



Multidisciplinary Care Program for Advanced Chronic Kidney Disease: Reduces Renal Replacement and Medical Costs[☆]

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ABSTRACT

BACKGROUND: Multidisciplinary care is advocated as an effective chronic kidney disease treatment program in a few, but not all, studies. Our study aimed to evaluate the effect of multidisciplinary care on renal outcome and patient survival using a larger cohort.

METHOD: A total 1382 chronic kidney disease patients, ages 18-80 years, with chronic kidney disease stage 3B-5, in nephrology outpatient clinics were enrolled. Using age, sex, chronic kidney disease stage, and diabetes mellitus as variables, 592 multidisciplinary care program participants were matched with 614 non-multidisciplinary care patients. The primary outcomes were long-term renal replacement therapy and mortality. Secondary outcomes included changes of biochemical markers and blood pressure, infection hospitalization, cardiovascular events, and emergent start of long-term dialysis. Annual medical costs were compared.

RESULTS: There were no between-group differences regarding mortality. In the multivariate competing-risk regression model, the multidisciplinary care group had a better renal survival (hazard ratio 0.640; 95% confidence interval, 0.484-0.847; $P = .002$). This effect was most prominent in stage 4 (hazard ratio 0.375; 95% confidence interval, 0.219-0.640; $P < .001$), but not in stage 3B and 5 patients. The multidisciplinary care group showed a slower estimated glomerular filtration rate decline (-2.57 vs -3.74 mL/min/1.73 m², $P = .021$), and a smaller increase in phosphate ($+0.03$ vs $+0.33$ mg/dL, $P = .013$). Cardiovascular and infection events were both decreased in the multidisciplinary care group ($P < .001$). There was also less requirement of emergent start dialysis (39.6% vs 54.5%, $P = .001$). The annual cost for the multidisciplinary care group was lower than the nonmultidisciplinary care group (US \$2372 vs \$3794, $P < .001$). In addition, considering the reduction of patients requiring renal replacement therapy, the multidisciplinary care program saved a total US \$1931 per patient annually.

CONCLUSIONS: Our analysis demonstrated that the multidisciplinary care program provided better health care and reduced renal replacement therapy in patients with advanced chronic kidney disease. By decreasing hospitalizations, emergent start, and the need for renal replacement therapy, the multidisciplinary care program was cost-effective.

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KEYWORDS: Chronic kidney disease; Multidisciplinary care; Renal outcome

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Funding: See last page of article.

Conflicts of Interest: See last page of article.

Authorship: See last page of article.

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The incidence of end-stage renal disease in most countries is increasing. Chronic kidney disease, the major cause of end-stage renal disease, is associated with increased risk of comorbidities and mortality. Finding an effective treatment to prevent the progression is an important issue.

Multidisciplinary care is an integrative medical care system that includes doctors, nurses, and dietitians to participate in the medical treatment, patient education, diet consultation, behavior adjustment, and close monitoring system. Earlier studies demonstrated that multidisciplinary care participants were better prepared for dialysis.¹ There were also beneficial effects on patient overall survival, laboratory parameters,^{2,3} less unplanned dialysis, and lower incidence of cardiovascular events.⁴ However, there was a report revealing no beneficial effect on renal function progression.⁵ The initial report of the Multifactorial Approach and Superior Treatment Efficacy in Renal Patients with the aid of Nurse practitioners (MASTERPLAN) study did not reveal improvement on cardiovascular outcomes, all-cause mortality and end-stage renal disease.⁶ However, the extended follow-up showed a better composite outcome of end-stage renal disease, death, or 50% increase of creatinine.⁷

Taiwan initiated a nationwide multidisciplinary care program for stage 3B-5 chronic kidney disease patients in November 2006, after that a slower renal function deterioration was found.^{8,9} A survey revealed a progressive decrease of end-stage renal disease incidence since 2007.¹⁰ However, several studies in Taiwan showed a contradictory effect. One observation showed that multidisciplinary care was associated with a slower decline rate of estimated glomerular filtration rate (eGFR) and less initiation of dialysis.¹¹ In central Taiwan, multidisciplinary care participants had paradoxically more long-term dialysis.¹²

To provide evidenced-based data for the exact benefit of a multidisciplinary care program, we conducted a retrospective study to evaluate the effect of this program on dialysis incidence, eGFR decline, patient survival, change of biochemical markers, and medical costs.

METHODS

Participants

We performed a retrospective single-center analysis in National Taiwan University Hospital. Patients ages 18-80 years who were diagnosed with chronic kidney disease stage 3B-5 for at least 3 months and joined the pre-end-stage renal disease multidisciplinary care program between 2007 and 2009 were included. These patients were defined as a

multidisciplinary care group. We excluded patients who have had a kidney transplant, had acute kidney injury, ever received renal replacement therapy, had Child Pugh class B-C liver cirrhosis, and had terminal malignancies. We used a 4-variable equation from the Modification of Diet in Renal Disease-4 equation ($186 \times \text{Scr}^{-1.154} \times \text{Age}^{-0.203} \times 0.742$ (if female) $\times 1.212$) to estimate eGFR.

For the comparison group (nonmultidisciplinary care group), we choose patients not entering the multidisciplinary care program during the same period and treated at our nephrology outpatient clinic with the diagnosis of International Classification of Disease, 9th Revision codes 585 and 582. The inclusion and exclusion criteria were the same as the multidisciplinary care program recipients. We further matched those comparison group patients with multidisciplinary care group patients by chronic kidney disease stage, age, sex, and diabetes. All patients in the multidisciplinary

care and nonmultidisciplinary care group were treated according to the Kidney Disease Outcomes Quality Initiative guidelines.¹³ This study was approved by the National Taiwan University Hospital Research Ethics Committee.

Multidisciplinary Care Program

The multidisciplinary care program integrated the care of nephrologists, nurses, dietitians, and pharmacists. On visiting our nephrology clinic, those with eGFR ≤ 45 mL/min per 1.73 m^2 were all requested by the physician to join the program. The nursing staff conducted a detailed interview with the patients, consisting of basic knowledge of chronic kidney disease, lifestyle modification, clarifying risk factors, and condition of end-stage renal disease. Dietician consultation was conducted at the same time. The participants return to the clinic every 1-3 months, according to the judgments of primary care nephrologists. The educational programs conducted by the nursing staff and routine laboratory tests are required at least every 3 months. The registration fee was US \$40 and annual fee was US \$150 (stage 3B-4) or US \$180 (stage 5). Once the patients entered chronic kidney disease stage 5, they were invited to visit our dialysis center to receive dialysis education regarding the modality of renal replacement therapy. Preparation of the hemodialysis vascular access or peritoneal dialysis catheter was encouraged when suitable.

Data Collections

Data of age, sex, underlying diseases, and comorbidity were recorded. The definition of cardiovascular disease

CLINICAL SIGNIFICANCE

- This study demonstrated the beneficial effect of a multidisciplinary care program in chronic kidney disease patients.
- Patients in a multidisciplinary care program had a benefit of risk reduction of 33.6% renal replacement therapy compared with patients not receiving this program.
- Patients receiving a multidisciplinary care program had less chance of admission or emergent dialysis.
- A multidisciplinary care program is cost-effective.

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