# Is Living Kidney Donation the Answer to the Economic Problem of End-Stage Renal Disease?

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***Summary:*** The escalating number and cost of treating patients with end-stage renal disease is a considerable economic concern for health care systems and societies globally. Compared with dialysis, kidney transplantation leads to improved patient survival and quality of life, as well as cost savings to the health payer. Despite efforts to increase kidney transplantation, the gap between supply and demand continues to grow. In this article we explore the economic consideration of both living and deceased transplantation. Although living kidney donation has several advantages from an economic perspective, efforts to increase both deceased and living donation are required. Strategies to increase kidney donation are underfunded, and even costly strategies are likely to lead to net health care savings. However, demonstration of efficacy of these strategies is required to ensure efficient use of resources.

***Keywords:*** *Kidney transplantation, health care costs, chronic kidney failure, health care economics*

In 2006, $23 billion was spent caring for patients with end-stage renal disease (ESRD), and this amount has increased by 3% to 12% annually in the past 5 years.[1] Although comprising less than 1% of beneficiaries,[2] the cost for ESRD accounts for 6.4% of the entire Medicare budget.[1] The high costs of ESRD care are driven largely by the provision of dialysis therapy, which although life saving, is resource intensive. The number of prevalent patients treated with dialysis continues to increase globally,[3] with attendant cost implications for health care systems. It is likely that growth in the number of patients with ESRD will continue to increase given the large number of patients with chronic kidney disease and the evolving epidemic of diabetes mellitus.[4] In this era of fiscal restraint and finite health care budgets, ESRD care represents a significant challenge to health care systems worldwide.

## HEALTH CARE COSTS OF ESRD TREATMENT AND TRANSPLANTATION

The cost to the health care system for one dialysis patient is $30,000 to $80,000 annually depending on the modality used,[5] and is composed largely of costs related to the provision of dialysis therapy itself.[6] Kidney transplantation is associated with health care costs that are similar in magnitude to dialysis in the first posttransplant year, but decrease rapidly in the second year, with total costs approximating 40% of the annual costs of dialysis.[7,8] The initially high observed costs with transplantation are largely owing to the surgical procedure and attendant hospitalization episode.[8] The subsequent health care expenditure is composed of several smaller cost categories, including out-patient, in-patient, and medication costs.[7] The comparative cost sav-

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ings associated with transplantation continue over time, and it has been estimated that one additional kidney transplant will lead to a direct net health care cost savings of approximately $100,000 compared with dialysis treatment.[9,10] However, it should be noted that the total costs of kidney transplantation activity may not be captured completely. The majority of published costing studies and economic analyses focus on recipient costs and outcomes, and the costs of other transplant-related activity (organ procurement organizations, educational initiatives, and so forth), as well as the costs of identification, work-up, and the management of potential and realized living and deceased donors are not well described. Exclusion of these costs may overestimate the reported cost savings of transplantation compared with dialysis, although given the magnitude of reported cost savings the conclusions are unlikely to be altered.

Kidney transplantation also is associated with a gain in both quantity and quality of life compared with dialysis.[7,11] The quality-adjusted life-year (QALY) is a common metric of overall health status, and its use facilitates comparison of effectiveness and cost-effectiveness ratios between different patient populations and treatments. The QALY incorporates both quality of life and quantity of life, and is important from an economic perspective because societies and health care systems are willing to spend resources to achieve QALY gains. Although the precise values, and indeed the methods to estimate the value of a QALY, vary and may be controversial, it generally is considered reasonable for a health care system in a developed nation to spend $30,000 to $50,000 on interventions or strategies to achieve an additional QALY.[12-14] Kidney transplantation results in an estimated net gain of 2 to 3.5 QALYs compared with dialysis,[9,10] and if this estimated monetary value of QALY is included,[15] the net economic worth of obtaining an additional kidney for transplantation from the health payer's perspective is approximately $300,000.

The perspective of an economic evaluation will dictate whether only costs incurred by the health care payer, or broader societal costs such as patient time costs, out-of-pocket medical costs, and home and workforce productivity costs are included.[16] Patient-borne costs, including time costs of health care contact, transportation, accommodation, and child care are reported to decrease dramatically from $15,000 to $5,000 per year posttransplantation.[7] Available data also indicate that increased social participation and improved social status occurs after kidney transplantation, although the quality of available studies precludes definitive conclusions.[17]

Despite ongoing promotion and increased awareness of both deceased and living organ donation and transplantation over the past decades, the gap between demand and supply continues to grow. In the United States, the median waiting time on the transplant list continues to increase—it is estimated at 4 years for patients added to the list in 2008 compared with 2.8 years in 2003.[1] Prolonged time on the transplant wait list also may contribute to mortality on the wait list, which was estimated at 16% for patients listed in 2001.[1] Although living kidney donation accounts for 45% to 50% of all transplants, the rapid growth in living donors observed in the past has slowed in Canada,[18] and in the past 2 years the rate of living kidney transplantation has decreased by 3% in the United States.[1]

## COSTS ASSOCIATED WITH LIVING AND DECEASED DONATION

Compared with deceased kidney donation, living kidney donation offers several advantages that translate into economic efficiency. The need for dialysis therapy, and dialysis access creation and maintenance, can be minimized or eliminated entirely through pre-emptive transplantation, thus reducing both the duration of therapy and the attendant costs for an individual patient. Reducing the length of pretransplant dialysis also may shorten the length of stay for the transplant hospitalization episode.[19] Patients with a failed graft who return to dialysis also incur greater health care costs than dialysis patients who have not been transplanted,[7] and improved graft outcomes with kidneys from living donors may minimize this occurrence and associated costs. Although high-quality evidence that accounts for all confounding recipient factors is sparse, an analysis of Medicare