The Coming Fiscal Crisis: Nephrology in the Line of Fire

Martin J. Andersen and Allon N. Friedman

Summary

Nephrologists in the United States face a very uncertain economic future. The astronomical federal debt and unfunded liability burden of Medicare combined with the aging population will place unprecedented strain on the health care sector. To address these fundamental problems, it is conceivable that the federal government will ultimately institute rationing and other budget-cutting measures to rein in costs of ESRD care, which is generously funded relative to other chronic illnesses. Therefore, nephrologists should expect implementation of cost-cutting measures, such age-based rationing, mandated delayed dialysis and home therapies, compensated organ donation, and a shift in research priorities from the dialysis to the predialysis patient population. Nephrologists also need to recognize that these changes, which are geared toward the population level, may make it more difficult to advocate effectively for the needs of individual patients.

Clin J Am Soc Nephrol 8: 1252–1257, 2013. doi: 10.2215/CJN.00790113

Division of Nephrology, Indiana University School of Medicine, Indianapolis, Indiana

Correspondence: Dr. Martin J. Andersen, Indiana University Health West Hospital, 1115 N. Ronald Reagan Parkway, Suite 141 Avon, IN 46123. Email: martande@iupui.edu

On questions of economic law it does not matter at all what the electors think or vote or say. The economic laws proceed.

Winston Churchill, 1929

Nephrologists in the United States face a harsh economic future. The health care industry in this country consumes nearly one sixth of the gross domestic product (1) and is in serious financial straits. According to the federal government, the Medicare and Social Security programs are estimated to run a $39 trillion deficit over the next 75 years (2). However, officials concede that even this astronomical sum is likely an underestimation of the true unfunded liability burden facing the public given that certain tools to constrain Medicare expenditures, such as severely reducing physician reimbursement, will be politically unpalatable (2). In fact, some outside experts estimate the real deficit to be closer to $90 trillion (3). In addition, the federal government is estimated to have a debt of nearly $22 trillion by 2022 (4), and this burden will likely grow over time through insufficient taxable income from its aging citizenry (3,5).

In 2010 the Patient Protection and Affordable Care Act (ACA) was enacted in part to remedy the health care economic crisis. The ACA's mandate for the formation of accountable care organizations (ACOs) has already begun to impress upon physicians the need for health care cost containment (6). An ACO is a network of physicians tasked with providing quality comprehensive care to a group of Medicare patients (6). If the ACO is able to do this in a cost-effective manner, it may be eligible to receive some of those cost savings from Medicare. However, if the ACO's costs exceed Medicare's expectations, the ACO will be responsible for paying back to Medicare some of the excess costs (6). Because an ACO will serve at least 5000 Medicare beneficiaries (7), the rare patient with ESRD in a large ACO may find himself or herself receiving suboptimal care (6). To address this, earlier this year the Centers for Medicare & Medicaid Services (CMS) announced the ESRD Seamless Care Organization (ESCO) program (8). An ESCO is akin to an ACO in that dialysis units and nephrologists will be responsible for providing and coordinating good-quality, cost-effective care for patients with ESRD (8). If this occurs, some of those savings will be paid back to the ESCO. However, if costs exceed Medicare's expectations, the ESCO will be liable for paying back some of the costs (8).

Although ACOs and ESCOs may help reduce health care costs, they are complicated and rely on controlling physician remuneration. A simpler method to controlling costs—which may ultimately be integrated into ACOs/ESCOs in any case—would be to overtly ration patient care. The ACA contains a provision for a 15-member independent payment advisory board whose mandate is to present to Congress "proposals to reduce costs and improve quality for (Medicare) beneficiaries. When Medicare costs are projected to exceed certain targets, the Board's proposals will take effect unless Congress passes an alternative measure to achieve the same level of savings" (9). Although the ACA states that the independent payment advisory board cannot provide recommendations that lead to rationing (9), it does not clearly define rationing and the grim fiscal realities make health care rationing a distinct and realistic possibility. In fact, we believe it is only a matter of time before the federal government implements mandatory cost-cutting measures, and some policymakers are already advocating this (10). To this end, the ESRD program, which is primarily funded by Medicare, must be considered

 Copyright © 2013 by the American Society of Nephrology

"low-hanging fruit." In 2009, Medicare paid $29 billion—nearly 6% of its total budget—for ESRD care (11). No other chronic disease is so generously funded as the ESRD program, a fact that has raised the eyebrows of some ethicists (12). Nephrologists who believe that ESRD care will remain unscathed in this era of cost consciousness need only hearken back to the not-too-distant past when overt rationing determined the fate of patients with CKD needing dialysis (13).

One strategy nephrologists can use to better understand how financial circumstances will influence future CKD care is to imagine themselves as high-level government bureaucrats whose job is to rein in government costs while maximizing health care efficiency. This paper will focus on the most attractive and feasible policies available to achieve the bureaucrats' goals, including age-based rationing, mandated delayed dialysis and home therapies, compensated organ donation, and an increased emphasis on forestalling CKD progression.

How Will the Government Measure the Value of Care?

The first step to achieving the bureaucrats' goals is to be able to measure the value of care provided. In this vein, nephrologists may soon need to familiarize themselves with the concepts of quality-adjusted life-years (QALYs) and incremental cost-effectiveness ratios (ICERs), which are currently used by the United Kingdom's National Health Service to determine how to best ration health care (14). A QALY measures the both the quantity and quality of life that would be obtained by pursuing a medical or surgical intervention (15). To calculate a QALY, one must determine a patient's utility score (15). The utility score is a measurement, often from 0 (death) to 1 (perfect health), that quantifies through various methods the health preferences of a patient (15,16). After a utility score is ascertained, one multiplies the utility score by the amount of life a health care intervention is expected to give a patient (15). Thus, a health care intervention that adds 4 years of life to a patient with a 0.5 utility score provides 2 QALYs. To determine whether one intervention is economically preferable over another, one calculates an ICER by dividing the difference in costs between the two interventions by the difference in their QALYs (17). Traditionally, an intervention has been considered economically justified at ≤$50,000/QALY (18). Investigators recently estimated the ICER of dialysis compared with that of palliative care to be $110,814/QALY (19).

CMS is currently prevented by statute from considering cost when determining what is appropriate care for Medicare beneficiaries (20), and analyses show that a substantial number of Medicare-approved interventions are >$100,000/QALY (21,22). To date, society has been willing to pay for dialysis despite its high ICER. However, as health care cost containment becomes paramount, we believe the federal government will change health care law to allow CMS to address cost per QALY when determining what medications, procedures, and surgeries it will pay for. Dialysis, an expensive procedure with a high mortality rate, will not be immune to these pressures.

Restricting Access to Dialysis

Of all the strategies the federal government can use to ration care, the simplest would be to set age limits on who is eligible for dialysis therapy. The literature would seem to support such a strategy from an economic standpoint, at least on a population level. Between 2000 and 2009, the incident and prevalent rates of dialysis patients 75 years or older increased by 12% and 37%, respectively (23), despite generally dismal outcomes. Kurella *et al.* noted a persistent 46% 1-year mortality for octogenarians and nonagenarians who initiated dialysis between 1996 and 2003, even though comorbid conditions such as anemia, heart failure, and malnutrition improved over the study period (24). A study by the same investigators of elderly nursing home patients starting dialysis revealed even worse results, with 87% of them dying or experiencing a functional decline in the first year after dialysis initiation (25). Not surprisingly, cost utility analyses reveal that elderly patients with ESRD have higher ICERs than younger patients (19,26).

Is it possible that despite its poor long-term outcomes dialysis at least extends the lives of elderly dialysis patients? Not necessarily, according to several studies from the United Kingdom. Murtagh *et al.* studied 129 patients with stage 5 CKD older than 75 years who elected to pursue dialysis or conservative care and controlled for lead-time bias (27). Although overall mortality at 2 years was lower in the patients choosing dialysis (24% versus 53%), it was no better in the subgroup with multiple comorbid conditions or heart disease. A more recent study of 844 patients with stage 5 CKD essentially confirmed these findings (28). In light of the exorbitant medical costs of caring for elderly hemodialysis (HD) patients—now >$100,000 annually (29)—nephrologists should brace themselves for age-based rationing. Previous studies show that elderly patients with ESRD 80 years and older or 70 years and older with peripheral vascular disease are costlier to take care of than younger patients with ESRD without vascular disease (30), so age limits would most likely begin with these types of patients. Although no economic analyses are available to estimate the savings provided by restricting dialysis by age, we suspect it would be substantial, given that in 2010 >25% of incident dialysis patients were 75 years or older (31).

Delaying Dialysis as a Financial Imperative

One must keep QALYs and ICERs in mind when considering the issue of dialysis initiation. Over the past 15 years, the estimated GFR (eGFR) of patients initiating dialysis has risen (32) without any discernible improvement in patient outcomes (33,34). The reasons nephrologists opted for earlier dialysis initiation most likely have their basis in older studies that touted the benefits of early dialysis initiation (35,36) and professional guidelines that provided justification for this strategy. Thirty-six years ago, Bonomini and colleagues argued that patients who started intermittent HD with creatinine clearance (CrCl) >5 ml/min had less neuropathy and renal osteodystrophy and improved mortality compared with patients who initiated HD with lower CrCl (35). A follow-up study reported that early dialysis initiation, while confirming the mortality benefit, also improved lipid and BP control and lowered hospitalization rates (36). These early studies, along with National Kidney Foundation guidelines recommending that any patient with stage 5 CKD (eGFR <15 ml/min

per 1.73 m^2) be considered for dialysis (37), led to a significant increase in the number of patients initiating dialysis with an eGFR greater than 10 ml/min per 1.73 m^2 (32).

In contrast, recent studies report that early dialysis initiation is actually associated with increased mortality risk (33,34,38) and that delaying dialysis initiation is safe, as demonstrated by the Initiation of Dialysis Early or Late (IDEAL) trial that randomly assigned 828 patients with advanced CKD to an early (estimated CrCl of 10–14 ml/min per 1.73 m^2) or late (estimated CrCl of 5–7 ml/min per 1.73 m^2) start on dialysis (39). The median time difference to initiating dialysis was approximately 6 months. After 3.6 years of follow-up, the late starters experienced no increase in mortality or adverse events compared with the early starters.

To the government, mandating that initiation of dialysis be delayed offers highly attractive cost savings. Lee *et al.* performed a computer simulation using data from the U.S. Renal Data System (USRDS) and Kaiser Permanente to determine the cost-effectiveness of delaying dialysis initiation (19). In their current practice scenario, dialysis was started when the eGFR fell below 9 ml/min per 1.73 m^2. Three delayed initiation scenarios were then used: slight delay, moderate delay, and significant delay. ICERs were calculated by comparing a dialysis strategy to its next least costly strategy (*e.g.*, by dividing the difference in cost between the current practice and slight delay scenarios by the difference in their QALYs). The ICERs favored delayed dialysis. The current practice scenario cost $129,090/QALY, while the slight delay, moderate delay, and significant delay scenarios cost $118,540/QALY, $100,717/QALY, and $40,446/QALY, respectively. On the basis of data from the IDEAL trial, direct dialysis costs were nearly $10,800 more per patient in the early start group compared with the late start group, with the early start group's transportation costs being $3600 more per patient (40).

Mandating the Modality of Dialysis

The modality of dialysis provided strongly influences a patient's health care costs, making it a prime target for cost savings. In the United States in-center HD has been estimated as 20%–50% more expensive than peritoneal dialysis (PD) (41). Shih *et al.* noted that the adjusted annual cost in 2004 dollars for an incident PD patient was $56,807 compared with $68,254 for an incident HD patient (42). Significant cost savings over 3 years were also noted for incident PD patients who did not switch to HD or switched only after 2 or more years of PD therapy. Therefore, restricting access to HD would be financially advantageous. In fact, mandating PD as the treatment of choice is theoretically possible because most patients have no contraindications to PD (43). Even debilitated elderly patients not traditionally thought to be PD candidates can receive assisted PD through home nurses or family members (44). At least part of the cost savings involves the higher rate of employment (2.6 times higher) and productivity seen in PD versus in-center HD patients (45,46).

Despite the potential savings for Medicare, in 2009 only about 6% of patients with incident ESRD began renal replacement therapy on PD (23). If HD offered improved survival compared with PD, its overwhelming use could be justified. However, no such benefit has been consistently identified (47–49). In addition, studies demonstrate either no difference in quality of life between HD and PD or greater patient satisfaction with the latter modality (50–52). Because there are no differences between HD and PD in terms of survival or quality of life, one can assume that the cost per QALY favors PD, something that has been confirmed in several studies of diverse populations. A Swedish study reported a cost of $82,470/QALY for PD and $98,530/QALY for HD (46); one in a Greek population concluded that HD cost approximately $79,412/QALY while PD cost $71,716/QALY in 2007 dollars (53). Thai investigators recently estimated the ICERs of HD and PD compared with palliative care to be $63,000/QALY and $52,000/QALY, respectively (26).

Although PD is the most common home dialysis modality, both short daily HD and home nocturnal HD are increasingly popular options (54). Not only may they offer additional health benefits, such as improved BP control and regression of left ventricular hypertrophy (55,56), they are also less expensive. The National Health Service estimated 10-year home HD costs to be far lower than those of both hospital-based and satellite-based HD (57). Compared with hospital-based and satellite-based HD, home HD saves $30,758 and $25,260 in 2010 dollars, respectively, while generating 0.38 more QALYs. A Canadian group compared 19 patients receiving thrice-weekly in-center HD to 24 receiving nocturnal HD at home; nocturnal patients had significantly higher utility scores than in-center patients (0.77 versus 0.53) while costing less (approximately $48,103/QALY and $84,733/QALY in 2000 U.S. dollars) (58).

One must note, however, that home dialysis modalities may be cheaper than in-center HD because home patients may be healthier than in-center patients (59). A randomized controlled trial would be helpful in determining whether clinically useful information, such as dialysis costs and mortality, favors home dialysis over in-center HD, although efforts to design such a trial have been unsuccessful to date (50). To reduce the influence of selection bias in observational studies, researchers use propensity score matching. Propensity score matching allows various underlying patient covariates to be reduced to a single score, enabling patients from each treatment group with similar scores to be matched (60). A recent propensity score analysis of privately insured dialysis patients revealed that the median yearly health care costs for each HD patient were $43,510 more than for each PD patient, due mostly to significantly higher inpatient costs for the HD patient (61). The 2012 USRDS report showed similar results. After matching of PD patients to similar HD patients, yearly HD costs were at least 25% higher than PD costs (62).

Compensating Kidney Donors

Kidney transplantation is the ideal treatment for ESRD, both medically and economically. Dialysis patients experience a 6.5- to 7.4-fold increase in all-cause mortality compared with the general population versus only a 0.1- to 0.6-fold higher rate for transplant patients (63). The comparative 5-year survival rates for HD, PD, and transplantation are 34%, 40%, and 73%, respectively (63). In 2009 the

Medicare per person per year costs for an HD patient, a PD patient, and a kidney transplant recipient were $82,285, $61,588, and $29,983, respectively (11). Unfortunately, the demand for donated kidneys far outstrips available supply, and the median waiting list time is now approaching 4 years (64). In 2009, death while waiting for a transplant was the second most common cause of removal from the waiting list (64).

One strategy to help alleviate the lack of donor kidneys is kidney-paired donation (KPD) (65,66). With KPD, live donors who are not compatible with their intended recipients are matched with unknown, compatible recipients, and unknown donors are then matched to the intended recipients of the first live donors (66). Although society benefits through KPD, its overall effect on transplantation rates will probably be marginal, as it is a barter transaction (67), and financial disincentives still remain for potential donors to undergo medical evaluation for unknown recipients (68).

An option that is far more likely to reduce waiting list time involves financial compensation of kidney donors. Currently, concerns about exploitation of vulnerable populations have dampened enthusiasm for paid organ donation, as expressed in the 2008 Declaration of Istanbul on Organ Trafficking and Transplant Tourism (69). One nation that has practiced direct-paid organ donation for nearly 25 years is Iran (70). Kidney donors in that country receive health insurance and a government payment. However, critics note that Iranian donors, who are largely poor young men (71), receive only a year of free health care, a $1200 government payment, and poorly regulated recipient payments (72).

Despite the limitations of the Iranian model, paid organ donation makes perfect economic sense. Kidney transplantation is subject to the same economic laws that govern other transactions. The 2012 Nobel Prize in Economics was awarded to Alvin E. Roth, whose work ultimately led to novel exchange markets, such as the physician residency matching program and incompatible kidney swaps. An article describing his work noted how "there is a more fundamental solution to the kidney shortage. Don't 'design' a market; simply allow one. A ban on selling kidneys is essentially a price control of zero and, like other price controls, causes a shortage. There are thousands of 'demanders.' There are also thousands of potential suppliers who, at a price of zero, are not willing to give up a spare kidney" (67). The lifetime costs of a transplant patient are $94,579 less expensive than those of a dialysis patient, and a living unrelated kidney donation provides the recipient 3.5 QALYs more than dialysis (73). Because altruistic incentives to get people to donate kidneys have been unsuccessful (74), paid donation may be the most viable option to increase transplantation rates. Despite concerns surrounding the exploitation of kidney donors, the adoption of payments for kidney donors offers such an enormous financial incentive to the government that it is highly likely over time such a policy will be adopted. Indeed, it appears that the public is already generally comfortable with the idea (75).

An Emphasis on Forestalling the Progression of CKD

In recent decades, several multicenter, adequately powered, randomized controlled trials have failed to identify treatment interventions that significantly improve outcomes in dialysis patients (76–80), providing a great deal of frustration for clinical nephrologists (81). We expect that this poor track record, coupled with the obvious financial benefits inherent in delaying the start of dialysis, will cause the government to shift its research funding to support attempts to delay CKD progression. This is no doubt a daunting task, as CKD is a highly complex, multifactorial disease that lacks suitable surrogate end points and biomarkers of disease progression (82). However, if these obstacles are overcome, it makes greater fiscal sense from the government's perspective to invest in preventive strategies to slow progression of CKD.

Conclusion

We strongly believe that the fiscal realities weighing heavily on the federal government will lead inevitably to health care rationing and other mandated strategies for patients with CKD. The untenable federal budget, the gargantuan unfunded liability burden of Medicare, and the aging population of the United States will all work to bring this eventuality sooner rather than later regardless of which political party holds the reins of power. Because government rationing programs are designed to maximize savings and benefits on a population rather than individual level, they will inevitably lead to a weakening of nephrologists' capacity to advocate for their patients (83); that is, what is good economically speaking for society as a whole may not be beneficial for an individual patient. Nevertheless, by accepting reimbursement for the majority of their services from the government, nephrologists have become government employees of sorts, with all the restrictions that entails. The acceptance of government-mandated strategies will be variable. Although paid organ donation may be popular with the public (75), age-based rationing will certainly be controversial (84). How both the nephrology community and the general public ultimately deal with these and related issues remains to be seen. Regardless, nephrologists need to recognize that the days in which ESRD care revolved around large in-center HD units that catered to elderly patients with ESRD are likely to be numbered. Rationing, whether they like it or not, is coming.

Disclosures

None.

References

1. Catlin A, Cowan C, Hartman M, Heffler S; National Health Expenditure Accounts Team: National health spending in 2006: a year of change for prescription drugs. *Health Aff (Millwood)* 27: 14–29, 2008
2. Centers for Medicare & Medicaid Services: 2012 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. Available at: http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ReportsTrustFunds/Downloads/TR2012.pdf. Accessed April 8, 2013
3. Cox C, Archer B: Why $16 trillion only hints at the true U.S. debt. *Wall Street Journal*. November 26, 2012. Available at: http://online.wsj.com/article/SB10001424127887323353204578127374039087636.html?mod=googlenews_wsj. Accessed April 8, 2013
4. Congressional Budget Office: The budget and economic outlook: fiscal years 2012 to 2022. January 2012. Available at: http://

www.cbo.gov/sites/default/files/cbofiles/attachments/01-31-2012_Outlook.pdf. Accessed April 8, 2013
5. Cohn D, Taylor P: Baby boomers approach age 65–glumly. Pew Research Social & Demographic Trends. December 20, 2010. Available at: http://pewresearch.org/pubs/1834/baby-boomers-old-age-downbeat-pessimism. Accessed April 8, 2013
6. Nissenson AR, Maddux FW, Velez RL, Mayne TJ, Parks J: Accountable care organizations and ESRD: The time has come. *Am J Kidney Dis* 59: 724–733, 2012
7. Gold J: FAQ on ACOs: accountable care organizations, explained. Kaiser Health News. October 21, 2011. Available at: http://www.kaiserhealthnews.org/stories/2011/january/13/aco-accountable-care-organization-faq.aspx. Accessed April 8, 2013
8. Centers for Medicare & Medicaid Services: Center for Medicare and Medicaid Innovation. Comprehensive ESRD care (CEC) model. Available at: http://innovation.cms.gov/Files/x/CEC-rfa.pdf. Accessed April 8, 2013
9. The Patient Protection and Affordable Care Act. Available at: http://dpc.senate.gov/healthreformbill/healthbill52.pdf. Accessed April 8, 2013
10. Rattner S: Beyond Obamacare. *New York Times.* September 16, 2012. Available at: http://www.nytimes.com/2012/09/17/opinion/health-care-reform-beyond-obamacare.html. Accessed April 8, 2013
11. U.S. Renal Data System: USRDS 2011 Report. Costs of ESRD. Available at: http://www.usrds.org/2011/pdf/v2_ch011_11.pdf. Accessed April 8, 2013
12. Fleck LM: The costs of caring: Who pays? Who profits? Who panders? *Hastings Cent Rep* 36: 13–17, 2006
13. Levinsky NG: The organization of medical care. Lessons from the Medicare end stage renal disease program. *N Engl J Med* 329: 1395–1399, 1993
14. National Institute for Health and Care Excellence: Measuring effectiveness and cost effectiveness: the QALY. April 20, 2010. Available at: http://www.nice.org.uk/newsroom/features/measuringeffectivenessandcosteffectivenesstheqaly.jsp. Accessed April 8, 2013
15. Neumann PJ, Zinner DE, Wright JC: Are methods for estimating QALYs in cost-effectiveness analyses improving? *Med Decis Making* 17: 402–408, 1997
16. Ferguson BM, Keown PA: An introduction to utility measurement in health care. *Infect Control Hosp Epidemiol* 16: 240–247, 1995
17. Claxton K, Sculpher M, Culyer A, McCabe C, Briggs A, Akehurst R, Buxton M, Brazier J: Discounting and cost-effectiveness in NICE - stepping back to sort out a confusion. *Health Econ* 15: 1–4, 2006
18. Grosse SD: Assessing cost-effectiveness in healthcare: history of the $50,000 per QALY threshold. *Expert Rev Pharmacoecon Outcomes Res* 8: 165–178, 2008
19. Lee CP, Chertow GM, Zenios SA: An empiric estimate of the value of life: Updating the renal dialysis cost-effectiveness standard. *Value Health* 12: 80–87, 2009
20. Neumann PJ, Rosen AB, Weinstein MC: Medicare and cost-effectiveness analysis. *N Engl J Med* 353: 1516–1522, 2005
21. Chambers JD, Neumann PJ, Buxton MJ: Does Medicare have an implicit cost-effectiveness threshold? *Med Decis Making* 30: E14–E27, 2010
22. Gillick MR: Medicare coverage for technological innovations—time for new criteria? *N Engl J Med* 350: 2199–2203, 2004
23. U.S. Renal Data System: USRDS 2011 Report: Incidence, prevalence, patient characteristics, and treatment modalities. Available at: http://www.usrds.org/2011/pdf/v2_ch01_11.pdf. Accessed April 8, 2013
24. Kurella M, Covinsky KE, Collins AJ, Chertow GM: Octogenarians and nonagenarians starting dialysis in the United States. *Ann Intern Med* 146: 177–183, 2007
25. Kurella Tamura M, Covinsky KE, Chertow GM, Yaffe K, Landefeld CS, McCulloch CE: Functional status of elderly adults before and after initiation of dialysis. *N Engl J Med* 361: 1539–1547, 2009
26. Teerawattananon Y, Mugford M, Tangcharoensathien V: Economic evaluation of palliative management versus peritoneal dialysis and hemodialysis for end-stage renal disease: Evidence for coverage decisions in Thailand. *Value Health* 10: 61–72, 2007
27. Murtagh FEM, Marsh JE, Donohoe P, Ekbal NJ, Sheerin NS, Harris FE: Dialysis or not? A comparative survival study of patients over 75 years with chronic kidney disease stage 5. *Nephrol Dial Transplant* 22: 1955–1962, 2007
28. Chandna SM, Da Silva-Gane M, Marshall C, Warwicker P, Greenwood RN, Farrington K: Survival of elderly patients with stage 5 CKD: Comparison of conservative management and renal replacement therapy. *Nephrol Dial Transplant* 26: 1608–1614, 2011
29. Mau LW, Liu J, Qiu Y, Guo H, Ishani A, Arneson TJ, Gilbertson DT, Dunning SC, Collins AJ: Trends in patient characteristics and first-year medical costs of older incident hemodialysis patients, 1995-2005. *Am J Kidney Dis* 55: 549–557, 2010
30. Grun RP, Constantinovici N, Normand C, Lamping DL; North Thames Dialysis Study Group: Costs of dialysis for elderly people in the UK. *Nephrol Dial Transplant* 18: 2122–2127, 2003
31. U.S. Renal Data Service: USRDS 2012 Report: Incidence, prevalence, patient characterisitics, and modality. Available at: http://www.usrds.org/2012/pdf/v2_ch1_12.pdf.
32. Rosansky SJ, Clark WF, Eggers P, Glassock RJ: Initiation of dialysis at higher GFRs: Is the apparent rising tide of early dialysis harmful or helpful? *Kidney Int* 76: 257–261, 2009
33. Rosansky SJ, Eggers P, Jackson K, Glassock R, Clark WF: Early start of hemodialysis may be harmful. *Arch Intern Med* 171: 396–403, 2011
34. Susantitaphong P, Altamimi S, Ashkar M, Balk EM, Stel VS, Wright S, Jaber BL: GFR at initiation of dialysis and mortality in CKD: A meta-analysis. *Am J Kidney Dis* 59: 829–840, 2012
35. Bonomini V, Albertazzi A, Vangelista A, Bortolotti GC, Stefoni S, Scolari MP: Residual renal function and effective rehabilitation in chronic dialysis. *Nephron* 16: 89–102, 1976
36. Bonomini V, Feletti C, Scolari MP, Stefoni S: Benefits of early initiation of dialysis. *Kidney Int Suppl* 17[Suppl 17]: S57–S59, 1985
37. Kidney Disease Outcomes Quality Initiative: KDOQI 2006 Updates on hemodialysis and peritoneal dialysis adequacy and vascular access. Available at: http://www.kidney.org/professionals/kdoqi/pdf/12-50-0210_JAG_DCP_Guidelines-HD_Oct06_SectionA_ofC.pdf.
38. Traynor JP, Simpson K, Geddes CC, Deighan CJ, Fox JG: Early initiation of dialysis fails to prolong survival in patients with end-stage renal failure. *J Am Soc Nephrol* 13: 2125–2132, 2002
39. Cooper BA, Branley P, Bulfone L, Collins JF, Craig JC, Fraenkel MB, Harris A, Johnson DW, Kesselhut J, Li JJ, Luxton G, Pilmore A, Tiller DJ, Harris DC, Pollock CA; IDEAL Study: A randomized, controlled trial of early versus late initiation of dialysis. *N Engl J Med* 363: 609–619, 2010
40. Harris A, Cooper BA, Li JJ, Bulfone L, Branley P, Collins JF, Craig JC, Fraenkel MB, Johnson DW, Kesselhut J, Luxton G, Pilmore A, Rosevear M, Tiller DJ, Pollock CA, Harris DC: Cost-effectiveness of initiating dialysis early: A randomized controlled trial. *Am J Kidney Dis* 57: 707–715, 2011
41. Just PM, Riella MC, Tschosik EA, Noe LL, Bhattacharyya SK, de Charro F: Economic evaluations of dialysis treatment modalities. *Health Policy* 86: 163–180, 2008
42. Shih YCT, Guo A, Just PM, Mujais S: Impact of initial dialysis modality and modality switches on Medicare expenditures of end-stage renal disease patients. *Kidney Int* 68: 319–329, 2005
43. Khawar O, Kalantar-Zadeh K, Lo WK, Johnson D, Mehrotra R: Is the declining use of long-term peritoneal dialysis justified by outcome data? *Clin J Am Soc Nephrol* 2: 1317–1328, 2007
44. Jiwakanon S, Chiu YW, Kalantar-Zadeh K, Mehrotra R: Peritoneal dialysis: An underutilized modality. *Curr Opin Nephrol Hypertens* 19: 573–577, 2010
45. Julius M, Kneisley JD, Carpentier-Alting P, Hawthorne VM, Wolfe RA, Port FK: A comparison of employment rates of patients treated with continuous ambulatory peritoneal dialysis vs in-center hemodialysis (Michigan End-Stage Renal Disease Study). *Arch Intern Med* 149: 839–842, 1989
46. Sennfält K, Magnusson M, Carlsson P: Comparison of hemodialysis and peritoneal dialysis—a cost-utility analysis. *Perit Dial Int* 22: 39–47, 2002
47. Termorshuizen F, Korevaar JC, Dekker FW, Van Manen JG, Boeschoten EW, Krediet RT; Netherlands Cooperative Study on the Adequacy of Dialysis Study Group: Hemodialysis and

peritoneal dialysis: Comparison of adjusted mortality rates according to the duration of dialysis: analysis of The Netherlands Cooperative Study on the Adequacy of Dialysis 2. *J Am Soc Nephrol* 14: 2851–2860, 2003
48. Jaar BG, Coresh J, Plantinga LC, Fink NE, Klag MJ, Levey AS, Levin NW, Sadler JH, Kliger A, Powe NR: Comparing the risk for death with peritoneal dialysis and hemodialysis in a national cohort of patients with chronic kidney disease. *Ann Intern Med* 143: 174–183, 2005
49. Mehrotra R, Chiu YW, Kalantar-Zadeh K, Bargman J, Vonesh E: Similar outcomes with hemodialysis and peritoneal dialysis in patients with end-stage renal disease. *Arch Intern Med* 171: 110–118, 2011
50. Korevaar JC, Feith GW, Dekker FW, van Manen JG, Boeschoten EW, Bossuyt PM, Krediet RT; NECOSAD Study Group: Effect of starting with hemodialysis compared with peritoneal dialysis in patients new on dialysis treatment: A randomized controlled trial. *Kidney Int* 64: 2222–2228, 2003
51. Rubin HR, Fink NE, Plantinga LC, Sadler JH, Kliger AS, Powe NR: Patient ratings of dialysis care with peritoneal dialysis vs hemodialysis. *JAMA* 291: 697–703, 2004
52. Kutner NG, Zhang R, Barnhart H, Collins AJ: Health status and quality of life reported by incident patients after 1 year on haemodialysis or peritoneal dialysis. *Nephrol Dial Transplant* 20: 2159–2167, 2005
53. Kontodimopoulos N, Niakas D: An estimate of lifelong costs and QALYs in renal replacement therapy based on patients' life expectancy. *Health Policy* 86: 85–96, 2008
54. U.S. Renal Data System: USRDS 2010 Report: Treatment modalities. Available at: http://www.usrds.org/2010/pdf/v2_04.pdf.
55. Culleton BF, Walsh M, Klarenbach SW, Mortis G, Scott-Douglas N, Quinn RR, Tonelli M, Donnelly S, Friedrich MG, Kumar A, Mahallati H, Hemmelgarn BR, Manns BJ: Effect of frequent nocturnal hemodialysis vs conventional hemodialysis on left ventricular mass and quality of life: A randomized controlled trial. *JAMA* 298: 1291–1299, 2007
56. Chertow GM, Levin NW, Beck GJ, Depner TA, Eggers PW, Gassman JJ, Gorodetskaya I, Greene T, James S, Larive B, Lindsay RM, Mehta RL, Miller B, Ornt DB, Rajagopalan S, Rastogi A, Rocco MV, Schiller B, Sergeyeva O, Schulman G, Ting GO, Unruh ML, Star RA, Kliger AS; FHN Trial Group: In-center hemodialysis six times per week versus three times per week. *N Engl J Med* 363: 2287–2300, 2010
57. Economic Report: Home Haemodialysis. Available at: http://www.quantafs.com/img/uploads/files/documents/CEP10063_%20economic%20report_home%20haemodialysis.pdf. Accessed April 8, 2013
58. McFarlane PA, Bayoumi AM, Pierratos A, Redelmeier DA: The quality of life and cost utility of home nocturnal and conventional in-center hemodialysis. *Kidney Int* 64: 1004–1011, 2003
59. Miskulin DC, Meyer KB, Athienites NV, Martin AA, Terrin N, Marsh JV, Fink NE, Coresh J, Powe NR, Klag MJ, Levey AS: Comorbidity and other factors associated with modality selection in incident dialysis patients: The CHOICE Study. Choices for Healthy Outcomes in Caring for End-Stage Renal Disease. *Am J Kidney Dis* 39: 324–336, 2002
60. Rubin DB: Estimating causal effects from large data sets using propensity scores. *Ann Intern Med* 127: 757–763, 1997
61. Berger A, Edelsberg J, Inglese GW, Bhattacharyya SK, Oster G: Cost comparison of peritoneal dialysis versus hemodialysis in end-stage renal disease. *Am J Manag Care* 15: 509–518, 2009
62. U.S. Renal Data System: USRDS 2012 Report: Costs of ESRD. Available at: http://www.usrds.org/2012/pdf/v2_ch11_12.pdf.
63. U.S. Renal Data System: USRDS 2011 Report: Mortality. Available at: http://www.usrds.org/2011/pdf/v2_ch05_11.pdf.
64. Health Resources and Services Administration, Scientific Registry of Transplant Recipients: Scientific registry of transplant recipients: 2010 Report for Kidney Transplantation. Available at: http://srtr.transplant.hrsa.gov/annual_reports/2010/pdf/01_kidney_11.pdf.
65. Blumberg JM, Gritsch H, Veale JL: Kidney paired donation: Advancements and future directions. *Curr Opin Organ Transplant* 16: 380–384, 2011
66. Johns Hopkins Medicine: Paired kidney exchange. Available at: http://www.hopkinsmedicine.org/transplant/programs/kidney/incompatible/paired_kidney_exchange.html.
67. Henderson D: On marriage, kidneys and the Economics Nobel. *Wall Street Journal* October 15, 2012. Available at: http://online.wsj.com/article/SB10000872396390443675404578058773182478536.html. Accessed April 8, 2013
68. Rees MA, Schnitzler MA, Zavala EY, Cutler JA, Roth AE, Irwin FD, Crawford SW, Leichtman AB: Call to develop a standard acquisition charge model for kidney paired donation. *Am J Transplant* 12: 1392–1397, 2012
69. International Summit on Transplant Tourism and Organ Trafficking: The Declaration of Istanbul on organ trafficking and transplant tourism. *Clin J Am Soc Nephrol* 3: 1227–1231, 2008
70. Ghods AJ, Savaj S: Iranian model of paid and regulated living-unrelated kidney donation. *Clin J Am Soc Nephrol* 1: 1136–1145, 2006
71. Zargooshi J: Iranian kidney donors: motivations and relations with recipients. *J Urol* 165: 386–392, 2001
72. Griffin A: Kidneys on demand. *BMJ* 334: 502–505, 2007
73. Matas AJ, Schnitzler M: Payment for living donor (vendor) kidneys: A cost-effectiveness analysis. *Am J Transplant* 4: 216–221, 2004
74. Hippen B, Ross LF, Sade RM: Saving lives is more important than abstract moral concerns: Financial incentives should be used to increase organ donation. *Ann Thorac Surg* 88: 1053–1061, 2009
75. Barnieh L, Klarenbach S, Gill JS, Caulfield T, Manns B: Attitudes toward strategies to increase organ donation: Views of the general public and health professionals. *Clin J Am Soc Nephrol* 7: 1956–1963, 2012
76. Eknoyan G, Beck GJ, Cheung AK, Daugirdas JT, Greene T, Kusek JW, Allon M, Bailey J, Delmez JA, Depner TA, Dwyer JT, Levey AS, Levin NW, Milford E, Ornt DB, Rocco MV, Schulman G, Schwab SJ, Teehan BP, Toto R; Hemodialysis (HEMO) Study Group: Effect of dialysis dose and membrane flux in maintenance hemodialysis. *N Engl J Med* 347: 2010–2019, 2002
77. Paniagua R, Amato D, Vonesh E, Correa-Rotter R, Ramos A, Moran J, Mujais S; Mexican Nephrology Collaborative Study Group: Effects of increased peritoneal clearances on mortality rates in peritoneal dialysis: ADEMEX, a prospective, randomized, controlled trial. *J Am Soc Nephrol* 13: 1307–1320, 2002
78. Wanner C, Krane V, März W, Olschewski M, Mann JF, Ruf G, Ritz E; German Diabetes and Dialysis Study Investigators: Atorvastatin in patients with type 2 diabetes mellitus undergoing hemodialysis. *N Engl J Med* 353: 238–248, 2005
79. Fellström BC, Jardine AG, Schmieder RE, Holdaas H, Bannister K, Beutler J, Chae DW, Chevaile A, Cobbe SM, Grönhagen-Riska C, De Lima JJ, Lins R, Mayer G, McMahon AW, Parving HH, Remuzzi G, Samuelsson O, Sonkodi S, Sci D, Süleymanlar G, Tsakiris D, Tesar V, Todorov V, Wiecek A, Wüthrich RP, Gottlow M, Johnsson E, Zannad F; AURORA Study Group: Rosuvastatin and cardiovascular events in patients undergoing hemodialysis. *N Engl J Med* 360: 1395–1407, 2009
80. Chertow GM, Block GA, Correa-Rotter R, Drüeke TB, Floege J, Goodman WG, Herzog CA, Kubo Y, London GM, Mahaffey KW, Mix TC, Moe SM, Trotman ML, Wheeler DC, Parfrey PS; EVOLVE Trial Investigators: Effect of cinacalcet on cardiovascular disease in patients undergoing dialysis. *N Engl J Med* 367: 2482–2494, 2012
81. Covic A, Gusbeth-Tatomir P, Goldsmith D: Negative outcome studies in end-stage renal disease: How dark are the storm clouds? *Nephrol Dial Transplant* 23: 56–61, 2008
82. Formentini I, Bobadilla M, Haefliger C, Hartmann G, Loghman-Adham M, Mizrahi J, Pomposiello S, Prunotto M, Meier M: Current drug development challenges in chronic kidney disease (CKD)—identification of individualized determinants of renal progression and premature cardiovascular disease (CVD). *Nephrol Dial Transplant* 27: iii81–88, 2012
83. Wouldn't it be NICE to consider patients' views when rationing health care*BMJ* 338: b85, 2009
84. Rothenberg LS: Withholding and withdrawing dialysis from elderly ESRD patients: part 1 — a historical view of the clinical experience. *Geriatr Nephrol Urol* 2: 109–117, 1992

Published online ahead of print. Publication date available at www.cjasn.org.