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Synopsis from the article: [Agar JWM, Somerville CA, Dwyer KD, Simmonds RE, Boddington JM, Waldron JM. Nocturnal hemodialysis in Australia. *Hemodialysis International* 2003; 7: 278-289](#)

Because of the vast distances, sparse population and seaboard location of all major centers—particularly in Australia—home dialysis, and particularly home hemodialysis, has been common throughout Australia and New Zealand.

Though the proportion of home patients as a percentage of the total 7,000 patient dialysis population [including hemodialysis (HD), continuous ambulatory peritoneal dialysis (CAPD) and automated peritoneal dialysis (APD)] has slowly fallen from >50% in the late 1970's to only 36% in March 2002 (with home HD accounting for just over 30% of all the home-based patients), the appearance of the new modality, nocturnal home hemodialysis (NHHD) fell on fertile ground where home-based therapies were still considered normal and held strong ongoing support.

It was relatively straightforward, therefore, for the authors to argue for government support to do a trial of NHHD. This pilot study was initiated in Geelong, a city of ~250,000 just outside Melbourne in the State of Victoria. By the start date of the program in 2001, NHHD had already developed an impressive track record in Canada and one or two centers in the US, but was hampered in North America by the relatively few training programs and broad unfamiliarity with and support systems for home hemodialysis. In Australia however, such systems were historically and, in actuality, alive and well.

NHHD was established in Geelong and the program rapidly grew. By the time of the report in *Hemodialysis International*, 16 patients had been trained between July 1, 2001 and March 1, 2003. Two of the 16 opted for alternate night NHHD (altNHHD) while 14 elected for 6 night/week NHHD (6xNHHD). One of the 14 6xNHHD patients decided after several weeks of 6xNHHD to switch to altNHHD, while 2 of the remaining 13 6xNHHD were subsequently successfully transplanted at 4 and 9 months of effective NHHD. One patient, a 78-year-old man who had desperately wanted to dialyze at home, failed to manage at home and was brought back into the satellite dialysis unit. This left 10 6xNHHD in the ongoing program. By March 2003, 497 patient weeks had been logged by the 6xNHHD, while the altNHHD had logged 158 total weeks of experience at home. No deaths were recorded and 5 hospitalizations for 11 inpatient days were required in that period.

The experience of the unit—and a detailed educational package and program for potential NHHD patients which has received extensive acclaim both in Australia and around the world—has been developed by the Geelong team and can be found on the Internet at <http://www.nocturnaldialysis.org>.

The clinical results, as have now become the accepted and universal outcome of NHHD programs the world over, have been excellent. Biochemistry has normalized, bone strength is returning, measurements of heart size and function have shown steady reversal from abnormal to normal, and sleep patterns have normalized. As phosphate removal in particular is so efficient with long slow overnight dialysis, all phosphate binders are ceased at program entry. Indeed, we have to add phosphate to the dialysate in most patients to sustain the serum phosphate level.

Though some North American programs have utilized modem monitoring as a means of remote 'control' over the dialysis process, home patients have not traditionally been monitored during the day in Australia and New Zealand. As NHHD is a far slower, more gentle dialysis offering ~50 hours of membrane contact time per week compared with only ~12 hours for conventional home and center-based dialysis techniques, hypotension does not occur. Simply put, one cannot drink enough fluid nor eat enough potassium in one day that cannot be easily yet gently removed over 8 hours later the same night. As a result, diet and fluid intake is free and all patients can eat and drink as they wish. Moreover, the major reason for monitoring patients is to detect hypotensive crises and manage these by rapid saline infusion — of itself a counterproductive but necessary response in in-center dialysis where one of the main objectives is fluid removal. In NHHD, however, there are 8 hours each night to remove each day's 16-hour fluid intake. This allows the removal rate of fluid to be so gentle that hypotensive episodes rarely, if ever, happen.

Safety has been our main concern. To assure fistula integrity and needle safety, an electrode-impregnated tape is loosely wound around the fistula site and connected to an alarm in case of blood leakage through the night. No such leaks have occurred and patients sleep soundly with a mean of 1.5 alarms at night. All our patients use native forearm or upper arm fistulae - indeed we have not put in a graft for > 10 years now. Two NHHD patients have required the surgical revision of an arterio-venous fistula stenosis known to be present prior to commencing NHHD and have used brief 'bridging' catheter access to allow the surgery while continuing NHHD at home.

These factors have permitted not only a non-monitored program, but our patients can now safely dialyze, at home, at night, alone. A further benefit of the program is that, by dialyzing at night, there is a complete return of daytime freedom. A number of our patients have returned to work now that they feel stronger and better and their days are free to actually contemplate re-employment.

Beyond the exciting and positive clinical outcomes has been our cost analysis. NHHD has proven uniformly and significantly cheaper than standard satellite and/or center-based programs. This is because there are no nursing wages or infrastructure costs beyond the low costs of the training unit itself (2 chairs, 2 nurses). Two nurses can easily train, support and manage 30 home patients, while 8 nurses would be needed for a similar program in a center. The patient's home is the center—no bricks, no mortar, no building and engineering costs. In Australia, dialysis is government-funded. There is a government subsidy for water and power for home patients while machines and home

installation are provided free to all patients and all consumables are funded through government grants. There are no out-of-pocket expenses for patients—whether in center or in the home—but the in-center program costs to the provider are huge. As the home dialysis program grows, the differential cost savings to government also grow.

Post-script:

NHHD has grown rapidly in Australia since this program was evaluated by other services around Australia. There are now ~200 NHHD patients in Australia and New Zealand and home hemodialysis numbers are growing again as a proportion of all dialysis patients.

The Geelong program has now trained 29 patients for NHHD from its HD pool of ~110. This is approaching 30% of our HD patient pool. Of these, 24 remain supported in the home. The authors believe a conservative estimate of 30-40% of all HD patients can and should be supported in the home on NHHD rather than on less effective, higher morbidity and higher cost, in-center programs. Though there will always be a need for in-center support for the older and the frail, too few dialysis services accord their more capable patients the respect, trust, and faith that self-determination and self-management readily nurture.

The present authors have recently published a review entitled ‘*Nocturnal dialysis in Australia and New Zealand*’ in *Nephrology* 2005;10: 222-30.

Also in press in *Nephrology* is a detailed cost analysis paper, albeit primarily applicable to the Australian scene, which agrees closely with the comparative NHHD costs published from North America. This paper from the Geelong team estimates the potential program savings from NHHD to be 11% [6xNHHD] to 32% [altNHHD] when compared to the costs of conventional satellite unit HD.

The present authors have also published, in an abstract form, an comparison between altNHHD and 6xNHHD. These data, presented at the Annual Dialysis Conference in Tampa, Florida, in March 2005 concluded that although altNHHD is clearly more cost efficient, there remain strong claims for 6xNHHD as the optimal clinical therapy.

Funding processes are required that permit either NHHD option, depending upon patient choice. In a forward-looking move, the Department of Human Services (Victoria) gazetted NHHD in December 2004 as a fundable, recognized and supported dialysis modality in Victoria—one of the first known governments to so do.

Finally, in a paper entitled “‘*Flexible*’ or ‘*lifestyle*’ dialysis: is this the way forward?” which will appear in *Nephrology*, the Geelong group have shown how they have used the savings gained from NHHD to fund a program of consumable-expensive short daily hemodialysis (SDHD) yet at cost-neutrality to the costs of standard ‘conventional’ HD. The 10 SDHD and 24 NHHD (20 @ 6xNHHD and 4 @ altNHHD) now together comprise >30% of the total Geelong HD pool.

Commentary by Todd S. Ing, MD

Dr. Agar and his colleagues, pioneers in the use of nocturnal hemodialysis in Australia, have demonstrated the clinical and economic advantages of the 6 times/week and the 3 times/week nocturnal dialysis regimens. Many other centers in the world have observed similar benefits.