectfully and our opinions were sought out when clinical decisions regarding treatment, needed to be made. Ward rounds occurred twice a week and were undertaken in the large lounge in the middle of the ward. Apart from the medical and nursing staff we had regular attendance by a service manager, a pharmacist, a dietitian and a social worker, dialysis technician. Frequently we would have the consultant psychiatrist present. All these people made an incredibly valuable contribution to the plan for current and ongoing care and were routinely approached for their input.

The first 'renal nurses' in Wellington were recruited by Charge Nurse Wendy Couchman in response to her increasing workload. She was then the only nurse able to carry out haemodialysis (HD) treatments (prior to the employment of any qualified dialysis technicians). Nurses with renal experience were few and far between, and so were sought-after and snapped up if they were returning from overseas with renal experience. In 1968, the renal service shared Ward 22 in the Seddon Block at Wellington Hospital with cardiology. Marilyn Odinot comments:

Ward 22 at that time ticked all the boxes for me. The nursing was interesting, challenging and at times extremely stressful but I learnt so much about the specialty from the more experienced staff as it was a real 'hands on' approach to learning. Above all, my most enduring memory of this time was the phenomenal team spirit and energy that existed within the ward staff. Although the shifts were often so busy and the work load demanding, I always felt incredibly well supported by both the nursing staff and doctors.

Patients who were admitted to the renal ward included all those who were starting dialysis, as well as those undergoing transplantation. Any patients who became unwell for any reason while they were established on dialysis or on the transplant programme were also admitted to the renal ward. Both the HD and PD programmes began in the ward, initially as acute services and subsequently, when chronic treatment became more established, located in two home training houses in a local suburban street nearby. The ward provided respite care, much appreciated by families, and also terminal care for dialysis patients. Marilyn Odinot explains the procedure for PD:

Initially peritoneal dialysis (PD) was carried out acutely as an in-patient only (48 hours consecutively once a week), for those in whom haemodialysis was not an

option, or for those who needed acute haemodialysis and we were waiting for the fistula to mature. So, a stab catheter was inserted into the abdomen in a side room in the ward. Hourly exchanges of PD fluid for 48 hours, home for a week and then return the next week for another 48 hours dialysis. These dialysis exchanges had to be carried out by the only registered nurse on duty; sometimes there could be four or more patients requiring hourly dialysate changes. This as well as looking after a full ward (30 patients) with renal and cardiac patients and relieving the nurses in the Coronary Care Unit for their meal breaks!

HD opened up a new dimension of nursing practice which combined highly technical knowledge and skills with already well-established psycho-social skills embedded in chronic care. Wendy Clarke comments:

I loved the combination of patient and machine and managing both aspects independently and together. The technology was constantly improving and the patients were long term and always interesting.

Establishing these treatments was often a process of learning by trial and error. For example, in early HD treatments the composition of the dialysate in the 'washing machine-like' Kolff machine was altered 'on the fly' by the nurse adding spoonfuls of specific salts from various jars to the dialysate mixture on the basis of half-hourly blood results phoned from the lab and recorded on a blackboard. Wendy Clarke again:

Those old Kolff dialysis machines! The old washing machines... oh my god; a dessert spoon of this and a dessert spoon of that went in... and then the coil would rupture and you had blood all over the place... we used to call it 'pinkies in the water'.

Those few skilled nurses often worked very long hours. For example, when a deceased donor kidney transplant occurred or an acute dialysis was required in the Intensive Care Unit (ICU). These treatments were often complicated by clinical emergencies such as cardiac arrests. The work involved challenges for nurses that would be difficult to imagine in today's context: evacuating the ward and calling the fire brigade to manage a spillage of formalin (used to sterilise the dialysis machines); having to return home to change one's clothing after having been covered in blood (from a ruptured coil dialyser); kneeling on a trolley pressing on a bleeding artery as a post-transplant patient was wheeled back to theatre; holding onto the leg of a psychotic patient (on high dose steroids to treat rejection of their kidney transplant) intent on jumping from a window. For some, this dynamic setting was too much and they left; others relished it and stayed. Marilyn Odinot remembers:

As each of the various new therapies (in-centre and home haemodialysis, transplantation, in-centre and home continuous ambulatory peritoneal dialysis) were successfully introduced, the range of patients able to be treated widened. As a result of this relentless growth in patient numbers the ward was generally full, often to overflowing with beds sometimes in the dayroom or even the corridors, and clinical equipment stored everywhere. The shortage of space, equipment and staff was endemic. From the renal staff perspective, hospital management was sluggishly reactive to the needs of the service, in an era when proactive strategic planning of clinical service delivery had not yet been contemplated.

In 1988, a new dedicated renal ward (Ward 40) under the leadership of Charge Nurse Jasmine Plimmer, was established in level 2 of the newer Ward Support Block at Wellington Hospital, together with the dialysis unit and outpatients clinic. This continued co-location of services was unique yet crucial, not only for maintaining the specialised nursing workforce and supporting collaborative interdisciplinary teamwork, but it also gave long-term kidney patients a home base in the hospital. Patients, their families and staff highly valued the co-ordinated approach.

Renal nursing at Dunedin Hospital

Maree McDonald remembers her first exposure to patients with kidney failure and dialysis as a student nurse in Dunedin. In 1966, when nursing on her first ward, she looked after two young men with nephrotic syndrome. They died of kidney failure within 24 hours of each other. No dialysis option was available. In 1968, McDonald remembers performing acute PD in the side room in the Dominion Ward of Dunedin Hospital. She wore a gown and mask for the eight-hour shift. The PD fluid was in glass bottles which were heated in a metal bath filled with warm water. The fluid balance chart was pivotal in the treatment being successful. She remembers that by 1969 one of her patients with kidney failure was transferred to Auckland for HD.

The renal nurses and dialysis technician, Ray Parker, worked ten to 12 hours on Mondays, Wednesdays and Fridays, caring for patients dialysing for ten hours with Kiil dialysers and a Drake Willock proportionating machine. Patients requiring PD were 'specialised' in the ICU by dialysis staff. After undertaking a postgraduate dialysis and renal transplantation course at the Royal Free Hospital in London, McDonald was appointed Charge Sister in early 1975. She recalls that in the early days of the Dunedin renal unit before the appointment of ward clerks and department secretaries that:

The renal nurses were responsible for not only providing acute and training HD, PD training, acute and chronic plasma exchange and community support but were expected to undertake all clerical duties, stocktakes, data input, answer endless phone calls and order all supplies.

The on-call service delivered by nurses has changed over the years. In the early 70s and 80s the only means of contact was by landline phones. Tracers were an improvement but were often unreliable and still required access to a landline. It was only with the introduction of the cell phone that being on-call for nurses became less restrictive.

Following Dawne McPhee's retirement in late 2002, Maree McDonald took over as Charge Nurse for the Dunedin Renal Unit again.

Renal nursing in the regions

Shona Barlow, a District Nurse in New Plymouth, was recruited in the mid-1980s to care for patients on PD in Taranaki. After training at Wellington Hospital, she was a sole practitioner with no local nephrology support. It was challenging to get management to acknowledge the resources that were required to support these patients on home CAPD. Any patient requiring hospital treatment was transferred to Wellington Hospital. Barlow recalls some early challenges:

I was given little help but I just got on with it, frequently returning back to the district office long after everyone else had gone home for the day. I also had to work hard at getting acceptance from the Māori community who very politely told me they wanted

their own Māori nurse. Once they accepted that there was no choice, they really supported me, and, in fact, often demanded my presence when they were admitted to hospital and would not trust any of the staff to do their treatment.

One of my first patients lived in Waitara and I would phone her and set up a time to go to see her but when I arrived, after a twenty-five-minute drive, she was not home, or wouldn't open the door. After this happened three times I was feeling very frustrated so on the next visit I drove to Waitara first, then phoned and set the time for 25 minutes later but turned up in five minutes. As I arrived I saw her at the window, then she disappeared, and then I saw her run into the garden and hide behind shrubs. I found her in the garden and the poor woman was very frightened. She was not doing her dialysis correctly and was frightened of the whole procedure believing that the dialysis fluid was draining her soul away. I spent a lot of time with her and gained her confidence and she never refused to open the door again, but she could not change her beliefs and so her compliance was very poor. I tried hard, but sadly she did not survive for long.

Ellen (Mo) Atkinson (née White), remembers a patient with acute kidney failure being treated with HD at Whangarei Hospital in 1978. The patient had suffered a road traffic accident that required urgent bilateral lower limb amputation. It was considered that urgent dialysis was necessary before the patient could be transferred safely to Auckland Hospital. The lead dialysis nurse at the Whangarei Hospital was a midwife who had had extensive haemodialysis experience in South Africa and Ellen had experience of dialysis treatment at Wellington Hospital in 1972. Ellen still works in Whangarei as a Clinical Nurse Specialist and the patient was still alive in 2013.

Home dialysis

Renal nurses and clinical technicians (see Chapter 6) played a crucial role in the establishment of home dialysis services. Self-managed dialysis at home enabled many more patients to be offered treatment and was enthusiastically adopted in New Zealand in the early years after maintenance dialysis was established. This was partly because it was the only way to enable people living far from one of the few renal services to continue their lives at home, but it was also because it enabled independence and a better quality of life for patients. In Wellington, the development of self-care dialysis at home was led by the specialist nursing staff who set up the home training units and worked with the medical staff to establish the treatment protocols, training methods and materials. The specialist home HD and PD nurses developed their own training resources (often modifying those available from the dialysis companies) which they tailored to the needs of the individual patient and family. Ailsa Jacobsen recalls:

We were not given any formal education advising us how to provide adult training. So, it was all of us learning together. I remember one patient (on CAPD) when I was trying to simplify the information by indicating what I thought was a novel way of explaining the different strength dialysates, that it was like adding more teaspoons of sugar and the more sugar added the more fluid he would take off. At the end of the session he said 'thanks but I prefer the extra sugar in my tea'!

In an era when most patients with a significant health condition simply received health care services, the renal service aimed to empower patients to be independent. Nurses encouraged and worked alongside patients to enable them to take responsibility for their own care.

There were novel challenges to helping patients to achieve self-care dialysis in their own home as noted by Margaret Woodbridge:

I guess one stand out is when I took the first home dialysis patient home. We did not have technicians then so relied on local plumbers etc. to have everything ready for the machine. He lived in a rural central North Island town and as city girl I had only ever driven through – it seemed so far away. I went to the patient's home first. I clearly recall he had three or four very young children running around while we tried to set up clean areas and places to keep poisons, needles etc. – I do not think I had given any thought about the impact this was having on the young family (something that is now well documented).

I went to see the local district nurse who was completely overwhelmed at the prospect of any responsibility and the GP, who was equally feeling it was not a viable option for him to be able to cope with. Luckily the patient was amazing and he and his wife were very competent. Once he was cannulated and on for the night I went to stay at the local pub. It was freezing and I huddled in the cold room very apprehensive about anything going wrong in the night. There were no cell phones and I was relying on a call via the hotel if I was needed. To top it off there was a brawl and lots of bottle throwing in the bar downstairs so I doubt if any one would ever have heard the phone ring! Next a.m. I found them extremely happy and all had gone well as it continued to for some time.

By 1975, the HHD nursing team, led by Marg Woodbridge, had their own home dialysis house at 62 Owen Street in Newtown, where patients learning dialysis could live several streets away from the hospital's renal ward. From the beginning, they were encouraged and supported to become independent. Critical to success in training people to manage their own care was the staff's conviction that the patient could achieve this. Training for HHD in a house rather than a clinical hospital setting reinforced this approach.

Ailsa Jacobson and Kathy Flynn (née Faircloth), set up the CAPD training unit in 1979/80 in a residential home owned by Wellington Hospital, situated a few doors away at 38 Owen Street. Under their direction the house was modified for PD training and accommodation for patients and their families during their training. Ailsa Jacobson reports:

We spent a lot of time coming up with new and innovative ways of ensuring that the patients as much as possible were able to continue to work and play as usual. We visited the patients' employers. We found out what each patient's leisure activities were so that we could find ways of them continuing their lives while changing their bags to retain as normal as a lifestyle as possible. For example, advising a patient how to go tramping and change her bag in the bush safely. We worked on the basis that we had a responsibility to make the life of a patient less onerous. Very little was out of bounds. We devised a local way of training a patient who was blind to change his bag in a sterile manner. It worked.

The nurses developed close relationships with the patients and their families, which established a basis for providing ongoing support to the patients when they went home to undertake their own treatment, supported by on-call nurses, regular home visits and clinic assessments with the nurses and the physician. Patients often developed a high level of expertise in the management of their dialysis, in particular in assessing their fluid balance and maintaining sterility on PD or cannulating their fistula on HD.

Continuous ambulatory peritoneal dialysis (CAPD) in the Waikato

Sue Steel began work as a renal nurse in the Waikato renal unit in September 1979 when CAPD was starting in New Zealand. Over her career, Steel experienced the changes in technology from one litre glass bottles and spiked tubing and a hospital based-treatment to modern home-based CAPD with plastic bags, disconnect tubing systems and a range of modern dialysis fluids. When introduced, CAPD offered an important new therapy for people with kidney failure that was far superior to the current intermittent PD.

Steel remembers stab PD catheters being used in the 1980s to treat patients presenting late with ESKD and no vascular access for HD. Acute, intermittent PD treatment was uncomfortable for patients and time consuming for nursing staff. Technical problems and peritonitis were common. At first hot water bottles were used to heat the dialysis bags and stored in chilly bins. Now patients and staff have the convenience of microwave ovens. The renal nursing role changed from managing acute intermittent PD episodes for in-centre patients to teaching patients to manage self-care CAPD. Next they provided them with support to do their own treatment at home, and in particular, managing situations when the patient had problems with the treatment or became unwell at home.

In the Waikato, CAPD was the preferred mode of self-care renal replacement therapy. By 1989, Steel and Trish Valentine were looking after 51 patients on CAPD across the Waikato region and training nurses in Rotorua, Tauranga, and Whakatane (later Gisborne as well). These nurses took over the day-to-day care of their patients. This work was done in close liaison with renal physician, Martin Wallace, and the renal registrar. Multi-disciplinary meetings were held weekly at this stage involving renal medical and nursing staff, a dietitian, pharmacist and psychologist. By 1993, the PD unit could no longer accommodate the burgeoning CAPD population and the unit was shifted to a renovated building, described by the current manager as “opulent”. This was home for the next 20 years. The staff were more than happy.

By 2010, the Waikato unit had 261 patients on CAPD. Steel attributes the wealth of experience of the nursing staff and improved standards of care both during the training and in the community, for reducing the rate of peritonitis over that in the previous 30 years.⁶¹

Transplantation

The first deceased donor kidney transplants were acute and unplanned events requiring intensive work from the renal team, starting with contacting the recipient, arranging their transport into the ward and preparing the patient for surgery. Following surgery, the team set up the space and staffing to manage the patient postoperatively. At Wellington Hospital, patients who had received transplants returned directly to the ward from the operating theatre (rather than after 24 hours in ICU, as became the practice later). A single nurse cared for patients in full isolation in Ward 22 Wellington Hospital, with only sterilised equipment allowed in the cubicle. In the early years of kidney transplantation, sometimes things did not go to plan as related by Wendy Clarke:

We also had many patients who underwent renal transplants and sometimes it went well and sometimes it turned into a terrible decline as they rejected the kidney and endured not just the effects of anti-rejection therapy but the knowledge that their dream of getting off dialysis was crushed and they would need to pick themselves up, do their best to recover and carry on as before. Some didn't make it and despite all our efforts infection would intervene or they just weren't strong enough to stand the rigours of transplant therapy.

⁶¹ Further information regarding national peritonitis rates available at <https://www.health.govt.nz/about-ministry/leadership-ministry/expert-groups/national-renal-advisory-board/papers-and-reports>

The Wellington Transplant Clinic within Ward 22 was established to co-ordinate workup of potential transplant recipients and to provide support after the patients were discharged. As well as co-ordinating the clinical testing and medication regimens, the nurses in the transplant clinic carried out important tasks, such as educating those considering transplantation, teaching them about post-transplant self-care, and giving ongoing support for people who had received kidney transplants. This comprised a strong dimension of psychosocial support, initially helping the patient and their family adjust to life with a transplant after years of living on dialysis. This support also included managing any episodes of rejection or other complications and sometimes the need to return to dialysis when a kidney failed. Elna Lindsay relates her tasks as a clinic nurse:

Being [a] Transplant Clinic nurse was the best job in the whole hospital. I used to do daily bloods on the post-transplant patients while they were still in hospital, all the one-day renal function tests on the outpatients, run the renal clinic... Transplant patients would come in every day to start with, then once a week, then once a month when everything was stable ... You sorted things out when there was a concern, and got the bloods and the results, and decided when they should come back, recorded everything on those very large flow charts.

This clinic, operating in the 1970s, was an early forerunner of what have now become known as nurse-led clinics in other specialities.

Specialised roles in a new nursing specialty

New roles for nurses undertaking HD, kidney transplantation, or PD, gradually evolved to meet the new clinical needs of patients as the various different types of treatments for kidney failure were introduced and refined. In the 1970s the advent of self-care dialysis created new sub-specialty roles, requiring nurses with renal knowledge and skills who could also teach patients to undertake their own treatment, and then provide home support.

At that time, this was a unique nursing group, separate from the hospital-based community nurse role, a forerunner of the range of special nursing roles in the community, such as palliative care nurses. Subsequently, further innovative roles were developed, such as pre-dialysis educator, dialysis access nurse and renal nurse educator. Specialist nursing roles were integral to the development of the new types of care, with nurses acquiring the specific clinical skills to manage the routine care of specific groups of renal patients.

Typically, during the first two decades of the treatment of kidney failure at Wellington Hospital, renal nurses had a high level of independence in their decision-making. Nurses developed protocols and procedures for treatment at home (early dialysis prescriptions), for training and for management of complications of treatment.

They prepared these protocols in collaboration with the medical team and technicians and by using available literature and information from dialysis companies. Using them, the nurses determined and varied the dialysis prescription and management of complications like peritonitis (including hospital admission).

Doctors expected that nurses would decide when to refer to them. In early acute HD in the ICU, it was common for the only specific medical instruction to be the target fluid removal for the session: the renal nurse managed all other aspects of the dialysis. The specialist renal nurse in the 1970s and 80s operated at a level equivalent to a nurse practitioner today.

We were on call 24/7 and whenever a patient developed peritonitis, we were rung. We frequently intervened to ensure that appropriate treatment was commenced in a timely manner. I remember having a heated discussion with one of the renal physicians about an infectious disease physician in one of the regional hospitals who was not recommending best practice treatment and putting the patient's recovery at issue. It wasn't an isolated incident! (Attributed to Ailsa Jacobson)

Caring for the patient

The technical expertise of renal nurses was complemented by skilled psychosocial care. Renal nurses spent long periods of time with their patients and got to know them and their families very well. Home training nurses in particular developed close relationships, becoming mentors and confidantes to the families in their care. Wendy Clarke has fond memories of this time:

We used to make breakfasts for those dialysis patients [in training]. We would have bacon, eggs, tomatoes and toast if they wanted it and we used to cook it up in the kitchen. Oh, the smell, and the patients used to love that food as it was a forbidden meal at any other time. Eventually those meals were stopped — it didn't cause a riot but we were sorry too as we knew what it meant to our patients.

At its best, the relationship between the patient and the nurse had, from the patients' point of view, a degree of equality, sometimes signalled by their speaking of a "friendship". From the experienced renal nursing perspective, this indicated that the professional relationship was being successfully negotiated with the patient, by the skilled and empathetic nurse. However, in a complementary fashion, renal nurses themselves often talked of "learning from their patients", a comment reflecting both the openness in the clinical relationship and the capacity of some experienced patients to contribute to the education of renal nurses themselves. Nick Polaschek recalls:

Starting as a nurse in the dialysis room, a key skill was cannulating a patient's fistula with needles to access their circulatory system. As a dialysis nurse you not only had to have the skill, you had to have confidence in your ability that you could transmit to the patient, especially a new patient, and maintain even if you were initially unable to successfully get the needles correctly into their new fistula. Some of the patients had been there for years and were reluctant, often vocally, to have new nurses cannulate them. But there was one elderly man, a real gentleman, with a large obvious fistula who would happily guide new nurses through cannulating it. Getting used to his fistula helped new nurses build their confidence before approaching other patients.

Developing such close relationships had a cost for renal nurses, in particular when a patient reached the point where they stopped treatment and subsequently died in the renal ward. Wendy Clarke remembers:

I remember one young dialysis patient who decided she no longer wanted to continue with dialysis and came into the ward to spend her last days in our care. She was a beautiful young thing with no family support at all and we felt privileged to spend those last days caring for her as she died from renal failure.

Often it was the nurses to whom patients turned while reflecting on such a decision. Supporting patients and their families over time to cope with the stresses and uncertainties of renal failure and its treatments was often stressful for nurses and other renal staff. Informal mutual debriefing came to be supplemented by professional psychological counselling.

Training renal nurses

At first, the training of nurses to undertake the various renal nursing roles was provided by senior renal nurses in the department, who developed their own expertise while working with physicians during the introductory phase of new therapies. Many of the first senior nurses had undertaken renal courses while working overseas, at places like London's Guy's Hospital or Melbourne's St Vincent's Hospital, before returning to New Zealand. Peer training by experienced renal nurses was soon complemented by in-house hospital courses; initially a course covering all intensive care areas. Kathy Flynn relates how she gained her skills:

At an early stage of my spell in the dialysis unit I had undertaken the Intensive Care Course. This involved six months of lectures and a time spent in each of the four ICUs at the hospital: The general ICU, Cardio-thoracic Unit, Coronary Care Unit and the Dialysis Unit. This course gave me a broad range of skills in clinical observation, accurate interpretation and appropriate nursing interventions. It taught a new nursing language and most importantly it cultivated a style of nursing that was collaborative, innovative and research based. I believe this set me up with the skills needed to introduce the completely new process of CAPD to our nursing team and our patients.

By 1978, a stand-alone renal nursing course at Wellington Hospital had evolved, again under the guidance of Wendy Couchman. This six months course, based on the long-running United Kingdom's English National Board nursing courses, was conducted annually, with a theoretical component covered during one classroom study day per week, and a clinical component involving rotation between the renal ward and the Dialysis Unit:

Clinical experience will be gained in both the Renal Ward and the Renal Dialysis Unit, nursing both children and adults. Acute haemodialysis experience will be gained in the Intensive Care Unit. Provisions will be made for nurses to visit other Special Care Areas: to see the insertion of an AV Shunt/Fistula, Renal Biopsy, Renal Transplantation and other areas of interest, or special procedures, including working in the Home Dialysis Training Centre.⁶²

The structure and tradition of the Wellington Hospital Renal Nursing Course was consolidated steadily each year. By 1987, when Miranda Walker took over from Anne Beattie as Course Co-ordinator, the course was attracting nurses from hospitals throughout the country. Between 1989 and 2000 the renal nursing course was in its heyday, training around 70 nurses in renal specialty nursing over that period. Miranda Walker recalls:

There was no other course like it in the country, and I recall that we had nurses enrolled from Palmerston North, Hawkes Bay, and Christchurch at various times. They attended the study days each week and did their clinical component at their own

⁶² Renal Medicine and Dialysis Course General Information, October 1980.

hospitals. We went to a lot of effort to make sure they were exposed to all aspects of clinical work. There was a lot of respect nationally for our course – everyone was always very interested in it and people from other units around the country often told me how envious they were of us because of it.

The Course Co-ordinator was a one day per week position until 1994, when it became a fulltime role, with broader responsibility for all renal nursing practice development, including orientation and assuring clinical competency among all renal nursing staff. In 1994 at Auckland Hospital, Carmel Gregan-Ford, having completing the English National Board renal speciality course, started working in the new role as Renal Clinical Nurse Educator. She ran the renal speciality paper alongside the Auckland Institute of Technology and supported newly graduated nurses coming into the renal service. Miranda Walker said:

I remember Ailsa (Jacobson) and I developed this new role of Clinical Educator. I had read about it in overseas journals, and Ailsa sent me up to Auckland to meet Carmel Gregan (who was Clinical Educator in the Auckland renal service) to find out what she did and how she worked. I remember it being an exciting time – it felt like we had a real opportunity to do something new.



First renal educators meeting. Auckland Hospital 17 March 2002

Back row L-R: Balaji Jaganadham (Clinical technician, Middlemore), Karin Norman (Waikato), Kay McLaughlin (Wellington), Brenda Clune (Auckland) Deborah Angel (Clinical technician, Melbourne), Cheryle Kiwi (Whangarei), Adrian Buttimore (Clinical technician, Christchurch)

Front row L-R: Catherine Eggleton (Fresenius Medical Care), Denise Cumberpatch (Christchurch), Hannah Cattaway (Middlemore), Jodie Morgan (Clinical technician, Melbourne), Liz Edwards (Dunedin)

By the early 2000s, political and economic factors were forcing change within nursing education nationally as well as locally. The drive to move nursing education from hospitals to universities, along with increasingly constrained health budgets, meant that the Wellington Renal Nursing Course became less sustainable with each year. In 2005, the Wellington course became a stand-alone paper run through Victoria University and in 2009 it was finally subsumed entirely within the Applied Pathophysiology paper offered as part of the university's Master of Nursing programme.

Over many years, the Wellington Hospital renal nursing course provided a steady source of skilled nurses for every subspecialty area of the renal service in Wellington. It also acted as a recruitment tool for the department, attracting new nurses who were interested in developing specialty practice with the promise of a clear career pathway. Another benefit of the course for the department was the collegiality and sense of belonging it promoted. Nurses who went through the course firmly identified themselves and their colleagues as 'renal nurses', embedding the idea of a distinct group of specialists with a discreet set of knowledge and skills to offer.

National nursing collaboration

Each of the five early renal departments was quite isolated from each other with limited opportunities for sharing insights and resources between teams and so each developed separately, with a somewhat different approach to patient care, resource use and specialised staffing to support care. However, renal nurses all over the country recognised that such a new and dynamically evolving area of nursing required a degree of collegial peer review and formed networks and structures to foster and support inter-hospital communication and knowledge sharing.

In 1976, at a meeting of the Australasian (now Australian and New Zealand) Society of Nephrology in Christchurch, the New Zealand branch of the Dialysis Society of Australasia was formed. Adrian Buttimore from Christchurch was the first President, supported by Alison Watson (Vice President) and Sue Holloway (Secretary) from Wellington. The following year they produced their first newsletter with articles that included a description of preliminary trials with single needle dialysis in Auckland.

Since those humble beginnings, the Society has continued to grow and provide renal nurses (and other renal practitioners) with a collegial forum for discussion and knowledge sharing. From 22 members in 1977, the Society grew to around 100 members by 2016. A meeting has been held each year with peer-reviewed presentations by members as well as valuable opportunities for national networking. These meetings have been consistently supported by the dialysis industry, which is itself heavily populated by ex-renal nurses recruited from various New Zealand renal departments.

In 1986, the name was changed to the Renal Society of Australasia (New Zealand Branch) Inc. (RSA), to reflect the growing diversity of renal treatment. As well as providing opportunities for renal nurses in New Zealand to meet and learn from each other, the RSA has also been the link between them and their Australian counterparts. The RSA Journal is the only peer-reviewed academic journal for Australasian renal nurses. The annual Australasian conference, held each year since the society was first formed in 1972, has allowed New Zealand renal nurses the opportunity to broaden and expand their renal knowledge while forming connections with colleagues in Australia and even further afield.

The RSA (NZ Branch) has also provided a structure for on-going professionalisation of the renal nursing workforce in New Zealand. In the late 1990s a group of senior New Zealand renal nurses, supported by the RSA, began work on the development of nursing standards for the speciality. An initial document, prior to the existence of any national nursing competency framework, Competency Standards for the New Zealand Renal Nurse (1999), was followed by the New Zealand Nephrology Nursing Knowledge and Skills Framework (2012).⁶³ This pioneering document which described the distinctive skills and knowledge of the renal nurse at different levels of practice, demonstrates the role of the RSA in facilitation of professional recognition of renal nurses within the New Zealand health sector.

⁶³ These documents can be found at <https://www.health.govt.nz/system/files/documents/pages/nz-nephrology-nursing.pdf>

6

Dialysis Technician to Clinical Physiologist-Dialysis Adrian Buttimore

The introduction to New Zealand of the first Kolff artificial kidneys in Wellington in 1958 meant that staff were required to operate and maintain them.⁶⁴ Initially, doctors and nurses, usually trained overseas, were responsible for the clinical operation of the dialysis machines. The machines were technically very simple and maintenance was carried out by staff from the hospital engineering departments.



Travenol Kolff Coil Dialysis Machine

In 1967 the Renal Unit at Auckland Hospital purchased a Multiple Artificial Kidney System (MAKS) central supply machine and Kiil dialysers. A new type of dialysis staff member was needed to operate and maintain the supply unit and also clean, build, sterilise and prepare the dialysers for use. The first of these “dialysis technicians” was William Howard-Taylor. As the unit expanded, a further three were appointed and trained by early 1968. Each dialysis shift required a technician to be in attendance.

Interestingly, the nurses working in the unit at that time were not permitted to perform phlebotomy and so the technicians were trained and seconded to obtain the blood samples required for both clinical care and clinical trial needs.

In late 1969 and early 1970, dialysis technicians, Christine Walker and Adrian Buttimore, left Auckland to join the home dialysis training centre that had been newly developed by Peter Little in Christchurch. Little had specifically decided to use technicians to train patients in the techniques of HD as he believed that they would provide a more dialysis specific and stable workforce than nurses. He believed that home dialysis would not thus be constrained by the “sickness” model then inherent in nursing practice. So, in 1969, the “Clinical Dialysis Technician” was born. A small number of nurses were also employed,

⁶⁴ This machine was named after the Dutch nephrologist, Willem Kolff, who developed the first successful dialysis machine in the early 1940s in the Netherlands.

whose role was to attend to the nursing-specific (as perceived at that time) requirements of the patients.



MAKS Central Dialysate Supply Machine (Auckland 1969)

The dialysis technicians trained the patients and arranged for the installation of the plumbing and electrical requirements in the home. They installed the dialysis and water treatment equipment, liaised with the local hospital, pharmacy and general practice, and ensured the ongoing supply of dialysis consumables requirements. They were also responsible for the maintenance and repair of the equipment, both in the training centre and in the home. This model for the clinical dialysis technician was later adopted, at least in part, by the new home dialysis training centre at Auckland Hospital and continued when this unit later transferred to Middlemore Hospital.

The “traditional” role of the non-clinical dialysis technician, which would evolve into the “biomedical dialysis technician”, continued in Auckland and Dunedin hospitals. Biomedical technicians would eventually be employed in almost all of the major dialysis units in New Zealand. They were/are responsible for equipment (including water treatment) installation, maintenance and repair. In more recent times these technicians have been employed by dialysis companies with contracted services to individual District Health Boards (DHBs).

In the 1970s, the growth in demand for dialysis treatment, especially for in-centre dialysis, saw a shortage of trained dialysis nurses, particularly in the Auckland region. There the shortage was met by employing and training more clinical technicians. Early attempts at establishing a national training programme were unsuccessful as the numbers of technicians were too few for a programme to be viable, either logistically or financially.

With a limited capacity to recruit and train sufficient numbers locally, recruitment began from South East Asia: initially Malaysia and then Singapore, where clinical technicians formed the majority of the dialysis workforce. Most of these technicians were trained in India where, after completing a science degree, they undertook postgraduate training of at least one year in clinical HD before qualifying as dialysis technicians. Many of them were subsequently contracted, typically for two to three years, to work in dialysis units in Singapore. At the completion of their contract, they were required to leave the country, thus providing a fruitful recruitment opportunity for New Zealand and many were employed in Auckland and Middlemore (now Counties Manukau DHB) Hospitals.

Outside of Christchurch, nurses became increasingly reluctant to work with clinical technicians, seeing them as an unregulated group without New Zealand recognised

training and qualification and as intruding on a traditional nursing role.

The need to recognise this group of health professionals more formally and with New Zealand qualifications, came with the increasing number of technicians being employed and with the introduction of the Health Practitioners Competency Assurance (HPCA) legislation.

This was recognised by Auckland nephrologist and Clinical Director, Dr John Collins, who together with Adrian Buttimore, a clinical technician and manager of the dialysis service in Christchurch, proposed the formation of a “Board of Practice” to pursue these aims and to regulate the profession. The New Zealand Board of Dialysis Practice (NZBDP) was formed in 2001 under the auspices of the New Zealand branch of the Renal Society of Australasia (RSA) and the New Zealand group of the Australian and New Zealand Society of Nephrology (ANZSN). Membership was to include representative clinical technicians from each of the DHBs that employed them, a nephrologist and a nurse appointed by ANZSN and the RSA respectively. The inaugural Board comprised:

- Chairperson: Adrian Buttimore
- Technician members: Paul Santamaria (Auckland Hospital), David Lilley, (Middlemore Hospital)
- Nurse member: Brenda Clune (Auckland Hospital)
- ANZSN appointee: Dr John Collins (Auckland Hospital)
- RSA appointee: Miranda Walker (Wellington Hospital)



(L-R) Paul Santamaria, John Collins, Fredric Doss at first NZBDP Symposium 2011

The Board immediately set about seeking an appropriate qualification and pursuing registration under the HPCA. It was obvious from previous failed attempts, both “in house” and Polytechnic based, that the number of New Zealand technicians and the NZBDP’s lack of resources would, at least initially, preclude the development of a training, examination and certification programme from scratch. The Board directed its attention to existing overseas certification programmes.

Adrian Buttimore made two exploratory visits to the United States to investigate possible

options for a certification process. On his return he reported his findings to the Board which decided to adopt the examination and certification programme offered by the Board of Examiners, Nursing and Technology (BONENT) with a longer-term aim of developing a tertiary-based process in New Zealand.

This process was also adopted by clinical dialysis technicians (CHT) in Victoria, Australia. Initially, the two countries co-ordinated their examination activities. BONENT also conducted examinations for HD nurses (CHDN) and peritoneal dialysis (PD) nurses (CPDN).

The first New Zealand-based examination for BONENT certification took place in Auckland on 6 October, 2001 with 26 candidates: 14 New Zealand clinical technicians, five Melbourne clinical technicians, five New Zealand HD nurses and two New Zealand PD nurses. Successful candidates were registered with the NZBDP as CHT, CHDN or CPDN. (BONENT examinations continued to be offered in New Zealand until the advent of the “Post Graduate Certificate in Physiology – Dialysis” at the Manukau Institute of Technology in 2014) To further develop the profession and to meet the likely requirements of HPCA registration, the NZBDP developed “Scopes of Practice, Competencies and Levels of Practice for Clinical Dialysis Technicians”.

In 2005, it was recognised that there was a need for renal nurses to have an opportunity to develop their own professional scopes of practice and to have formal representation on the National Renal Advisory Board (NRAB). In response to this, between 2005 and 2007 the NZBDP became the New Zealand Board of Nephrology Practice and incorporated both a clinical technician and a renal nursing work stream with a common executive. In 2008 the Nursing Advisory Group was formed under the auspices of the RSA (NZ Branch) and the NZBNP reverted to the NZBDP.

Upon its formation in 2003, the NRAB together with the Ministry of Health (MOH) took over responsibility for the NZBDP and recognised the need for a formal training programme to build on the original one, which had been developed by the NZBDP and undertaken in Auckland Hospital in 2007. Auckland and Counties Manukau DHBs developed a joint one-year training programme and first offered it in 2009. Successful candidates had to complete a further one year “internship” before being registered by the NZBDP as Clinical Dialysis Technicians. In 2010, Adrian Buttimore stepped down as chairman and was succeeded by Fredric Doss, a clinical dialysis technician, who was employed as the Haemodialysis Educator at Auckland Hospital.

With a view to merging with like professional groups and acquiring HPCA regulation, NZBDP initiated talks with Clinical Physiologist Registration Board (CPRB) and formally merged in 2013. Thus, CPRB now undertakes registration for sleep, cardiac, respiratory and the dialysis professions. Annual Practising Certificates are also issued by this board. As a result of the merger, the title Clinical Dialysis Technician has changed to Clinical Physiologist (Dialysis). With the NZBDP no longer responsible for vocational registration, it has become an incorporated society, the New Zealand and Australia Society of Renal Dialysis Practice Inc., which functions as a professional society for Clinical Physiologists (Dialysis).

In conjunction with the Manukau Institute of Technology and with the support of the three Auckland DHBs, the NZBDP has developed a Graduate Diploma in Health Sciences-dialysis specialty qualification. This is an NZQA accredited level 7 qualification. The first intake commenced in July 2014 and was an important milestone for the profession.

National and Regional Planning of Renal Services in New Zealand

Kelvin Lynn and Martin Wallace

The history of national and regional planning of dialysis and transplantation services is characterised by the continued commitment of a number of skilled and determined health professionals, patients and volunteer groups. By contrast, at times the government and the Ministry of Health (previously Department of Health) have been reluctant to establish and listen to national advisory groups.

Clinician-led national service planning

The first meeting of health professionals “to discuss the establishment of extended dialysis and renal transplantation facilities in New Zealand” was held at the Medical Unit at Auckland Hospital on 22 July 1968. The meeting was chaired by Derek North. Also present were Peter Little (Christchurch), Martin Wallace (Waikato), Bruce Morrison (Wellington), Robin Irvine (Dunedin), Peter Doak, John Montgomerie, Campbell Maclaurin and Athol Duke (Auckland). From figures supplied by the Government Statistician, the group estimated that approximately 110 patients per year in New Zealand were dying of kidney failure and that 50-60 per cent would be suitable for long-term dialysis treatment, i.e. 40 to 60 patients (14.5 to 22 per million population) annually.⁶⁵ (The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) report for 2016 records 559 new dialysis patients in New Zealand or a rate of 119 per million population.)

The group agreed that a probable maximum estimate of the patient load in New Zealand would be 60 new patients per year and assuming transplantation at the rate of 30 per year and a ten to 20 per cent yearly mortality that in five years 100 patients would require regular dialysis with a roughly similar number having had transplants.⁶⁶

The meeting recognised the difficulties of defining suitable criteria for access to dialysis treatment:

This varies considerably depending on the availability of treatment, and it is impossible to lay down rigid criteria. It is unusual to accept patients less than fifteen years of age or over fifty years, but exceptions do occur. It is unusual to accept patients with generalised systemic disease.

The group made recommendations for dialysis treatment standards related to equipment, facilities, water treatment and medical, nursing and technical staffing. The group also recorded that there were at least eight types of dialysis machines available for long term dialysis with purchase costs of about \$3,000.

⁶⁵ In 1968 the New Zealand population was 2.74 million.

⁶⁶ Minutes of Meeting held at Medical Unit, Auckland Hospital 22nd July, 1968. To discuss the Establishment of Extended Facilities for Dialysis and Renal Transplantation Facilities in New Zealand.

It was agreed that the Auckland, Hamilton and Wellington Hospitals would provide facilities for hospital HD and that Christchurch Hospital would provide facilities for HHD training.

The West Report

In 1977, the Rt Hon. Frank Gill, Minister of Health, sensed that in the new kidney units he was looking at fledgling big spenders and asked Mr HG West, Chairman of the Nelson Hospital Board, to chair a group set up to establish a framework for a national renal service.⁶⁷ The committee members were West (Chair), Maclaurin, Little, Wallace and Mr JWE Raine (President of the Royal Australasian College of Surgeons). The Minister accepted the group's report that recommended establishing a technical standing committee, which would be representative of each dialysis centre. Its role would be to examine the standardisation of equipment and techniques, and to keep under review all aspects relating to renal dialysis and transplant programmes.

It also recommended that a career structure be established for dialysis technicians (see page 79) and central funding for dialysis machines. The report had an extensive section of comprehensive national statistics about the activity of renal units and the modelling of demand for services. In 1976, there were 47 patients on HHD and 81 on hospital dialysis. It was estimated that the cost of their treatment was \$1,363,500 in that year. In 1975, there were 72 kidney transplants. The Report's authors suggested that:

If the population increases to 4.12 million by 1991, and the modest goal of 30 new patients per million population per year is reached and maintained, new patients admitted to treatment will increase from about 70 now to 124 by 1991.

In 1992, the number of patients starting treatment was 246 (71 per million population) showing how difficult it can be to predict patient numbers. This reflected the impact of PD, which was not established as a home therapy until the 1980s. By 1996 sixty per cent of all patients on dialysis were undertaking PD.

National Technical Committee on Renal Dialysis and Transplant

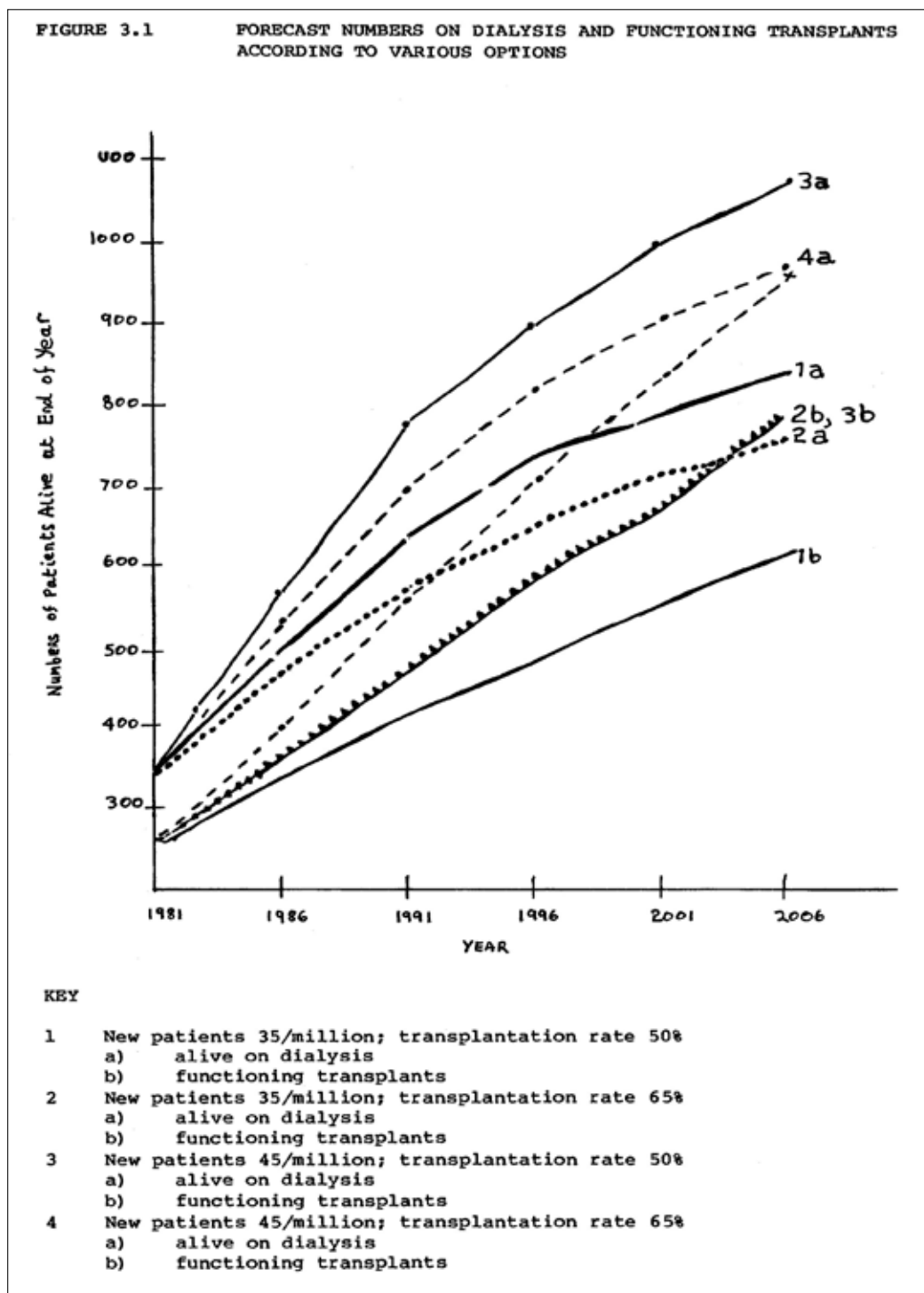
In 1979, the National Technical Committee on Renal Dialysis and Transplant was formed by the Health Department. Representatives of medical, nursing, and technical staff were included from all those centres recognised by the department as being active in the field. Health Department staff members were also included. The Health Department did not at first include representation from Waikato Hospital, but at the insistence of medical staff from the other centres, Waikato Hospital was included after the first meeting.

The committee was outstandingly successful, with Bruce Morrison as Chair of a group of doctors, nurses, a technician, a statistician and a member of the then North Canterbury Hospital Board Supply Department. He was proud that the group instituted a uniform patient care plan, service costings and projections for the future. He commented that all this was done by people at the cutting edge without a manager in sight. The committee set up a system of evaluating and standardising the equipment needed and its purchase by bulk tender on a national scale. All staff worked together to achieve this goal. The Canterbury Hospital Board arranged the tender, which saved several hundred thousand dollars each year. In 1987, the savings were \$800,000 on disposables.

⁶⁷ Report of Committee on Renal Dialysis and Transplantation to the Hospitals Advisory Council June 1977 See Appendix A for Committee members

Other issues addressed by this committee included:

- National criteria for patient selection
- Provision of information on treatment and costs
- Evaluation of dialysis equipment
- Prediction of future patient numbers (with the invaluable work of biostatistician John Hyslop)
- Dialysis safety – water purity, aluminium in water (see Hospital Circular 1983/36)
- Standardising transport of donated kidneys
- Ensuring uniform selection of transplant recipients nationally



Example of John Hyslop's predictions of dialysis patient numbers.

It is striking how similar the committee's activity in regard to drug purchasing is to the mechanisms later used by PHARMAC. It is of interest that PHARMAC recently announced its intention to take over national tendering for dialysis machines and consumables.

The expected transplant rates proved to be very optimistic but the dialysis predictions were much closer, at least until 1996 (see line 3a in the graph). The ANZDATA Registry reported that in 1996, 285 patients started dialysis (78 per million population), and that there were 932 patients on dialysis (256 per million population). Ninety-six transplant operations were done – a rate of about ten per cent of the dialysis population and 26 per million of the general population.

Martin Wallace succeeded Morrison as chairman in 1987 and had to try to deal with the effects of the Labour government's economic reforms on the public health system.

Morrison also chaired a small group to develop service planning guidelines, to predict patient numbers and to give advice on regional services, staffing and bed numbers.⁶⁸ This work was published by the Department of Health as the Hospital Board Service Planning Guidelines in 1986.⁶⁹

In 1988, members of the National Technical Committee were told the committee was to be disbanded. Wallace wrote to David Caygill, Minister of Health, on 22 November 1988 seeking a review of the decision. In Wallace's letter he accurately predicted the effects of doing away with the involvement of clinicians in decision-making regarding renal services:

Over the nine years since 1979, this committee has established, with successive members, a valuable forum in which New Zealand kidney failure services have been reviewed and to some extent managed. This committee has been able to overcome parochialism, and has established an atmosphere of good-will, leading to concerted and consistent action in patient care activities.

This substrate is worth conserving, and in the opinion of the present committee, activities could be expanded to deal with perceived difficulties with patient care in this field. Some problems foreseen are:

1. With the change to Area Health Board organisation, there is a danger that decisions taken in isolation by ill-informed authorities, who do not have a dialysis/transplant service, will inhibit the delivery of a comprehensive service to those in need.

2. There is a risk of variable levels of service within New Zealand, without a national review, audit, and standard-setting mechanism.

3. Area Health Boards may well find the costs of dialysis and transplant services beyond them, either to provide or to "purchase", if cost containment mechanisms are lost [see below].

4. With respect to kidney transplantation, there are important national factors to be determined with respect to:

- [1] organ sharing, including with Australia?

- [2] tissue- typing standardisation

- [3] the possibility of a New Zealand transplant co-ordinator for organ retrieval and distribution

- [4] changes in transplant organ perfusion techniques.

⁶⁸ Dr Bruce Morrison, Mrs D Roud Charge Nurse, Dialysis Unit Auckland Hospital, Professor J B Morton Department of Surgery Christchurch Hospital, Mr P Clark Chief Executive Hawke's Bay Hospital Board, Mr R Hutchison Renal Technician, Dialysis Unit Auckland Hospital, Mr J Hyslop Management Services and Research Unit.

⁶⁹ Hospital Board Service Planning Guidelines, Regional Specialty Services. Renal Dialysis and Transplantation. Issued by Division of Hospitals, Department of Health. July 1986.

5. The advent of very expensive, but very effective treatments [such as the use of erythropoietin for anaemia in kidney failure] has to be faced. Without the experience and knowledge of those working in the field reasonable decisions will be less likely.

The committee feels it has a case for the continuation of a similar mechanism.

Some established principles should continue in any replacement mechanism:

1. Geographical representation [from all Units involved in the treatment of end age renal failure.]
2. Professional representation with nursing, technical and medical staff involved.
3. Regular changes of personnel.
4. Accountability maintained, with clear indications for reports etc.

In 2003, the Ministry of Health established the National Renal Advisory Board. Its stated aims encompassed all of these principles.

New Zealand Chapter of the Australian and New Zealand Society of Nephrology

In 1990, the New Zealand Nephrology community established the New Zealand Chapter of the Australian and New Zealand Society of Nephrology (ANZSN). The Chapter was initially an informal collection of New Zealand nephrologists, registrars, fellows and scientists. As well as involvement with the activities of ANZSN, the chapter addressed issues unique to New Zealand and was instrumental in the establishment of the National Renal Advisory Board (NRAB) (see p.87) and its precursor committees.

Attempts to define core renal services

The National Advisory Committee on Core Health Services, known as the National Health Committee, was established to rank health services and advise the Minister on which core personal health services that Regional Health Authorities (RHAs) should purchase and which services they would no longer offer. In 1992, as part of this process, a report was published entitled "The Management of End-stage Renal Failure (ESRF) Consensus Development Conference Report to The National Advisory Committee on Core Health and Disability Support Services".⁷⁰ Among the Report's recommendations were:

That a National Transplant Taskforce be set up to establish and monitor standards for organ transplant services

That a National Renal Failure Review Group be established to formulate guidelines, monitor standards and assess new technologies

The process in regard to renal services proved controversial for both health professionals and the public. A national agreement on what would be core renal services did not happen nor were the recommended review groups set up. In 1993, however, the South Auckland and Auckland Crown Health Enterprises (CHEs) published service specifications for tertiary renal services for their region.⁷¹

The disbanding of the Technical Standing Committee left a vacuum for professional advice on national matters related to kidney disease. In 1993, a National Taskforce on

⁷⁰ See Appendix B for committee members and at:

<http://www.moh.govt.nz/notebook/nbbooks.nsf/0/60555D48691B3F664C2565D700188789?OpenDocument>

⁷¹ In 1993 the 14 Area Health Boards were replaced by 23 Crown Health Enterprises for-profit organisations subject to ordinary company law.

Transplantation chaired by Joanna Innes-Walker, Transplant Donor Co-ordinator at the Auckland AHB, was established to produce a report for the Director General of Health.⁷² The report noted that the Technical Standing Committee had recommended the establishment of a national taskforce to address transplantation issues. The Auckland AHB Transplant Working Party and the Core Services Report 1994/5 had also expressed similar views. The Taskforce's report stated that:

New Zealand has a small population with diverse cultural beliefs. It is the view of the Taskforce that New Zealand needs a national focus to organ/tissue donation, retrieval, and transplantation services. A national focus will enable important issues of integration and co-ordination of services to be addressed, both locally and internationally, in order to maximise transplant outcomes for our population.

Although over time there was increasing co-operation between hospital and staff carrying our kidney transplants, particularly in regard to living donor kidney transplants, it was not until 2014 that the Ministry of Health set up the National Renal Transplant Service "to improve the volume of live donor kidney transplants in New Zealand."⁷³

Effects of the 1990s Health Reforms

As part of the National government's wide sweeping health reforms in the early 1990s, four RHAs and 23 CHEs were established and the Department of Health became a ministry. The health budget (then called "disability support budget") was reallocated to the new RHAs. This was an attempt to unify funding and delivery of services which had been fragmented between Vote Health and Vote Social Welfare. The CHEs were autonomous, publicly owned business units. The RHAs were designed to purchase services from a range of providers in a competitive health market and CHEs were expected to make a profit. Central to the health reforms was the need to control expenditure. Through the 1990s, there was an average nine per cent growth in dialysis patient numbers per year. Many senior health managers and politicians saw services for the treatment of people with kidney disease as being very expensive with uncontrolled access to treatment. One outcome of the focus on kidney failure treatment services was a realisation that access to treatment might not be equitable across the country.

In 1995, the Ministry of Health published a "Renal Replacement Services – Report from the Tertiary Services Review Committee", one of eight such reports on tertiary services.⁷⁴ The report noted that: 'There are significant differences in the rates of dialysis in different regions, and in the ratios between dialysis and kidney transplantation.'

The Minister of Health, Jenny Shipley, told a group of senior nephrologists that she had concerns that they were "shifting the goal posts" in regard to access to dialysis treatment, thus incurring increased costs for the health system. She also had concerns, probably justified, that there was unequal access to dialysis treatment among units.

In response to this, Auckland nephrologist John Collins and Patricia Metcalf from the University of Auckland School of Population Health, studied the access to dialysis treatment in New Zealand renal services, a project funded by the Ministry of Health.⁷⁵ The study

⁷² National Taskforce on Transplantation: final report to the Director-General of Health from the National Taskforce on Transplantation August 1993. National Taskforce on Transplantation 1993. Available at <http://www.moh.govt.nz/notebook/nbbooks.nsf/0/8557D3736631FCEF4C2565D70018B2F7>

⁷³ <http://www.health.govt.nz/about-ministry/leadership-ministry/clinical-groups/national-renal-transplant-service>

⁷⁴ [http://www.moh.govt.nz/notebook/nbbooks.nsf/0/BEFEDEF5428C78B24C2565D7001887AF/\\$file/tertiary-services-issues-paper-renal-replacement-services.pdf](http://www.moh.govt.nz/notebook/nbbooks.nsf/0/BEFEDEF5428C78B24C2565D7001887AF/$file/tertiary-services-issues-paper-renal-replacement-services.pdf)

⁷⁵ Collins J and Metcalf P. Access to dialysis in New Zealand renal services. NZ Med J 2003; 116:1-9.

found large centre variations in ethnicity and disease frequencies of patients referred for dialysis among renal units. For example, the proportion of Māori patients ranged from 10 to 60 per cent and the frequency of diabetes as a cause of kidney failure from 21 to 50 percent. These findings reflected both the ethnic demography of New Zealand and major ethnic differences in the frequency of disease processes, particularly diabetes, leading to kidney failure. During the two-year period of the study, 147 patients (17.9 per cent of those referred for consideration of dialysis treatment), either were not offered dialysis or chose not to have treatment. As a group they were significantly older, had more other health problems and were more disabled than those who accepted treatment.

The authors concluded that the adjusted rates for accepting people for dialysis treatment were, with one exception, not different among units. They commented that the unit with the lower acceptance rate might have been explained by a more limited availability of centre haemodialysis related to under-funding. Political concerns regarding access to dialysis treatment continued and led to well-publicised examples of the consequences of attempts at rationing access to dialysis. (For example see p.42) In the late 1990s and into the 2000s, hospital and satellite haemodialysis service availability increased, with facilities opening or expanding in many centres, particularly in the northern part of the North Island.

The National Renal Advisory Board

In 1994, Collins and Martin Searle, both then members of the Council of the ANZSN, wrote on behalf of New Zealand's nephrologists to Dr Colin Feek, Clinical Advisor to the Ministry, requesting Ministry support for the setting up of a national renal advisory group. The first meeting of the National Renal Advisory Board (NRAB), chaired by Richard Robson, Christchurch nephrologist and ANZSN Councillor, did not occur until 8 December 2000. In the interim there had been meetings of stakeholders to provide advice to the Ministry on kidney services but they had been unwieldy and their outcomes did little to improve kidney health services.

The exception to this was the renal transplant sub-committee. This group, chaired by Collins, undertook a review which led to the centralisation of tissue typing in Auckland and the establishment of a national renal transplant waiting list to ensure equitable access for all New Zealanders to deceased donor kidneys. Ian Dittmer, an Auckland nephrologist with expertise in tissue typing, was appointed to manage the national kidney allocation programme based in the Blood Transfusion Centre in Auckland.

The election of the Labour-Alliance government in the 1999 General Election saw the New Zealand Public Health and Disability Act 2000 passed by parliament. This led to the merging of the Health Funding Authority with the Ministry of Health and the formation of DHBs. In this new political climate, advice from health professionals was again seen as useful by the Ministry. The NRAB embarked on an ambitious work plan with objectives that included:

- Development of strategies for the prevention of kidney disease, particularly in people with diabetes.
- Establishment of guidelines for early referral and management of patients with chronic kidney disease.
- A review of the availability of renal services to ensure equitable access to appropriate therapies.
- Provision of an adequate qualified workforce for the renal programmes in New Zealand.
- Establishment of standards of practice and a process of audit for all forms of renal care.

- An advisory body on matters related to provision of appropriate pharmaceuticals for patients with renal disease.
- Promotion of renal transplantation.
- Co-ordination and purchasing of appropriate renal data collection for patients on renal programmes.

The NRAB did not meet again until April 2003. At that meeting, the board decided to focus on the development of national standards of practice, workforce planning, a national renal database and development of a template for costing renal services. The board also sought to have two nursing representatives and a Ministry of Health official join the board. Later that year, the Ministry confirmed funding for the meetings of the board and its two subcommittees – transplantation, and standards and audit.

The NRAB is now established as a credible, productive advisory committee valued by both the Ministry and Ministers and DHBs. It advises on and monitors renal care services and comprises clinical and managerial leaders from a range of DHBs with renal services, as well as relevant professional and consumer groups. It has developed strong links with Kidney Health New Zealand. Important outcomes of the NRAB's work have been:

- An annual New Zealand Dialysis and Transplantation Standards and Audit report⁷⁶
- A scoping paper on New Zealand's renal services⁷⁷
- A position paper on access to dialysis treatment to provide general guidance to health funders, providers and the public regarding assessment and decision making for patients with advanced kidney failure where renal replacement therapy is under consideration⁷⁸
- A renal services improvement plan together with the Ministry that resulted in a national consensus on the management of chronic kidney disease in the community, and improved regional co-ordination of renal services and improved information for and about people with kidney disease, and increased funding for live donor transplantation and the establishment of a National Renal Transplant Service

A number of health professionals have made significant contributions to the work of the NRAB, including chairs Drs Grant Pidgeon, Johan Rosman, Mark Marshall, Murray Leikis and Ian Dittmer. Dr John Collins, nephrologist from Auckland Hospital was a key player from the early 1990s and behind many of the board's initiatives. Adrian Buttimore, dialysis clinician and manager from Christchurch made a major contribution to the development of dialysis treatment standards and together with Collins established the New Zealand Board of Dialysis Practice (see Chapter 6). Dr Nick Polaschek, formerly senior renal nurse at Wellington Hospital, was the Ministry representative on the board for many years and his hard work and sage advice was critical in the realisation of many of the board's objectives.

⁷⁶ www.moh.govt.nz/nrab

⁷⁷ Adrian Field. Scoping paper. New Zealand's Renal Services: Towards a national strategic plan National Renal Advisory Board, 14 September 2006.

⁷⁸ <http://www.health.govt.nz/system/files/documents/pages/access-to-renal-replacement-programmes.pdf>

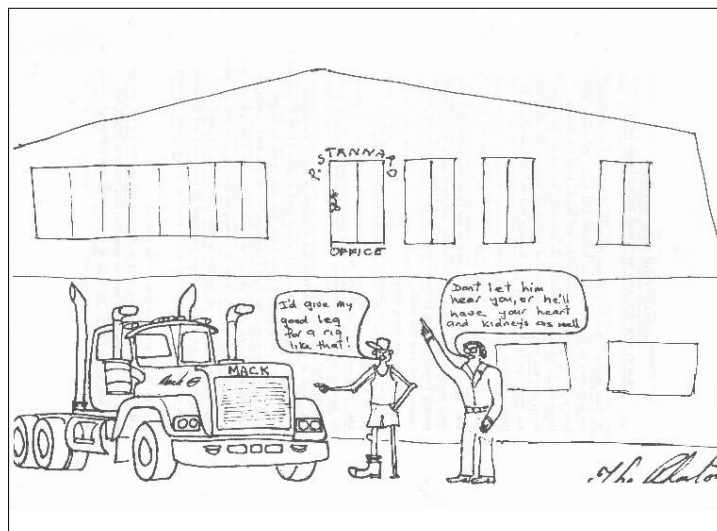
Kidney Health New Zealand and Kidney Societies

Kelvin Lynn and Peter Hatfield

National Kidney Foundation of New Zealand

Since the late 1970s, The National Kidney Foundation of New Zealand (NKF), (now Kidney Health New Zealand) and regional patient support groups have played key roles in advocacy and support for kidney patients.

The NKF was founded in 1979 by members of the Terrace End Rotary Club of Palmerston North and had its headquarters in Wellington. The main aims of the Foundation were: to fund research, raise community awareness about diseases of the urinary tract, support increasing facilities for home dialysis and encourage kidney donation and transplantation. Rotary clubs throughout New Zealand provided support for the establishment of local NKF branches, which numbered 15 by 1986. The NKF's first national programme, *Become a Life Donor*, was directed at raising awareness about organ donation. This campaign was the brainchild of Paul Stannard, a businessman from Masterton and an NKF councillor, who had donated a kidney to his sister.



('I'd give my good leg for a rig like that!' 'Don't let him hear you or he'll have your heart and kidneys as well.')

From NKF Newsletter No.7 Winter 1985

Key figures in the early days of the NKF were Trevor Roberts, a Wellington lawyer, and Dr Bruce Morrison, head of the kidney unit at Wellington Hospital. Morrison was made a Life Member of NKF in 1992, a few months before his premature death.

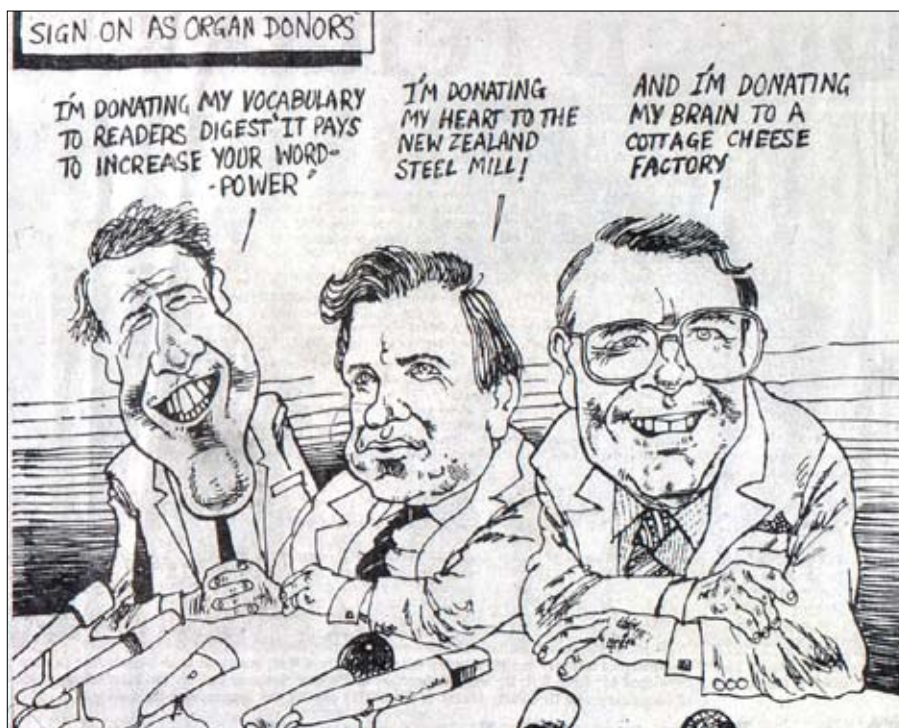
From 1987 the NKF, local branches and kidney units, helped by the pharmaceutical industry, ran a Kidney Week programme to raise awareness of kidney disease. These weeks promoted a specific area related to the major causes or prevention of kidney failure as well as promoting organ donation. The NKF sponsored a visit to New Zealand of the family of American Nicholas Green who donated his organs after he was accidentally killed by the Mafia when visiting Rome from the USA. Their donation to several Italian recipients resulted in world headlines, a bestselling book and a movie. Margaret and Reginald

Green's visit to New Zealand raised local awareness of the need for organ donation.

During one other Kidney Week programme, Just Water sponsored the promotion of the benefits of drinking water rather than sugary drinks. The company supplied drinking cups to virtually every primary school in the country. Other weeks focused on diabetes and raised blood pressure. More recently these activities have been centred on international World Kidney Day.

The Kidney Foundation lobbied for the introduction in 1987 of a "National Organ Donor Register" (NODR). Donor registration was made possible at the time of new or renewed motor vehicle driver registration. It was anticipated that this information, held by the Ministry of Transport, would be transferred easily to health files and included in the personal details attached to the National Patient Index (NPI). This did not happen and subsequently volunteers entered much of the data into the NPI manually. While well intentioned, the setting up of the NODR did not generate an increase in donation rates. The NKF sponsored the development of a Code of Practice for Transplantation by a group chaired by former Governor General, Sir David Beattie.

In 1999, the Foundation moved its headquarters to Christchurch and recruited Guy Johnson as Chief Executive. Johnson provided invaluable leadership in this role until his



Tom Scott cartoon showing Geoffrey Palmer, Richard Prebble and Michael Bassett signing the national donor register.

retirement in 2015. Carmel Gregan-Ford, current Education Manager, joined in 2002 and has developed key links with health professionals and patients. In 2005, NKF benefitted from its close relationship with Kidney Health Australia (KHA). Following advice from Warwick Prime, Chief Executive KHA, and Dr Timothy Mathew, Medical Director KHA, the Foundation reviewed its goals and activities.

As a result, the Foundation decided to employ a Medical Director and appointed Kelvin Lynn as the first Medical Director in 2006. In 2008, the Foundation changed its focus from solely people with kidney failure on dialysis or with transplants, to also include community education regarding early detection and prevention of kidney disease thus engaging with a much wider audience. This included individuals not currently affected by kidney disease

and who may have little or no knowledge of kidney disease. To reflect this new strategy the Foundation was renamed Kidney Health New Zealand (KHNZ).

Over the past nearly 40 years KHNZ has had an annual grant round for funding research. More recently, KHNZ has developed comprehensive educational material for patients and their families, including *Living with Kidney Disease*, the authoritative source of accurate information for New Zealand kidney disease patients and their families and a guide on the management of chronic kidney disease for general practitioners.⁷⁹ Each year a budgeted sum of money is allocated to research with summer scholarships being set up for medical students and small but relevant projects.

A successful campaign for full reimbursement of the expenses of live organ donors resulted in The Compensation for Live Organ Donors Act being passed on 5 December 2016, which ensures full financial compensation for live kidney and liver donors. KHNZ was also involved with the development of *Managing Chronic Kidney Disease in Primary Care 2014 A National Consensus Statement*.⁸⁰ More can be found about KHNZ's activities at www.kidneys.co.nz

Kidney Societies

Typically, patient support groups were formed by local medical and dialysis staff, patients and their families. They were concerned with the needs of local patients with kidney failure. Membership was usually cheap, initially only a few dollars annually. These volunteer run, not-for-profit organisations had to be very active in local fund raising to support their members. Groups would often provide services to patients and families that were not members. Common activities were advocacy, hospital visits, peer support, social events and funding equipment for patients, such as a television set for the local dialysis unit. Patient support groups raised funds for holiday dialysis homes such as the Otago Kidney Society did in Cromwell and the Wellington Region Kidney Society in Taupo. Initially, some patient support groups were local branches of the KHNZ and others were separate entities. Now there are no local branches of the KHNZ, but some local support groups receive support from the national organisation.

Christchurch

The first patient support group was probably started in Christchurch in the early 1970s when a kidney patient John Lawn persuaded Adrian Buttimore of the need for such an organisation. In 1977, Alexander Macintosh, a Christchurch business man and home dialysis patient, established the first formal group, confidently named "The New Zealand Kidney, Dialysis and Transplant Society (Inc.)". In 1978, this group funded the purchase of New Zealand's first mobile home dialysis unit (MDU), a purpose-built Bedford CF campervan.

Version three of the campervan commissioned in 2004 was a manual VW turbo diesel campervan fitted with a Fresenius 4000B dialysis machine and Gambro reverse osmosis unit. The intended national influence of the society never eventuated, and its name was formally changed to The Christchurch Kidney Society (Inc.) (CKS), in July 1985. Christchurch nephrologist, Ross Bailey, was an enthusiastic and active member of the committee. Tony Hearn, local lawyer and transplant recipient, was president for several years.

⁷⁹ <https://www.health.govt.nz/publication/living-kidney-disease>

⁸⁰ <https://www.kidneys.co.nz/Health-Professionals/CKD-consensus-statement-2015/>



Tony Hearn April 1998

Today CKS employs a Field Officer and runs a Kidney Information Centre which is a drop-in centre for patients and the public, providing information, support and fellowship. The CKS's Graeme Cox Youth Education Trust assists with providing education and educational aids for young kidney patients.

Canterbury patients were especially fortunate when two very active support groups were established in Ashburton and Timaru.



Haemodialysis patient using Christchurch's first Mobile Dialysis Unit in early 1980s

Auckland

The Auckland District Kidney Society (ADKS), now Kidney Society Auckland, was founded by renal patients and their families in 1980. The Society initially supported a small number of Auckland and Northland kidney failure patients who were cared for by the Department of Renal Medicine at Auckland Hospital.

This started to change in 1983 when Nora Van der Schrieck, whose husband Hans was on home haemodialysis, rather reluctantly joined the Society. She has become the driving force behind the Society's growth ever since.



Nora Van der Schrieck
Executive Director ADKS

From its Centre in South Auckland, Kidney Society Auckland supports people with kidney failure and their families in Northland, Auckland, the Waikato, Bay of Plenty, Tairāwhiti and Hawke's Bay. The Society has nine staff including one person on home haemodialysis and one with a transplant. Most of the Society's board are either patients themselves, or family members of patients. Almost 3,000 families registered with the Society receive free "wrap around" professional support services including health information, social work and a unique "wellness" rehabilitation/exercise programme delivered by a registered personal trainer.

In partnership with the Counties Manukau DHB in South Auckland the Society manages three Community Dialysis Houses – ordinary residential homes owned by the Society, where selected Counties Manukau HHD-trained patients can use a dialysis machine, just like they would at home. The houses are unstaffed and patients are responsible for their own treatment and safety. They all have a key to their allocated house and room and share their machine with just one other person.

They can dialyse at any time of the day or night on their allocated days, and swap days with their machine partner for special occasions. The DHB covers all costs and selects, trains and supports the patients. Dialysis technician, the late Dave Lilley, provided indispensable energy and expertise to the project. From small beginnings in 2004 with one house catering for 14 patients, this partnership has flourished and now caters for up to 60 patients. One of the houses also accommodates a one-room, staffed private dialysis unit for paying patients with a separate entrance to ensure that it does not compromise the community dialysis house model.



Dave Lilley



Calvert and Wallace Community Dialysis Houses South Auckland

Dunedin

Maree McDonald was the first chairperson of the Kidney Cottage Club known now as the Otago Kidney Society. The Society was set up to raise funds for the refurbishment of an old stone cottage in the Cromwell Hospital grounds for holiday dialysis. The Cromwell and Ravensbourne Lions Clubs assisted the Society. The cottage was the first permanent holiday facility in the country when it opened on January 28th, 1978. The cottage was closed in the early 2000s. The Society provides services over a large area of the southern South Island.



Kidney Cottage working party December 1977
L to R Anne Hocken, Karen Stedman, Marilyn Cooper, Maree McDonald

Wellington

The Wellington Region Kidney Society (WRKS) was established in 1977 by Peter Hatfield at the suggestion of HHD patient, Bill Geange. Initially the Society was an informal group of doctors, nurses, technicians, social workers, patients, their families and friends who formed a committee to look after patient interests. After meetings in Palmerston North and Hastings local branches were formed in these areas. One of the initial projects was to raise money to buy a holiday house, accessible to all patients and their families in the region. In 1978, after a huge charity ball and donations from Rotary and Lions' groups, WRKS was able to buy a holiday house in Taupo. After five years WRKS sold this house and bought a larger house in Taupo, which is still in use. Most years, working-bees were needed to maintain the house but WRKS are fortunate to have the Taupo Volunteer Fire Brigade to keep a watchful eye on the house. In Hastings, Norman, an HHD patient, raised money locally to buy a holiday campervan equipped with a dialysis machine. It was booked by patients throughout New Zealand.

The WRKS became an effective lobby group, increasing public awareness of kidney disease and promoting kidney donation and in 1981 they became incorporated as a Charitable Trust. Ken Russell, a transplant patient and first President of the Society, tried for many years to form a New Zealand Kidney Society to represent all the individual patient groups in New Zealand but was unsuccessful. He and Graeme Butler, an HHD patient, produced regular newsletters from 1985. Graeme's wife Janet married Ken Russell some years after Graeme died. This has been a happy match for them both and next year they will be celebrating 40 years for Ken's transplant. Ken is a semi-retired maths professor at Wollongong University.



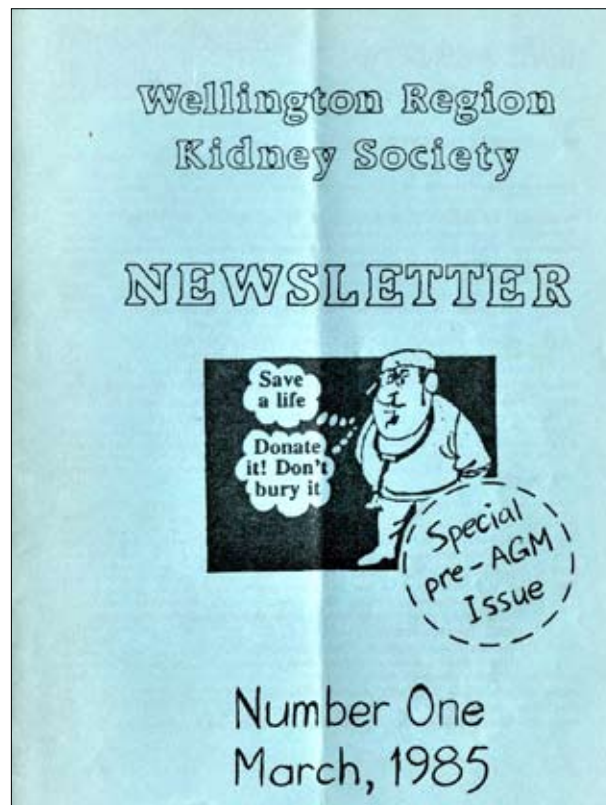
Janet and Ken Russell



Frances Fisher and Alex McLeod, gold and silver medal winners in golf. World Transplant Games

The WRKS has actively supported patients participating in the Transplant Olympic Games. Participants and their medals have always provided welcome stories for local newspapers. The current membership is approximately 300, comprising individual patients, patient families, renal staff and supporters.

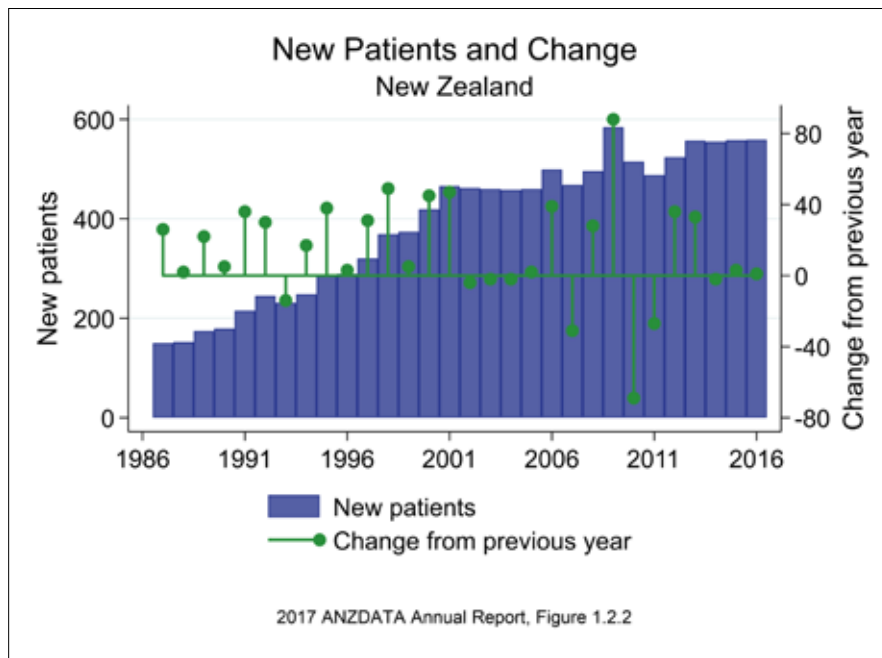
Currently there are patient support groups in Whangarei, Auckland/Waikato, Tauranga, Palmerston North, Taranaki, Wanganui, Wellington, Whitianga, Hawkes Bay, Christchurch, Ashburton, Timaru, Dunedin, Southland, Nelson/Marlborough, Gore and Queenstown. More information is available at www.kidneys.co.nz/Patient-Support/



Statistics and Trends for the Treatment of Kidney Failure in New Zealand

Kelvin Lynn

ANZDATA is the Australia and New Zealand Dialysis and Transplant Registry and since the Registry's first report in 1978 it has been the premier source of data relating to the incidence, prevalence and outcome of dialysis and transplant treatment for patients with ESKD in both countries.⁸¹ All renal units in Australia and New Zealand provide data for the Registry's annual reports. It is an invaluable database to support health care planning and research studies. Funding is provided by the Australian and New Zealand Governments and Kidney Health Australia. The Registry has provided valuable support for the writing of this book.



The first kidney transplant operation in New Zealand was undertaken in 1965 at Auckland Hospital, and the first patient began maintenance HD the same year. The number of patients starting dialysis each year increased steadily until around 2001 where the incident rate appeared to stabilise (except for a peak of 560 new patients in 2009). Since 1965, 13,270 New Zealand patients have started treatment for kidney failure – HD, 8,065; PD, 4,801; pre-emptive kidney transplant, 404. Over this period 4,611 kidney transplants have been carried out, including 1,441 from living donors. In 2016, 533 patients began dialysis and 26 received a pre-emptive kidney transplant.

For many years, it was expected that most dialysis patients would be managed with home dialysis. The first HHD patient began treatment in Christchurch in 1969 and the first

⁸¹ Data from The Australian and New Zealand Dialysis and Transplantation Registry (ANZDATA) from inception to December 2016 and ANZDATA Registry. 40th Report, Chapter 7: Transplantation. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2018. Available at: www.anzdata.org.au

CAPD patient in Hamilton in 1978. By 1990, 81 per cent of all dialysis patients were on either home HHD or PD but since then this proportion has declined with an increasing number of patients having their dialysis treatment in hospital or satellite units. In 1997 for the first time there were more hospital HD than HHD patients – 238 and 189 respectively. From 1983, PD patients became an increasing proportion of all HD patients. In 2016, 47 per cent of all patients were on home dialysis (468 HD and 823 PD); still very high by international comparison.

Increasing experience led to a widening of clinical criteria for acceptance for dialysis treatment. The first patient with diabetes was treated in 1973 and by 1996 40 per cent of new patients had diabetes as the cause of their kidney failure. Over the past decade around half of all new patients have had diabetic kidney disease. Since physicians started treating patients, the average age of new patients increased from less than 40 years to 56.6 years in 2016.

The first patients began treatment in satellite (stand-alone) facilities (a sort of half-way house between hospital and hospital, where patients do some or most of their treatment under supervision) in 1982 and now around 16 percent of all patients are treated in these units.

The number of kidney transplants carried out each year increased until the mid-1980s and then remained unchanged, at between 100 and 120 operations annually, despite an increase in living kidney donation from the late 1990s. Since the establishment of the National Renal Transplant Service in September 2014 there has been a marked increase in the number of transplants to 187 in 2017.⁸²

Māori and Pacific people have a much greater incidence of kidney failure than Pākehā mainly due to type 2 diabetes. Although Māori and Pacific people make up 15 and 5.5 per cent of the New Zealand population respectively, they make up 31 and 26 per cent of people on dialysis treatment. In 2015, of the 525 people starting dialysis 30 per cent were Māori and 20 per cent Pacific people and around 70 per cent in each group had diabetes as the cause of their kidney failure. At the end of 2016 there were 2,750 people on dialysis and 1,781 with a functioning transplant.

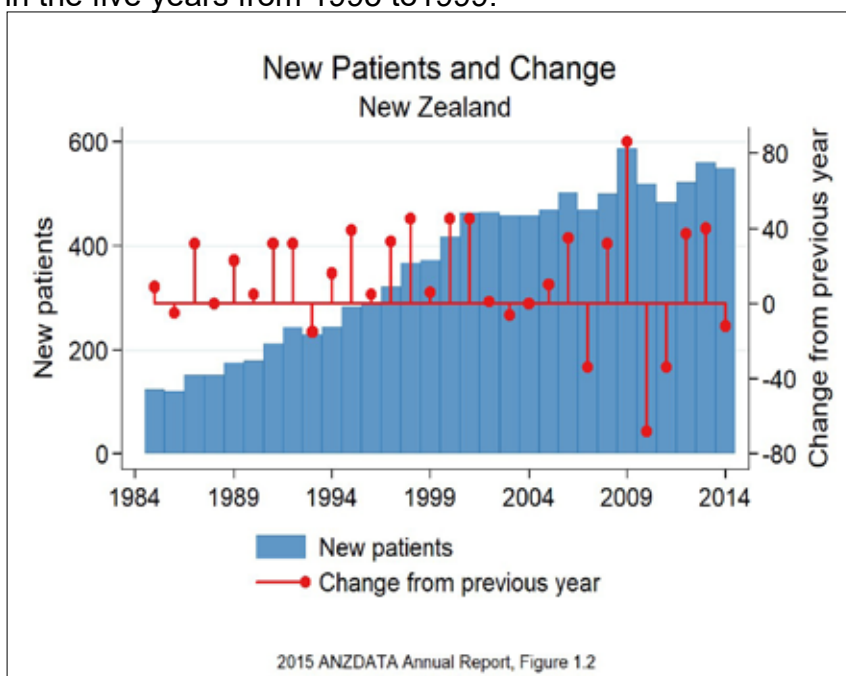
More comprehensive data are available at www.anzdata.org.au

⁸² <https://www.health.govt.nz/about-ministry/leadership-ministry/expert-groups/national-renal-transplant-service>

The Future of Dialysis

John Collins

From very modest beginnings the New Zealand dialysis programmes have grown year by year. Over the 20 years from 1995 to 2016 the number of people receiving dialysis treatment has increased from 850 (232 per million population) to 2,750 (611 per million population). The bulk of this growth has been in in-centre and satellite dialysis. The rate of growth in patient numbers has slowed dramatically, however.⁸³ As an example, in the five-year period from 2010 to 2014 yearly growth averaged 2.4 per cent and in 2016 growth was less than 0.5 per cent, compared with the previous year. This compares with 8.9 per cent growth in the five years from 1995 to 1999.



New ESKD Patients and Change in New Zealand 1984 – 2014

What can we expect in the future? Kidney failure rates increase with age.⁸⁴ In New Zealand, as in most Western countries, the percentage of people older than 65 is increasing because of steady increases in life expectancy and reduced birth rates. We now know that very elderly people, particularly those with other serious diseases, benefit little from dialysis.⁸⁵ This knowledge, coupled with improvements in the provision of quality supportive and palliative care, has resulted in some older patients choosing a supportive approach rather than dialysis. Will such trends counter the trends towards an increased incidence associated with an aging population?⁸⁶ What will it take to overcome the many

⁸³ ANZDATA Registry Report 2016

⁸⁴ Stevens L, Viswanathan G, Weiner D. CKD and ESRD in the Elderly: Current Prevalence, Future Projections and Clinical Significance. *Adv Chronic Kidney Dis* 2010; 17: 293-301.

⁸⁵ Okamoto I, Tonkin-Crine S, Rayner H, Murtagh F. Conservative care for ESKD in the United Kingdom: a national survey. *CJASN* 2015; 10:120-6.

⁸⁶ Foote C, Kotwal S, Gallagher M, Cass A, Brown M, Jardine M. Survival outcomes of supportive care versus dialysis

barriers to sustainability of conventional dialysis treatment? How can we improve survival and symptomatic outcomes for our patients? Will new technologies be viable and broadly applicable across the population? Or, might the development of engineered kidneys that do not require antirejection drugs lead to a significantly reduced role for dialysis?⁸⁷ These and many other questions arise as we reflect on the future of dialysis.

Trends in ESKD and dialysis

The incidence of CKD (Chronic Kidney Disease when 50 per cent of normal kidney function has been lost) is 30 per cent by the age of seventy and rises thereafter with an associated increase in the occurrence of ESKD (when eighty-five per cent of normal kidney function has been lost).⁸⁸ Yet in New Zealand in the last five years, the rate of patients beginning dialysis has remained stable for patients over the age of 65 years. Very few patients over the age of 84 years have started dialysis.⁸⁹ Median survival for those older than 84 years starting dialysis is two years and less in those with other serious health problems. For those aged 75-84 years the median survival on dialysis is three years.⁹⁰

Quality of life for older people on dialysis is often severely impaired with increased frequencies of depression, fatigue, pain and itch.⁹¹ It is not surprising that some well-informed, eligible dialysis candidates in these age groups choose a supportive, non-dialytic approach to treatment of their kidney failure.⁹² In addition, over 30 per cent of the deaths of elderly dialysis patients occur after they have elected to stop treatment.⁹³ If dialysis were less intrusive on lifestyle, and more effective in managing kidney failure and its associated symptoms, it seems possible that more patients in these age groups would benefit for longer.

Communication and engagement

Over the decades, the discourse around patient and dialysis decision-making has changed. In earlier years, the primary question nephrologists addressed when a patient was being considered for dialysis or transplantation was whether or not to offer treatment. Patients could of course decline that offer but few did. Until the implementation of PD in the late 1970s, dialysis was limited to younger patients awaiting transplantation who were mostly on HHD.

Very few patients with diabetes were accepted for dialysis as their survival was very poor on the treatments used in that era. In contrast, PD did not require the upfront capital cost of a kidney machine and was shown to be suitable for older and sicker patients because of its gentle continuous approach to waste product and fluid removal. Consequently, there was a major shift towards PD so that by 1995, in less than 20 years after its first use in New Zealand, 60 percent of all dialysis patients were on PD. The national cost

therapies for elderly patients with end-stage kidney disease: a systematic review and meta-analysis. *Nephrology (Carlton)* 2016; 21: 241-53.

⁸⁷ Attanasio C, Latancia M, Otterbein L, Netti P. Update on Renal Replacement Therapy: Implantable Artificial Devices and Bioengineered Organs. *Tissue Eng Part B Rev* 2016; 22: 330-40.

⁸⁸ Stevens L, Viswanathan G, Weiner D. CKD and ESRD in the Elderly: Current Prevalence, Future Projections and Clinical Significance. *Adv Chronic Kidney Dis* 2010; 293-301.

⁸⁹ ANZDATA Registry Report 2016.

⁹⁰ *Ibid.* Chapter 3: Mortality in End Stage Kidney Disease.

⁹¹ *Ibid.*

⁹² Morton R, Snelling P, Webster A, Rose J. Factors influencing patient choice of dialysis versus conservative care to treat end stage kidney disease. *CMAJ* 2012;184: E277-83.

⁹³ Foote C, Kotwal S, Gallagher M, Cass A, Brown M, Jardine M. Survival outcomes of supportive care versus dialysis therapies for elderly patients with end-stage kidney disease: a systematic review and meta-analysis. *Nephrology (Carlton)*. 2016;21.

of treatment rose rapidly as larger numbers of older and sicker patients and those with diabetes were accepted for dialysis. More importantly, people who failed PD needed to transfer to HD. However, there were still substantial constraints on the availability of HD throughout the 1980s and 1990s.

Most patients were accepted onto dialysis because there was a prospect of kidney transplantation. This raised major ethical dilemmas for renal physicians during this era. There were also concerns that for some people treatment was futile, as little was gained in terms of longevity with considerable personal suffering for the patient and family/whānau and cost to the health system. These concerns were partially addressed via a Ministry of Health consensus conference which, in 1992, led to the publication of “The management of end-stage renal failure report to the National Advisory Committee on Core Health and Disability Support Services”.⁹⁴

Subsequently, a kidney failure guideline development process was initiated in the Northern Regional Health Authority (which included Auckland and Northland). The Authority’s members included funders, managers, clinicians and health legal experts. This initiative led to the publication of the “Procedures and guidelines for entry into the Northern Region’s ESKD Programme” in 1995.⁹⁵ Renal services generally followed this approach for some years. Most patients and families accepted it when advised that they would not be offered dialysis. A few sought second opinions, which in some cases resulted in their being offered dialysis.

In 1995, in Northland, the family of a patient, who had been declined dialysis, took his case to litigation. The judge upheld the decisions of the medical team, emphasising that the decision not to offer dialysis was “a clinical one” and that “the medical staff approached the decision made in this case in a thorough and conscientious way”. The judge was also “satisfied that the resource issue, if it played any part in the decision, was a minor component”.

During the years 1997-1998, a national project collected data on all patients considered for renal replacement therapy in New Zealand.⁹⁶ Dialysis was not offered to 113 people (13.7 per cent of those assessed) and of those offered dialysis 34 (4.8 per cent) chose not to accept it. Those who were not offered or did not accept dialysis had much higher levels of other serious diseases and were more likely to be dependent on others for care. Subsequently, the National Renal Advisory Group formulated its own guidelines in 2003 which were widely adopted across New Zealand and have only recently been updated.⁹⁷

Since that era, the availability of facility HD has rapidly increased and now some centres have over 70 per cent of patients on centre or satellite HD with a national average of 53 per cent. Better patient education and assessment processes are in place for people nearing ESKD. Conservative care clinics are established in many centres supporting patients who choose not to have dialysis. The emphasis has now shifted towards patient choice for an appropriate treatment modality which includes non-dialysis supportive care, as opposed to that offered by a clinician. Such choices should be based on a full understanding of the available options and likely outcomes. Interestingly, when the clinical details of the Northland patient noted above were recently reviewed in 2017 by a multi-disciplinary renal care group in Auckland, there was a strong consensus to maintain dialysis at the request of the whānau as long as the patient could co-operate and appeared to benefit. This

⁹⁴ McKean W. The Management of Endstage Renal Failure. In: Ministry of Health, eds. Wellington: National Advisory Committee on Core Health and Disability Support Services. 1992..

⁹⁵ North Health. Procedures and Guidelines for entry into the northern region’s end-stage renal programme. Auckland; 1995.

⁹⁶ Collins J, Metcalf P. Access to dialysis in New Zealand renal services. NZ Med J 2003; 116(1175):1-9.

⁹⁷ www.kidneys.co.nz/resources/file/access-renal-replacement-programmes-in-nz-1.pdf

seems to reflect a more balanced approach in a better resourced era.

It is only in recent years that clinicians have studied the factors that influence patient decisions in order to understand better how to optimise this process of choosing the most appropriate treatment. The research made it clear that many people lacked the power to make decisions, usually because they did not understand the jargon of kidney failure and dialysis. Often this was because they had little knowledge of health matters in general and this was not helped by clinicians supplying inadequate explanations.⁹⁸ Even today, many people begin dialysis with limited understanding of what it is all about. Most continue on treatment long-term but others choose to withdraw and move to a palliative supportive care pathway.⁹⁹

Legal and ethical requirements for informed consent have evolved over the last two decades. This is being addressed in New Zealand renal services. The discussion with a patient and whānau around informed consent should include both the anticipated life expectancy of the illness and how the patient's life will be affected. This should be done with particular regard to the outcomes that are most important to the individual. The timing of such discussions can be problematic as some people are too unwell to weigh up all the issues and have an urgent need for dialysis. Many are able to give consent for the treatment itself but can take time to gain a full grasp of all the related requirements for issues such as medication, change in diet, fluid restrictions, and vascular access, as well as quality of life and survival outcomes.

Haemodialysis

Over the decades, the technology for HD treatment has steadily evolved. Dialysis is now more efficient, and machines deliver greater precision in fluid removal coupled with less impact on blood pressure. Dialysate water treatment provides “ultrapure” water resulting in minimal exposure to contaminants. Treatment at home enables greater control and optimisation of HD treatment but is now undertaken by only a small minority of patients. In contrast, patients having HD at a hospital or in a satellite unit incur travel costs, lose independence and may not dialyse for the optimal length of time at every session.

At each treatment, HD patients are exposed to a variety of risks, which over time can lead to major organ damage.¹⁰⁰ Research focused on understanding and minimising these risks may, in the long term, lead to safer more effective treatments, but HD conducted over a fraction of a week will never fully replace normal kidney function. Efforts to increase the length and frequency of dialysis are most realistic in home, self-care settings. However, many patients, particularly those who are frail or have other significant illness or disability, cannot be trained to undertake this, do not have supportive care-givers who can take responsibility, or have homes where such treatment can occur. This may change as dialysis companies develop simpler HD machines for HHD and new models of “home” care are developed. This will include the provision of unstaffed neighbourhood HD facilities where home-trained patients who lack space at home for a machine, can undertake their dialysis.

Recently in some dialysis facilities there has been a return to treatment periods of over six hours, principally overnight, with some evidence of improved outcomes compared

⁹⁸ Walker R, Howard K, Morton R, Palmer S, Marshall M, Tong A. Patient and caregiver values, beliefs and experiences when considering home dialysis as a treatment option: a semi-structured interview study. *Nephrol Dial Transplant* 2016; 31 133-41.

⁹⁹ ANZDATA Registry Report 2016 Chapter 3: Mortality in End Stage Kidney Disease.

¹⁰⁰ McIntyre C, Crowley L. Dying to feel better: the central role of dialysis-induced tissue hypoxia. *CJASN* 2016; 11: 549-51.

with treatments of conventional length.¹⁰¹ Evidence shows in those on three treatments a week, mortality and acute illness rates are twice as high in the last day of the long break preceding dialysis.¹⁰² Solutions to the problem include the use of four treatments per week, or alternate day dialysis; both strategies are best undertaken on home dialysis, not in a centre where rigid schedules limit frequency to three treatments per week. Neither solution is ideal but all approaches that provide longer duration or more frequent dialysis bring the patient a little closer to replicating normal kidney function and in theory should result in benefits. The burdens and costs of treatment, however, can rise resulting in trade-offs both at an institutional and personal level.

Peritoneal dialysis

In many ways PD should be the most effective and most preferred therapy for dialysis. It offers a continuous or semi-continuous approach to waste and water removal thus circumventing the issues with blood pressure and fluctuating blood levels of waste products associated with short, intense treatments such as intermittent HD. Its portability allows patients to undertake it at home and at work or in recreational settings. Compared with HD, it is relatively easy to master both by patients and by care-givers if the patient is dependent on others for care. Overnight Automated PD (APD) enables patients with work or other daytime commitments to be free of the burdens of performing therapy during the day, yet in many countries fewer than ten per cent of patients are on PD.

In New Zealand, 60 per cent of all dialysis patients were on PD in 1995 reflecting both prevailing clinical opinion and the very limited access to facility HD. This percentage had steadily reduced to 30 per cent by the end of 2014. Part of this under-utilisation relates to a number of false beliefs about the therapy.¹⁰³ Survival in the medium term is similar for HD and PD. Peritoneal dialysis can be undertaken successfully in selected patients with prior abdominal surgery, even some with colostomies, and is suitable for many obese patients. It can be resumed in many patients after a PD catheter has been removed for peritonitis and after abdominal hernia repair with a mesh. Older patients can undertake PD successfully either independently or with care-givers. Up to half of patients entering ESKD treatments choose PD when they are informed about it. However, the rate of technique failure is high.¹⁰⁴ Some patients never become established on PD because of early complications with their PD catheters. Excluding death, the commonest single cause of technique failure is peritonitis, although in most cases there are other contributory factors. Other key issues that limit the sustained use of PD are changes in the function of the peritoneal membrane over time and the loss of remaining renal function in the patient's kidneys. In addition, a chronic overload of fluid can build up and physical symptoms can develop, including fatigue, pain and itch, and chronic inflammation. These issues are often inter-linked and have led to an unsatisfactory survival of the technique. The concept of technique failure is being better defined and studied which may lead to new approaches to prolonging PD therapy.¹⁰⁵

PD fluid is essentially a glucose solution containing salt and calcium minerals. Safe inexpensive dialysis solutions that do not contain glucose need to be developed because

¹⁰¹ Bridge A, Holt K. Effect of Nocturnal Dialysis on prognosis in adult patients: a review of the literature. *Nephrology Nursing Journal* 2015; 42: 375-80.

¹⁰² Fotheringham J, Fogarty D, El Nahas M, Campbell M, Farrington K. The mortality and hospitalisation rates associated with the long inter-dialytic gap in thrice-weekly hemodialysis. *Kidney Int* 2015; 88: 569-75.

¹⁰³ Lee M, Barman J. Myths in peritoneal dialysis. *Curr Opin Nephrol Hypertens* 2016; 25: 602-8.

¹⁰⁴ ANZDATA Registry Report 2016 Chapter 5: Peritoneal Dialysis.

¹⁰⁵ Perl J, et al. Early peritoneal dialysis attrition: preliminary results from the Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS). *Nephrol Dial Transplant* 2017; 32(S3): 71.

high glucose concentrations and glucose degradation products are harmful to the peritoneal membrane, Newer, more biologically compatible PD solutions with reduced glucose degradation products, are already on the market and may prove to be better for the peritoneum, although currently they are more expensive. There is considerable variability in PD use and outcomes across different ethnic groups and across countries. In the future, these issues must be addressed if technique survival is to lengthen. Recently an international survey on practice patterns for PD began collecting very detailed data on thousands of PD patients around the world including some in New Zealand.¹⁰⁶ This study should shed considerable light on these issues and lead to improvements in practice along with new trial strategies to test novel interventions.

Although both PD and HHD are significantly cheaper than facility HD, costs are still considerable. This is very relevant at a time when the aging population and new novel expensive treatments for other diseases are making huge demands on the health budget. Strategies to reduce costs are an important part of the future in the provision of dialysis treatments. In New Zealand, the recent move to national purchasing for dialysis machines and consumables by PHARMAC should reduce cost. Interestingly a similar approach was successfully employed in the 1980s for the purchase of HD equipment and related consumables. Innovative ways to limit consumable transport costs and environmental impact are also needed.

Combination PD and HD-hybrid therapy

This type of combined treatment has been used in Japan for many years where in 2013, 20 per cent of all PD patients were also on HD.¹⁰⁷ This treatment's advantages are primarily in minimising the disadvantages of each separate dialysis type. There are many conceivable blends of therapy. PD exchanges are less frequent, two to three per day and patients undertake HD once or twice a week. However, there are unresolved issues with this approach and there is no controlled trial evidence to demonstrate benefit. Clinical staff and dialysis schedules would need to be re-aligned and it would be more expensive than PD alone.

Kidney failure waste products and dialysis therapy

We are yet to fully understand the body fluid changes caused by kidney failure (the "uraemic milieu"). The chemicals, urea and creatinine are protein breakdown products excreted by the kidney and they accumulate in kidney failure. Although measurement of them is used by nephrologists to estimate kidney function, they cause few if any of the symptoms of kidney failure. More than 100 other products that accumulate with kidney failure have been identified, many of which are toxic. Both PD and HD can remove many of these products but not all of them.

Researchers have proposed alternative strategies, in conjunction with dialysis, that use sorbents to extract these toxins. Others have studied ways of altering the intestinal microbial environment to reduce the production of toxins. Future management studies into kidney failure toxins ("uraemic solutes") will need to take account of a much broader range of such toxins including those that come from the bowel. It appears likely that treatment will need to focus on both sustained continuous reduction in toxin production along with innovative ways of toxin removal.¹⁰⁸

¹⁰⁶ Ibid.

¹⁰⁷ Maruyama Y, Yokoyama K, Nakayama M. Combined therapy with peritoneal dialysis and hemodialysis: a multi-centre retrospective observational cohort study in Japan. *Blood Purif* 2014; 38: 149-53.

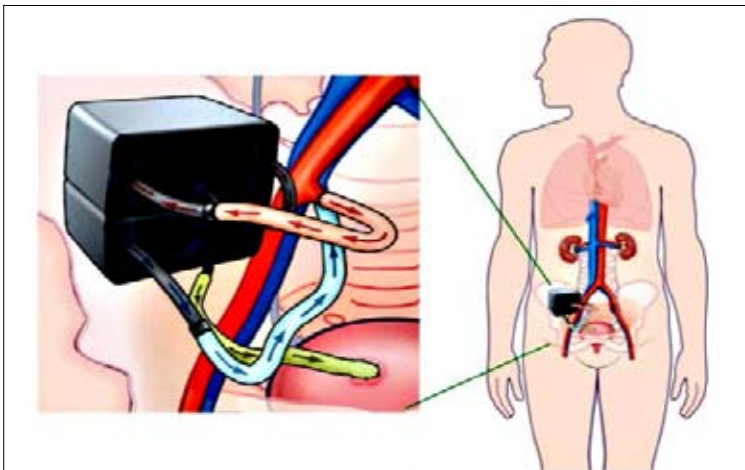
¹⁰⁸ Evenepoel P, Glorieux G, Meijers B. p-Cresol sulphate and indoxyl sulphate: some clouds are gathering in the uremic toxin sky. *Kidney Int* 2017; 92:1312-17.

New technologies

One can speculate about dialysis treatment in an ideal world. It would lead to freedom from all symptoms of kidney failure, a longer life and minimal treatment burden. To address the first two issues there would need to be a major change in the way dialysis is undertaken. Current dialysis treatments enable moderate small solute (waste) clearance but do not replace the lost metabolic, secretory, endocrine and reclamation functions of the kidney. Therapy needs to more closely mimic the native kidney in all its roles and be of sufficient duration to make the patient symptom-free. At this level of kidney dysfunction people feel well and there is much better long-term survival. It is likely that such treatments would be continuous or semi-continuous and thus to be practicable would need to be associated with a low personal burden and low cost to funders. There are several novel alternatives under development, three of which will be discussed briefly.¹⁰⁹ There are exciting developments in engineered materials and miniaturisation which will feed into these projects in time. At this stage of development, it is unclear whether any of these therapies will reach market and then be used widely.

Implantable Renal Assist Device (iRAD)

This device is being developed by investigators and industry with support and guidance from the US National Institutes of Health.¹¹⁰ It will be an implantable device with two chambers. One chamber is a blood filter (haemofilter) that will ensure the removal of small solute (waste). The second is lined with bioreactive renal tubular cells (cells that line the tubes of the filters in the normal kidney). It will replace the endocrine, secretory and metabolic functions of the kidney. Implantation will be like that of a kidney transplant, connected to the iliac blood vessels in the groin. The “urine” produced will drain into the patient’s bladder. It will be permanent and damaged components will be able to be replaced easily. Assuming it lives up to its claims such a device could revolutionise patient care.



Implantable artificial kidney

A diagram showing an implantable artificial kidney with artery, vein and ureter connected in the same way as used for a kidney transplant.

The silicon nanopore membranes within the device mean that arterial blood flow is sufficient for effective function.

(Front Biosci (Elite Ed) 2015; 7: 215–28)

Continuous wearable HD

The wearable artificial kidney (WAK) is a form of HD which is at an early stage of investigation.¹¹¹ Studies have been done with patients using sorbent cartridges continuously for removing toxins for up to twenty-four hours. Theoretically, such a therapy could provide

¹⁰⁹ Kim S, Fissell W, Humes H, Roy S. Current Strategies and challenges in engineering a bioartificial kidney. Front Biosci (Elite Ed) 2015; 7: 215-28.

¹¹⁰ Ibid.

¹¹¹ Gura V, Rivara M, Bieber S. A wearable artificial kidney for patients with end-stage renal disease. JCI Insight 2016; 1(8): e86397 <https://doi.org/10.1172/jci.insight.86397>.

vastly more effective solute (waste) removal in a fully independent context. Issues to be resolved include the stress on vascular access (such as an AV fistula) with the potential for more vascular access related infection. Other risks include the need for prolonged anticoagulation with its associated risk of bleeding, and a variety of technical issues that became apparent after the first trial.



Wearable Artificial Kidney (WAK)

Wearable PD

Wearable PD utilising the Automated WAK device is now entering human studies.¹¹² The device uses sorbent cartridges and a tidal approach to PD with frequent exchanges but unlike wearable HD, this system does not require direct access to the circulation, thus abrogating the risks of infecting the bloodstream and causing bleeding. PD effluent (waste



Automated Wearable Artificial Kidney (AWAK)

¹¹² Davenport A. Portable and wearable dialysis devices for the treatment of patients with end-stage kidney failure: Wishful thinking or just over the horizon. *Pediatr Nephrol* 2015; 30: 2053-60.

fluid) is replenished by passing it through a sorbent cartridge. Assuming its safety is well established in preliminary studies, trials will begin to assess long-term efficacy.

Summary

- The number of patients on dialysis will continue to rise slowly over the next decade but at a much slower rate than in previous decades.
- There will be an increasing emphasis on assessment, management, education, rehabilitation and informed consent for all patients approaching ESKD. This will be fully aligned to patient and family needs and expectations.
- Continuous improvements in HD technology and associated practices, coupled with better understanding of dialysis-related complications, will make this therapy more tolerable and may impact on longevity.
- A shift to independent predominantly home-based HD will continue to occur, driven by cost constraints, simpler technology and improved outcomes compared to facility dialysis.
- Nocturnal dialysis and increased frequency dialysis may become standard therapy.
- In PD “biocompatible” fluids will be affordable and may become the standard for treatment, helping to extend the length of treatment.
- Glucose will cease to be used as an osmotic agent in PD, being replaced by non-toxic solutes with high ultrafiltration capacity
- Hybrid dialysis will be used in selected patients to extend PD longevity.
- Treatments to reduce the bowel’s production of toxins and enhance their removal will be a key part of ongoing research and will lead to treatment strategies for patients in ESKD.
- Wearable forms of dialysis (AWAK and WAK) will become available commercially and be utilised in a minority of patients, but limited by cost and technology.
- The implantable renal assist device (iRAD) or similar devices will begin transforming renal replacement therapy within a decade and may lead to a winding down of facility dialysis units.
- This process will be accelerated upon full development and use of bio-engineered kidneys.

Conclusion

In this book we have told how the treatment of kidney failure started and became part of mainstream health care in New Zealand. We have told the story through the accounts of patients and their families, doctors, nurses and clinical technicians, whose leadership and advocacy we have recorded. Before 1965 all patients in New Zealand with ESKD died.

We have shown how politicians and changing societal attitudes to healthcare influence the development of kidney failure treatment services. We could not have told this story without ANZDATA's careful collecting and reporting of patient treatment data since the first dialysis and transplant patients began treatment.

We have not dealt in any depth with the important issue of the effects of kidney disease on Māori and Pacific peoples, nor do we claim that our book contains a full account of kidney research. We hope that others will be encouraged by our endeavours to address these topics.

A successful kidney transplant restores normal kidney function, but dialysis does not. Despite many technical advances over the past 50 years, the fundamentals of dialysis treatment remain unchanged. The challenge to make the current treatments for kidney failure more like the function of the normal kidney and less disruptive for patients and their families, remains largely unsolved. Completely new technologies and ways of managing dialysis in community settings are needed.

More kidney transplants are needed. Although transplant rates have increased in the past two years the number of both dead and live donor donations need to increase.

The Editors

Kelvin Lynn

MBChB (Otago), FRACP

Kelvin Lynn was born in Christchurch on 12 September 1947. After graduating in medicine from the University of Otago in 1971, he was encouraged to train as a nephrologist by Peter Little and Ross Bailey and was a Senior Nephrology Registrar at Christchurch Hospital before moving to London to take up a senior registrar position in the Renal Unit at Charing Cross Hospital, London headed by Professor Hugh de Wardener (1977-78).

Following this, he was a Wellcome Trust Research Fellow in the Department of Biochemistry, University of Strathclyde, Glasgow, for two years before returning to Christchurch in 1980 as a nephrologist. He was Clinical Director of the Department of Nephrology from 1991 - 2000 and 2006 - 09 and Chief of Medicine at Christchurch Hospital (2000 - 06). He was the Medical Director of Kidney Health New Zealand (2006 -15).

In 2007, he was appointed Clinical Professor, Department of Medicine, University of Otago, Christchurch. He has extensive clinical and research experience in home dialysis and has published more than 150 peer-reviewed papers. Kelvin was a member of the National Renal Advisory Board (1996 - 98; 2001-15) and lead the development of audit standards for New Zealand dialysis practice. He was a member of New Zealand Health Research Council Ethics Committee (1999 - 2005) and a member of the Australian and New Zealand Society of Nephrology Council (1988 - 92). He is a life member of the ANZSN and Christchurch Kidney Society. In retirement he follows his life-long interests of choral music and travel.

Adrian Buttimore

Certified Haemodialysis Technician, ONZM

Adrian was born in Cambridge on 15 October, 1948. He became a dialysis technician at Auckland Hospital in 1968, moving to Peter Little's newly established home dialysis training unit at Christchurch in 1970, where he became Chief Dialysis Technician in 1971, Officer in Charge of Dialysis Services in 1976, and retired as Clinical Manager of Dialysis Services in 2012.

In 1973, together with dialysis patient John Lawn, he founded the Christchurch Kidney Society patient support group. In 1976, he co-founded and was inaugural chair of the Dialysis (later Renal) Society of Australasia, New Zealand Branch, a position he held several times in the following years. He has held many executive positions, including a directorship with the federal body of The Renal Society of Australasia. Adrian was an inaugural member of The Technical Standing Committee on Renal Dialysis and Transplantation (1980 – 1984), The Renal Advisory Group (1996 -1998) and the National Renal Advisory Board (2000 - 2010).

In 2000, he became the founding chairman (2000 - 2010) of the New Zealand Board of Dialysis Practice, overseeing the introduction of the first formal qualification for New Zealand and Australian dialysis technologists. In 2004, he and Kelvin Lynn conceived and organised the first Australia and New Zealand Home Haemodialysis Workshop. He has published and presented widely to professional medical, nursing and technical organisations. Adrian is a life member of the Christchurch Kidney Society and of the Renal

Society of Australasia. In 2014, he was made an Officer of the New Zealand Order of Merit. Although now retired he works part time as the Living Kidney Donor Advisor for the Christchurch Nephrology service.

Peter Hatfield

MBChB (Otago), FRCP, FRACP

Peter Hatfield was born in Lower Hutt on 18 May 1941. He qualified from Otago University in 1964. Peter worked at Wellington Hospital with Bruce Morrison, followed by postgraduate training and research at Guy's Hospital, London, as a senior registrar with Drs Stewart Cameron and Chisolm Ogg. He researched purine metabolism and gout. When he returned to Wellington as a renal physician in 1975 he set up dialysis, home training and kidney transplantation for central New Zealand. He was the medical advisor for the Life Donor Campaign in 1983 and for National Kidney Week in 1986.

In 1986, he and the Minister of Transport (Richard Prebble) organised the organ donor scheme for the permanent driving licence. With Professor Peter Skegg he wrote the Code of Practice for Transplantation of Cadaveric Organs in 1987. From 1983 to 1988 he was Chairman of the Specialist Advisory Committee for Renal Medicine for the Royal Australasian College of Physicians. In 1988 he became Director of Renal Medicine in Wellington until 2001. He founded the Wellington Region Kidney Society in 1977 and the following year raised funds and bought a dialysis holiday home in Taupo. He returned to London in 2002 to work at Hammersmith Hospital as consultant renal physician before retiring to Wellington in 2006. Peter's interests are tramping (he has been Wellington Search and Rescue doctor for 20 years), climbing, skiing, gardening, music, film, theatre, history (past chairperson of the Wellington Medical Historical Society) and University of the Third Age (President 2014 – 18).

Martin Wallace

MBChB (Otago), B Med Sci (Otago), FRACP, FRCP (Lond)

Martin Russell Wallace was born in Tauranga on 29 October, 1935, and died in Hamilton on 13 September 2017. He trained in medicine at the University of Otago, graduating in 1960. His training included a Junior Research Scholarship in Medical Sciences in Pharmacology. His immediate postgraduate years were spent working at Wellington and Lower Hutt Hospitals. In 1965, he began his nephrology training as a registrar in the medical renal service headed by Oliver Wrong at the Royal Postgraduate Hospital, Hammersmith, London.

Martin returned to New Zealand to set up the renal medicine service at Waikato Hospital. Over subsequent years, Martin oversaw the establishment of dialysis and transplantation services in the central North Island. He introduced continuous ambulatory peritoneal dialysis to New Zealand in 1978. Martin was an early advocate of the importance of understanding and respecting culture in the care of Māori patients and communicated with them in Te Reo. In 1978, he was appointed to the newly established National Standing Committee on Dialysis and Transplantation and was chairman from 1976-78. His areas of research interest included oxalate metabolism and the role of aluminium-containing medicines in dialysis dementia. Martin retired from clinical practice in 2000 but continued his interest in medical history and critical appraisal of healthcare.

Chapter Authors

Ailsa Jacobson

RN

Ailsa began her nursing training at Waikato in 1962 and came to Wellington Hospital in 1967 as a State Registered Nurse. In 1978, she began the CAPD training in Wellington and then became departmental manager in 1995. She joined the Ministry of Health in 2003 where she works as a Senior Advisor.

John Collins

MBChB (Otago), FRACP (1982)

John Collins grew up in Wellington and studied medicine at the University of Otago. He worked as a junior doctor at Wellington Hospital where he began his nephrology training. He worked at the LA County USC Medical Centre 1981-1984 and was appointed Renal Physician at Auckland City Hospital in 1984, where he was Clinical Director from 1997 to 2008. He is currently in private practice at Medical Specialist Group, Mercy Hospital Auckland.

Max Morris

MBChB (Otago),FRACP

Max Morris is a consultant paediatric nephrologist who established the paediatric renal service in Princess Mary Hospital (Starship's precursor) in 1980. He retired from full-time practice at Starship Children's Hospital in 2011. At that time the service had grown to three consultants and two specialty nurses. Max undertook short locums at the Royal Children's Hospital in Melbourne, Australia, and back at Starship before full retirement in 2014. The Royal Australasian College of Physicians awarded Morris the John Sands Medal in 2003 for services to the College in paediatrics.

Miranda Walker

MPhil, DipNurs

Miranda worked in the Wellington Renal Service for over 20 years, most recently as Nurse Educator. She is a past President of the NZ branch of the Renal Society of Australasia, has sat on the Renal Advisory Board to the Ministry of Health, and lead the development of the National Nephrology Nursing Knowledge and Skills Framework. She works currently as a Diabetes Clinical Nurse Specialist, with a particular interest in early detection and management of diabetic kidney disease.

Nick Polaschek

BA, PhD

Nick Polaschek worked for 20 years as a dialysis nurse and renal manager at Wellington Hospital and led the renal project in the Ministry of Health for a number of years. Nick, now retired, is on the Board of Kidney Health New Zealand. Nick has degrees in Economics, Sociology and a PhD on the topic of the experience of Pākeha men living on home haemodialysis.

William Wong

MBChB (Otago), FRACP

William Wong is currently consultant paediatric nephrologist at Starship Children's Hospital and clinical head of the department. He has been a paediatric nephrologist at Starship since 1995. William was an assistant secretary for the Oceania region for the International Pediatric Nephrology Association between 2008 and 2013. His special interests are paediatric hypertension, haemolytic uraemic syndrome and acute post infectious glomerulonephritis.

Appendix A

Report of Committee on Renal Dialysis and Transplantation to the Hospitals Advisory Council June 1977

HG West, (chairman). Member of the Hospitals Advisory Council and Chairman of the Nelson Hospital Board

Mr CH Maclaurin, Associate Dean of Graduate Studies, Auckland University. Previously Transplant Surgeon, Auckland Hospital

Dr PJ Little, Renal Physician, Christchurch Hospital

Mr JW Raine, Surgeon, Wellington Hospital and President, Royal Australasian College of Surgeons

Dr RBI Morrison, Renal Physician, Wellington Hospital

Dr PB Doak, Renal Physician, Auckland Hospital

Dr M Wallace, Renal Physician, Waikato Hospital

Mr J Hyslop, Management Services and Research Unit, Department of Health

Appendix B

The Management of End-stage Renal Failure Consensus Development Conference 1992

Winston McKean, Manager, Health Needs and Policy, Southern Regional Health Authority

Professor TJ Neale, Wellington School of Medicine and Renal Physician, Wellington Hospital

Pat Capon, Charge Nurse, Acute Medicine, Whangarei Hospital

Bev Clark, Ethics Committee, Southland AHB

John Collins, Renal Physician, Auckland Hospital

Linda Grenell, Convenor, Maori Health Advisory Group, Canterbury AHB

Tony Hearn, Councillor, National Kidney Foundation, Chairman, Christchurch Kidney Society

Joanna Innes-Walker, Transplant Co-ordinator, Auckland AHB

Ailsa Jacobson, Service Manager, Renal Services, Wellington Hospital

Kelvin Lynn, Renal Physician, Christchurch Hospital

Owen Robinson, Chairperson, Wellington AHB Ethics Committee

Martin Searle, Renal Physician, Middlemore Hospital

Robert Walker, Senior Lecturer in Renal Medicine, University of Otago School of Medicine, Renal Physician, Otago and Southland

Appendix C

New Zealand nephrologists, surgeons and supporting physicians 1960-2000

Renal unit	Nephrologists/Physicians*	Surgeons
Auckland	Derek North Peter Doak Elizabeth Bowie John Montgomerie Robin Irvine David Richmond Ian Simpson Lawrie Williams Martin Gregory John Collins Ian Dittmer Helen Pilmore	Campbell Maclaurin Athol Duke Peter Christie Stephen Munn
Hamilton	Martin Wallace Bernard Hyne Maggie Fisher Peter Sizeland Kim Wong	Jim Gray Geoff Allen David Mee Bill Wright
Wellington	Bruce Morrison Peter Hatfield Jim Neale Alastair Macdonald Grant Pidgeon Joe McEvoy Nicky Hay J Verney Cable* Jack McCreanor*	Donald Urquhart-Hay Clive Stevenson John Nacey John McIlwaine Peter Meech Peter Johnston Dilip Naik
Christchurch	Peter Little Ross Bailey Kelvin Lynn Charles Swainson Richard Robson Martin Searle Errol Hannah*	Alan Chirnside John Morton William Utley Norman Greenslade Bill Macbeth Colin McRae Stephen Packer John Mercer Justin Roake

Renal unit	Nephrologists/Physicians*	Surgeons
Dunedin	Robin Irvine Winston McKean* Steve Dixon Tony Hocken John Stewart Rob Walker	John Black Stephen Packer
Starship Children's Hospital (Auckland)	Max Morris William Wong	
Middlemore	Ian Simpson David Richmond Sharon Kletchko Martin Searle Walter van der Merwe David Voss Krishan Madhan Mark Marshall	
Palmerston North	Peter Sizeland Norman Panlilio Ross Hayton* Murray Kirk* Richard Wigley*	John Coutts Richard Coutts David Dunlop
Regional hospitals	Physicians	
Tauranga	Neil Graham	
Hawke's Bay	Ian McPherson* Ted Ward* Richard Meech* Peter Fleischel*	
Whanganui	Tom Thompson Richard Stone Neil de Zoysa	
Nelson/Marlborough	Bruce King John Hedley	
Greymouth	Paul Holt	
Timaru	John Doran	
Invercargill	Charles Renner	

Appendix D

New Zealand Hospitals with Renal Units and Satellite Units 2018

Auckland City Hospital

- Auckland Home Training Unit
- Carrington Satellite
- Grafton Training Unit
- Greenlane Hospital

Starship Children's Hospital

Christchurch Hospital

Dunedin Hospital

Hawkes Bay Hospital

Middlemore Hospital

- Manukau Satellite
- Rito
- Toto Ora

Palmerston North Hospital

Taranaki Base Hospital

Waikato Hospital

- Rotorua Hospital
- Tauranga Hospital

Wellington Hospital

- Kenepuru Dialysis Unit
- Nelson Hospital

Whangarei Area Hospital

- Bay of Islands Hospital
- Kaitaia Hospital
- Kawakawa Hospital

Waitemata

- Waitakere Satellite

Private providers

- Nephrocare NZ, Fresenius Medical Care (South East Asia) Pty Ltd.,
- KidneyCare Ltd.

Glossary of kidney disease terms

Artery – blood vessel taking blood away from the heart.

Amino acid – the building blocks of protein and important in the body's metabolism.

Automated peritoneal dialysis (APD) – form of dialysis in which dialysis fluid is exchanged by machine at night while you sleep and during the day dialysis still occurs slowly as dialysis solution is left in peritoneal cavity.

Bacteraemia – presence of bacteria in the bloodstream that usually leads to septicaemia or blood poisoning.

Calcium – a mineral found mainly in the hard part of bones, where it is stored.

Cannula – another name for a catheter.

Catheter – hollow tube used to transport fluids to or from the body.

Centre (or hospital) dialysis – dialysis provided in a hospital-based unit.

Chronic kidney disease – Chronic kidney disease (CKD), also known as chronic renal disease is a term used to describe kidney damage or reduced kidney function (irrespective of the cause) that persists for more than three months.

Conservative treatment – Some people decide to have “conservative” treatment (also called, palliative or supportive care) rather than have dialysis or a transplant. The aim of conservative treatment is to manage the symptoms of kidney failure without using dialysis or transplantation. Conservative treatment includes medical, emotional, social, spiritual and practical care for both the person with kidney failure and their family/whānau.

Continuous ambulatory peritoneal dialysis (CAPD) – form of continuous peritoneal dialysis in which dialysis fluid is exchanged at regular intervals throughout the day.

Creatinine – a waste product of muscle activity that is removed from the body by the kidneys, and excreted in the urine; high levels of creatinine represent reduced kidney function.

Diabetes mellitus – (commonly called diabetes) disease of the pancreas in which production of insulin is decreased or insufficient for the body's needs, resulting in disturbed levels of glucose in the blood.

Dialyser – the part of a kidney machine which acts like a filter to remove wastes from the body.

Dialysis fluid or dialysate – special fluid used in dialysis into which wastes are passed.

Dialysis – a treatment for kidney failure which removes wastes and water from the blood. Dialysis is a process by which small molecules pass from one fluid where they are in

high concentration to another fluid where the concentration is lower, through a porous membrane.

End-stage kidney disease (ESKD) – stage in kidney disease when treatment, such as dialysis or transplantation, becomes necessary. “End-stage” refers to the end of kidney function.

Exchange – one complete cycle of peritoneal dialysis; consisting of inflow equilibration and outflow of dialysis fluid.

Extracorporeal sorbents – blood is passed through a special column outside the body to remove waste products caused by disease using equipment similar to that used in haemodialysis.

Fistula – commonly used method of providing access to the bloodstream in which a vein and an artery (usually in the arm) are joined together under the skin causing the vein to enlarge.

Gastrostomy tube - a tube is passed into a patient’s stomach through the abdominal wall, most commonly to provide a means of feeding when oral intake is not adequate.

Glomerular filtration rate (GFR) – glomerular filtration rate describes the flow rate of filtered fluid through the kidney The eGFR is an estimate of this flow rate obtained from a blood creatinine test. People with an eGFR < 60ml/min are considered to have chronic kidney disease (CKD). When the eGFR drops to below 15 mL/min, treatment with dialysis usually needs to start soon.

Glomerulonephritis – A condition in which the glomeruli, the tiny filters in the kidneys, are damaged: often referred to as nephritis.

Glucose degradation products (GDP) – these are produced during the sterilisation of peritoneal dialysis fluid.

Graft – commonly used method of providing access to the bloodstream in which a vein and an artery in the arm are joined together with a piece of the patient’s vein (usually from the lower limb) or a special plastic-like tubing.

Gut microbiome – all the organisms living in the human intestine.

Haemodialysis – treatment for kidney failure in which the blood passes through an artificial dialyser to remove wastes and water.

Haemodynamic shifts – changes in the amount of fluid in the body that can cause low blood pressure during dialysis treatments.

Haemofiltration – a type of haemodialysis that removes wastes by convection (the movement of waste molecules through a semipermeable membrane associated with the fluid being removed during ultrafiltration); waste molecules are swept through the membrane by a moving stream of ultrafiltrate.

Heparin – substance added to blood during haemodialysis to prevent it from clotting in

the dialyser.

Hypertension – high blood pressure which may be either the cause of, or the result of, kidney disease.

Icodextrin – a colloid osmotic agent, derived from maltodextrin, that helps remove water during peritoneal dialysis; other dialysis solutions use glucose for this purpose.

Immunosuppressive drugs – drugs that prevent or treat the rejection of a transplant; they are also called anti-rejection drugs.

Indoxyl sulphate – a waste product that accumulates in people with poor kidney function and is thought to cause some of the symptoms of kidney failure.

Jugular vein – blood vessel located in the side of the neck sometimes used to provide access for haemodialysis.

Kidney biopsy – a small piece of kidney tissue, removed using a needle which can be examined under a microscope.

Lactate – an organic substance that is added to peritoneal dialysis fluid to act as a chemical buffer to control pH or acidity.

Membrane – porous material which is used to filter waste from the blood.

Nephrology – the branch of medical science that deals with the kidneys.

Nephron – the structural and functional units of the kidney, numbering over a million in each kidney, which form urine.

Organ – structurally distinct part of the body which usually performs a particular function. An organ is usually made up of several types of tissue in a very organised structure, e.g. kidney, heart, lungs, liver.

Osmolality – a measure of the number of dissolved solute particles in a solution.

P cresyl sulphate – a waste product that accumulates in people with poor kidney function and is thought to cause some of the symptoms of kidney failure.

Palliative care – The aim of palliative or conservative treatment is to manage the symptoms of ESKD without using dialysis or transplantation. This care includes medical, emotional, social, spiritual and practical care for both the person with ESKD and their family/whānau.

Parathyroid hormone – a substance produced by the parathyroid glands in the neck the neck to control calcium metabolism Blood levels of parathyroid hormone rise in patients with kidney failure and can contribute to bone disease.

Peritoneal cavity – abdominal cavity that contains the intestines and other internal organs

It is lined by the peritoneum or peritoneal membrane.

Peritoneal dialysis – treatment for kidney failure in which dialysis fluid is introduced into the peritoneal cavity to remove wastes and water from the blood.

Peritoneum – thin membrane that encloses the peritoneal cavity and surrounds the abdominal organs.

pH – a measure of how acid or alkaline a solution is.

Polycystic kidney disease – inherited kidney disease that produces fluid-filled cysts in the kidneys that produce chronic kidney failure over many years.

Protein – substance obtained from food which builds repairs and maintains body tissues.

Protein bound toxins – Many small substances in the blood are transported in the blood stream closely attached to large proteins such as albumin; these protein-bound substances are not removed during dialysis as they are too large to pass through the dialysis membrane.

Recipient – person who receives a new organ.

Residual renal function – the small, but important, amount of kidney function usually remaining at the time people start dialysis treatment.

Renal – relating to the kidney e.g. renal failure.

Kidney failure – failure of kidney function.

Satellite dialysis – dialysis takes place in a unit separate from the hospital.

Sodium – mineral in the body fluids regulated by the kidneys. Sodium levels affect the amount of water retained in the body tissues.

Solute – in kidney failure these are waste products that are dissolved in the bodily fluids.

Tenckhoff catheter – a cuffed silicone catheter, named after its inventor, which is permanently inserted into the abdominal cavity for infusion of dialysing solution in patients undergoing peritoneal dialysis.

Tissue typing – a special pattern of markers (antigens), (called tissue type) is present on everyone's cells and tissues. Tissue typing is a test done in the laboratory in which the tissues of a prospective donor and recipient are tested for compatibility prior to transplantation.

Transplant – to transfer, as an organ or a portion of tissue, from one person to another.

Ultrafiltration – the process by which the human and artificial kidneys remove waste

products from the blood. During haemodialysis, this occurs across an artificial semi-permeable membrane and in peritoneal dialysis the patient's peritoneal membrane is used.

Uraemia and uraemic – condition caused by build-up of waste products in the blood.

Urea – waste product from the breakdown of protein.

Vein – blood vessel returning blood to the heart.

Vesicoureteric reflux – a condition in which urine flows retrograde, or backward, from the bladder into the ureters/kidneys and may be associated with kidney scarring.

Volume status – the volume of blood in the circulation. This can change rapidly during haemodialysis.

