

Health Policy for Renal Replacement Therapy in Developing Countries

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Abstract

In developing countries, treatment of end stage renal failure is largely guided by economic considerations; only about 5% of patients undergo transplant surgery. Studies have clearly shown that, compared to dialysis, a successful kidney transplant improves patient survival. Even taking into account the cost of immunosuppressants, kidney transplantation is cost

effective. We found that in the context of a developing country, pre-emptive transplant offered patient and graft survival comparable to conventional kidney transplant and eliminated complications, inconvenience and cost of dialysis. We submit that there is a need for the development of specific national strategies for treatment of end stage renal failure, with consideration toward the unique economic conditions of the countries involved. Creation of a national registry for renal replacement therapy for each country will help in assessing the need. Equal importance should be given to preventive measures and public education.

Keywords: Renal failure in developing countries; kidney transplant in developing countries; economics of dialysis; economics of kidney transplantation; pre-emptive kidney transplant in developing countries; national registry for renal replacement therapy in developing countries

Introduction

As developing countries rapidly become connected to the rest of the world by way of travel and the World Wide Web, expectation is rising for a range of medical and surgical therapies, from primary care to specialized areas such as complex heart surgery and renal transplantation, to be made available to all. It is not clear whether a national taxpayer-funded universal health service, similar to that in the United Kingdom and Canada, or an insurance-based system resembling that in the United States, would be the best type of health care system for developing countries. Identifying an ideal structure for making health care available is a matter of debate and controversy (Lameire, Joffe, & Wiedemann, 1999). India's mixed form of health care, in which the government provides only basic care and a few tertiary centers offer highly specialized care (Bhowmik, Pandav, & Tiwari, 2008), may be another alternative.

In developing countries, the possibility of long-term dialysis does not exist; it is too expensive, and patients simply die unless they can afford to obtain a kidney transplant. Even in a middle-income country such as India, only 5–10% of all patients with end stage renal failure (ESRD) gain access to some form of registry for renal replacement therapy (RRT) (Bhowmik, Pandav, & Tiwari, 2008).

The introduction of kidney transplantation in relatively poor countries, including Guyana, Ghana and Kenya, has recently been reported (Delmonico, 2009). Physicians from both the private sector and local governments performed the first few living-kidney transplants in these countries. A French agency, *Etablissement français des greffes*, in collaboration with a number of developing and East European countries, has undertaken an innovative plan to develop transplant programs; long-term success of this effort will be closely watched.

Pre-emptive living kidney transplantation with free or reduced-cost immunosuppressive medications from generic pharmaceuticals has been shown to be more cost effective than long-term dialysis (Milton, Russ, & McDonald, 2008). In developing countries such as India, treatment of ESRD is largely guided by economic considerations; only about 5% of patients undergo transplant surgery (Singh & Bhandari, 2004). Although the removal of organs from brain-dead patients has been legalized, the concept of donation of organs from the deceased has not received adequate social sanction. Only 2% of all transplants are performed with organs from deceased donors. The socioeconomic implication of a young population afflicted with a potentially terminal illness is devastating, and in the

face of growing epidemics of diabetes and hypertension, the burden of chronic kidney disease (CKD) is not likely to ease. In the final analysis, a national strategy taking into account the unique economic conditions of the specific country is needed for treatment of ESRD. A combination of private-governmental partnership with assistance from developed countries may be a solution for providing RRT.

Economics of Kidney Transplantation in Developing Countries

Incidence of Kidney Failure

The number of patients in both developing and developed countries requiring RRT either by dialysis or kidney transplantation is estimated to be 1.4 million; this number is growing at the rate of 8% annually (Schieppati & Remuzzi, 2005). Several factors may account for this increase, with diabetes, an aging population and hypertension seen as major causes. Due to a lack of national registries, it is difficult to estimate the burden of ESRD in developing countries. The incidence of diabetes, hypertension and genetic causes of renal failure in these countries is not apparent, as no hard data are available. However, it is anticipated that the incidence of kidney failure is likely to increase due to a dramatic rise in the incidence of diabetic nephropathy in developing countries (Cutter, 1998; Agarwal & Srivastava, 2009). Developing countries also have a high incidence of infectious causes of kidney disease. The role of environmental pollution and the widespread use of herbal medicines in causing ESRD are being explored (White, Chadban, Chapman, & Cass, 2008) in both developing and developed countries.

The incidence of ESRD varies from country to country. Some of the differences could be due to lack of national registries and under-reporting; large numbers of people may die from ESRD without ever receiving RRT. The incidence of new patients with ESRD treated with dialysis in Singapore rose from 96 per million population (pmp) in 1992 to 167 pmp in 2000. This near-doubling is not unique to Singapore. Many other Asian countries have seen a similar increase in the incidence of ESRD, in large part due to an increasing incidence of the risk factors for renal disease (Tan et al., 2005; Narasimhan et al., 2006; Teo, Ma, Xu, Li, & Lee, 2010).

Consequent to the high incidence of ESRD, toward the end of 2002, an estimated 301,649 patients in Asia were reported to be on dialysis; this, however, is a gross underestimate since the acceptance rate for RRT in Asian countries is very low (Chugh, Jha, & Chugh, 1999).

Cost Effectiveness of Dialysis versus Kidney Transplantation

A vast body of literature has shown that kidney transplantation is more cost effective than dialysis and that it confers improved quality of life. Globally, utility values for dialysis were 0.65 for the first six months and 0.68 after the first six months (Hornberger, Best & Garrison, 1997). Utility values range from 1.0 (perfect health) to 0.0 (death). The higher the utility value, the better the quality of life associated with a health state; the lower the value, the poorer the quality of life. Utility values can be obtained from patients or from surrogate respondents, such as physicians, administrators and the general public, although those obtained from patients who actually have a given health state are most relevant (Redelmeier & Detsky, 1995). The utility value for kidney transplantation was 0.84 six months post-transplant. In developing countries, this is particularly important, as

dialysis facilities may be non-existent or prohibitively expensive. Even allowing for the cost of immunosuppressants, kidney transplant is more cost effective.

Survival Advantage of Kidney Transplantation

Studies have shown that a successful kidney transplant will markedly improve patient survival compared to dialysis (Port, Wolfe, Mauger, Berling, & Jiang, 1993). In Scotland, investigators assessed the magnitude of the survival benefit of renal transplantation as compared with that of dialysis (Oniscu, Brown, & Forsythe, 2005). In a longitudinal study of survival and mortality risk in 1,732 adult patients, relative risk (RR) of death during the first 30 days after transplantation was 1.35 compared with patients on dialysis; the long-term RR (at 18 months) for the transplant recipients was 0.18 when compared with patients on dialysis. The projected life expectancy with a successful kidney transplant was 17.19 years, compared to 5.84 years on dialysis. Wolfe, et al. (1999) conducted a longitudinal study of mortality in 228,552 patients in the US who were receiving long-term dialysis for ESRD. Among these patients, 46,164 were placed on a waiting list for transplantation, and 23,275 of these received a first deceased-donor kidney transplant between 1991 and 1997. Among the various subgroups, the standardized mortality ratio for the patients on dialysis who were awaiting transplantation (annual death rate, 6.3 per 100 patient-years) was 38–58% lower than that for all patients on dialysis (annual death rate, 16.1 per 100 patient-years). Patients on the waiting list tended to be fitter and followed more rigorously with routine preventive work-up and careful cardio-pulmonary assessment at regular intervals. The long-term mortality rate was 48–82% lower among transplant recipients than patients on the waiting list, with relatively larger benefits among patients who were Caucasian and between 20 and 39 years old.

Rabbat, Thorpe, Russell, & Churchill (2000) investigated the potential of kidney transplantation in offering a survival advantage in regions where dialysis survival is superior to that in the US. A cohort of 1,156 patients who started RRT and were wait-listed for deceased-kidney transplant in Ontario, Canada between January 1, 1990 and December 31, 1994 was studied. Patients were followed from wait-listing ($n = 1156$), to first deceased kidney transplant ($n = 722$), to death, or to study end. The average RR of death was 2.91 in the first 30 days after transplantation, but was significantly lower one year after transplantation, indicating a beneficial long-term effect.

Survival benefit was observed even with Expanded Criteria Donor (ECD) kidney transplants. In a retrospective cohort study using data from a US national registry of mortality and graft outcomes among kidney transplant candidates and recipients, ECD recipients had a 27% lower risk of death (Merion, et al., 2005). However, in areas with shorter waiting times, only recipients with diabetes demonstrated survival benefit with ECD kidney transplants. This would mean that ECD should be offered to patients in regions of the country that have a long waiting list. Patients who have a living-kidney donor should not be offered ECD kidney, as the half-life of living kidneys is twice as long as that of a deceased-kidney donor.

Need for Kidney Transplants

In India, where some reliable data are available, 5–10% of all patients receive some kind of RRT. Most patients are initiated on hemodialysis, and a small proportion (<0.5%)

are started on continuous ambulatory peritoneal dialysis. About 60% of patients are lost to follow up within three months due to economic reasons, lack of education, or living a long distance from a dialysis center. Despite the fact that kidney transplantation is a less expensive option owing to reduced maintenance costs over time, only about 5–10% of patients with ESRD receive a transplant (Sakhuja & Kohli, 2006).

Burden of Chronic Kidney Disease

In the absence of nation-wide reporting systems or registries, the true incidence and prevalence of CKD in developing countries is difficult to determine. Observational and anecdotal data suggest that the normal ranges of glomerular filtration rate (GFR) may be lower in vegetarian, less muscular, Indian patients with different creatinine generation rates compared to their Western counterparts. In the last decade, we have seen a major evolution in the definition and classification of CKD based upon estimated GFR (eGFR). Application of these definitions would impact identification of disease, and, as a result, issues of global implementation will need to be resolved. Modi and Jha (2006) reported from an urban population in the city of Bhopal, India, that the crude and age-adjusted incidence rates of ESRD were 151 and 232 ppm, respectively. ESRD incidence rates lend themselves more easily to international comparisons, as the diagnosis is less susceptible to inaccuracies. These estimates are roughly similar to those of the US.

Pre-Emptive Kidney Transplant in Developing Countries

In many countries, it has been shown that pre-emptive kidney transplantation yields better patient outcomes than dialysis (Milton, et al., 2008; Shrestha, 2008; Liem & Weimar, 2009; Witczak, et al., 2009). This is especially true in developing countries, where practice involves avoidance of expensive and prolonged dialysis. Providing treatment for ESRD, however, is particularly difficult in developing countries where national incomes are not sufficient to cover even the basic requirements of their citizens (Jha, 2004). Although some developing countries are making active efforts to establish deceased-donor transplant programs, currently, for the majority, such programs are virtually non-existent (Evans & Kitzmann, 1998; Chugh, Jha, & Chugh, 1999).

John, Rao, and Jacob (1998) compared the results of 43 patients from India who underwent living-related, pre-emptive kidney transplants to 86 matched controls who underwent transplantation after hemodialysis. Controls received more transfusions, had higher hepatitis B surface antigen and more commonly had hepatic dysfunction in the pre-transplant period compared with the pre-emptive group. Similarly, at six months after transplant, the incidence of hepatitis B surface antigen positivity (13 versus two patients) and hepatic dysfunction (18 versus three patients) were higher in the control group compared with the pre-emptive group. This suggested that dialysis-associated complications were more common in their program in India and that pre-emptive transplant could avoid these complications. The one- and two-year graft and patient survival rates were comparable.

Similar experiences were demonstrated in Egypt (el-Agroudy, Donia, Bakr, Foda, & Ghoneim, 2004). Between 1976 and 2001, 1,279 first living-donor kidney transplants were performed at a single center. The 82 patients (6.4%) who underwent transplant without prior dialysis were compared with 1,197 patients who had been dialyzed before transplant. Actuarial graft and patient survival at five years was comparable in both groups; however,

there was an obvious economic advantage in eliminating the cost associated with dialysis after taking the cost of immunosuppressive medications into consideration. In Iran, pre-emptive kidney transplantation was compared with 300 kidney recipients receiving pre-transplant dialysis for at least six months. No significant differences were noted in the gender of the recipients or the age and gender of the donors, donor source or immunosuppressive therapy. The authors found that pre-emptive kidney transplant eliminated costs and complications associated with dialysis (Pour-Reza-Ghol, et al., 2007).

The timing of pre-emptive kidney transplantation should be carefully considered. In developed countries, the concept of pre-emptive kidney transplantation may be applied liberally; generally, a creatinine clearance of less than 20 mL/min is a sufficient legal and accepted indicator. Nevertheless, in developing countries, to reduce the cost of immunosuppressive medications, kidney transplant may be delayed as long as possible, while also avoiding the need for expensive dialysis and associated complications.

Experience of Renal Replacement Therapy in Developing Countries

Pakistan

Pakistan, with a population of 140 million people, two-thirds of whom live in rural areas, is fairly representative of a developing country. The per capita income is less than US \$500, and health expenditure by the government is 0.9% of the GNP. Overall, 33% of the people live below the poverty line, with only US \$1 per day for sustenance. Life expectancy is 61 years for males and 63 years for females. Rizvi, et al. (2003), from the Sindh Institute of Urology and Transplantation (SIUT), Dow Medical College, Karachi, have developed a unique community-government partnership, which has been successful for patients over age 15 years. This partnership carries out 110 transplants annually, with follow-up of free after-care and immunosuppressive drugs. According to their estimates, the prevalence of ESRD in Pakistan is 100 pmp. For a population of 140 million, the country has 150 dialysis centers, mostly in the private sector. The per-session cost for dialysis is US \$25. The country also has 15 transplant centers, 10 of which are in the private sector, where a transplant costs US \$6,000-10,000, an exorbitant amount for the vast majority of the population. The «free» kidney transplant costs to the SIUT are US \$1,640 for the surgery and US \$300 per month for immunosuppressive drugs. SIUT spends US \$1.6 million each year on transplantation alone, and excellent results have been consistently reported. More than 1,000 transplants have been performed in the last 20 years, with one- and five-year graft survival of 92% and 75%, and one- and five-year patient survival of 94% and 81%, respectively. In spite of this, the problem of post-transplant infections continues to be a major issue, with 15% of patients developing tuberculosis, 30% cytomegalovirus and nearly 50% bacterial infections.

Jamaica

Trisolini, Ashley, Harik, and Bicknell (1999), from Boston, collaborated with physicians, governmental officials and health care payers in Jamaica to develop a health policy for patients with ESRD. They concluded that rationing the available treatment capacity may be the best option; however, this action was regarded as politically challenging. In addition, it was believed that cost-saving strategies, such as peritoneal dialysis, pre-emptive kidney transplantation, preventive measures and public education, should be undertaken rigorously. They calculated that if all ESRD patients in Jamaica were to be treated with dialysis, the recurrent costs could reach 68% of the total Ministry of Health budget, a situation that would be unacceptable.

India

In India, Jha (2004) summarized the state of treatment options for ESRD. The high cost of dialysis puts it beyond the reach of all but the very wealthy, and maintenance dialysis is the exclusive preserve of private hospitals. India does not have state-funded or private health insurance schemes, and patients must finance health care on their own. Physicians in India have empirically tried to reduce costs by cutting down the frequency of dialysis, using cheaper cellulosic dialyzers, reusing dialyzers and reducing the use of erythropoietin. There is no organized deceased-donation program, and an overwhelming majority of transplants are performed using living donors. Jha concluded that the financial burden of RRT in developing nations impacts the lifestyle and future of entire families and extracts a cost far higher than the actual amount of money spent on treatment.

Guatemala

It has been estimated that only 35% of Guatemalan patients with ESRD would be diagnosed and treated at any time, and, unlike many developed countries, the age of presentation in 60% of the patients is before the fourth decade (Lou-Meda, 2006). The cost of death and disability due to ESRD in this young population is thus particularly severe, and results in reduced productivity, eventually affecting the economic growth of the country. It is also estimated that 400 pediatric cases develop progressive kidney disorder (e.g., neurogenic bladder, reflux nephropathy, chronic glomerulonephritis) annually, which, if left untreated, could result in ESRD in adulthood.

Thailand

Prakongsai, Tangcharoensathien, and Kasemsup (2006) explored the policy options of RRT for ESRD patients under universal coverage in Thailand. They investigated the efficiency in utilization of government health resources and equity in access to health care. They found that although neither hemodialysis nor peritoneal dialysis was cost-effective due to the expensive costs per life-year saved, a wider societal concern of protecting households against financial catastrophe justified public-funding treatment of ESRD. For this to be feasible, rationing would be unavoidable. They proposed that prevention of ESRD and provision of RRT to every patient up to a predetermined age, or to every patient with a defined number of renal replacement years, would be accomplished by providing more years to younger patients. These two options were financially viable and would achieve ethical principles of providing an equal chance to all patients, while two other alternatives – provision of life-time medical services to all or a selection of some – would become relatively less possible. Nonetheless, they recommended significant improvement in health services for preventive strategies, a centralized system of purchasing key medications, and, finally, a mandatory report on the Thailand Registry of RRT, with special emphasis on peritoneal dialysis and kidney transplantation.

Bangladesh

Rashid (2004) described the experience of managing patients with ESRD and kidney transplants in this country of 128 million people, 75% of whom lived in rural areas where the annual per capita gross national product was US \$380. As expected, treatment of ESRD had low priority: fewer than 10% of ESRD patients were able to maintain dialysis.

The majority of patients presented late in the course of their disease. Eighty percent of patients presenting with ESRD were unaware of their disease, and, as a result, most either dialyzed by temporary access, like jugular or femoral catheterization. Survival rates for patients on a three-times-per-week dialysis schedule were 77% and 57% at three and five years, respectively, whereas those on twice-weekly dialysis had survival rates of 55% and 40% at three and five years, respectively. All patients usually received cyclosporine, azathioprine and prednisolone for three to six months; cyclosporine was generally withdrawn within six months to one year due to financial reasons. The graft survival in Rashid's report was 90% and 80% at one and five years, respectively. The annual cost of hemodialysis varied from US \$4,000–5,500, an excessive amount in a developing country. The cost of renal transplant in Bangladesh is approximately US \$3,000, including surgical fees, medications and other hospital charges, for one month.

Establishing the First Kidney Transplantation Program in Guyana, South America

Burden of Renal Disease in Guyana

Renal diseases contribute to a major public health problem in Guyana, mainly because of a high incidence of diabetes and hypertension. Guyana has approximately 10,000 new hypertension and 8,000 new diabetes patients each year (Guyana Minister of Health, personal communication January, 5, 2008). These two conditions typically result in kidney failure, and account for a considerable portion of the more than 200 Guyanese in need of dialysis at this time.

Social Networks in Establishing the First Kidney Transplant Surgery in Guyana

The Guyanese-American community in the US has been actively participating in numerous medical charity programs in Guyana for the past 20 years. Because long-term dialysis is an expensive option (in 2006, the per-capita annual income in Guyana was US \$1,219 compared to \$43,562 in the US) (United Nations, 2006), a few influential members of the community decided to work towards establishing a kidney transplant program in that country.

The first kidney transplant was performed on a 17-year-old Guyanese boy in 2008. It required a collaborative effort among four communities: Guyanese-Americans, the Guyanese Ministry of Health, US transplant professionals and a team of Guyanese physicians. Teams were evenly balanced in terms of power, skill base and support. Representatives of the American-Guyanese business community, who had taken many goodwill health initiatives to their native Guyana in the past, were familiar with the socio-economic and political infrastructure of the country. The US Army's medical team (part of the US transplant professionals group) had the medical and surgical skills, as well as the training necessary to adapt to different and less sophisticated medical environments, including the operating facilities that would encounter in Guyana. The medical team based in Guyana was critical for the smooth functioning of the surgery, as members were familiar with the patient's social networks and medical history. The Minister of Health and his team were ready to facilitate and organize the teams and commit to providing free medications for at least three years (the cost of anti-rejection medications for one year was approximately US \$8,000).

In 2008, Dr Rahul M. Jindal, from Walter Reed Army Medical Center, and the US Army-Navy medical team began to cultivate a working relationship via email and telephone with local Guyanese doctors as they conducted patient work-up. The flow of information supplied vital information to formulate both a budget and the manpower requirements for the proposed kidney transplant. The Guyanese team created a “dense social network” based upon a shared opportunity to fulfill a medical need within their country (Jindal, 2009). Based on previous experience (Baines & Jindal, 2003), the network had to be highly flexible to effect a number of timely transitions in its role in the operation. In the early work-up stages, the members assumed a heightened responsibility that required them to be at the forefront of the operation. However, once the US-based team arrived in Guyana, their role became both supportive (hosting the visiting team and helping them negotiate the logistics of hospital life) and educational (accumulating knowledge from the visiting medical team). The psychosocial history of the donor and recipient presenting for transplant was intertwined with post-transplant medical and financial support from the Ministry of Health. Kidney disease and transplantation played out within the context of family attitudes, values, beliefs and cultures, along with the relational history of the families. Social network interactive relational history helped to determine what aspects might predispose or compromise medical non-adherence after a kidney transplant.

Jindal (2009) acted as the focal point to pull together all four social networks for this operation. His centralized positioning meant that all information flowed through him and that he was consequently in a strategic position to ensure cohesiveness of the group, solidify inter-dependencies, minimize differences and prevent isolation among the four networks. He accomplished this by ensuring that inter-connecting paths of communication among all four networks were in place. This eliminated the potential for rigid social boundaries and enabled maintenance of a balanced and harmonized collective network.

The transplant team (from the Walter Reed Army Medical Center [WRAMC] and National Naval Medical Center [NNMC]) had made an exploratory visit to Guyana to meet with native physicians, the Minister of Health, the patient, and donor (the patient’s mother), then returned later to set about the task of coordinating the transplant work-up. It was necessary to prepare the medical team, secure medical licenses to work in Guyana and arrange for travel, and the local team had to be advised in terms of OR, anesthesia, ICU and nursing staff. Also critical to the mission was the establishment of laboratory facilities for pre and post-operative care.

Some tests, such as tissue typing and cross-match, were not done in Guyana. Jindal obtained blood samples to perform tests in the Immunology Laboratory of WRAMC and NNMC, Washington, DC. The staffs in both institutions were gracious in donating their time and expertise. Over three hundred emails and 100 telephonic calls to Guyana were made by the medical team based in the US in the course of coordinating this effort.

Recommendations

International cooperation to draw the peoples of the world together takes various forms, and the first kidney transplant done in Guyana is an example of one such attempt. Jindal’s team has subsequently performed three additional living-kidney transplants and placed peritoneal dialysis catheters in seven patients with ESRD, representing the first

peritoneal dialysis in Guyana. Approximately 33 patients are in various stages of transplant work-up. Other agencies are also working to help bring RRT to people of the developing world. An innovative program has been undertaken by *Etablissement français des greffes*, a French organization that has been collaborating with a number of developing countries to support the procurement of transplantation programs within a proper ethical and regulatory framework. The main programs involve Morocco, Tunisia, Romania and Bulgaria, and, to a smaller extent, Mexico and Vietnam. The focus of these exchanges is to foster transfer of “know-how” between institutions, improve cooperation among professionals within their hospitals, and develop policies in the field of kidney failure and transplantation. The major drawback, according to the *Etablissement français des greffes*, has been reliance on a few highly motivated individuals, resulting in less satisfactory results in the projects aimed at developing procurement from deceased donors. Most of the organ transplantation programs in these countries rely on living donors. While this option is clearly relevant in terms of feasibility, it cannot alone provide access for all patients in need of an organ.

In an effort to increase awareness, detection, prevention and treatment of kidney and related diseases, a “World Kidney Day” was established in 2006 (www.worldkidneyday.org). The aim of this event was to raise awareness about the heavy burden CKD has on human lives and on health care budgets, and to put CKD on the agenda of governments and other institutions worldwide. The initiative has assumed increasing importance, as recently published studies have confirmed that CKD is a more common disorder than previously thought. Clinical trials have recommended use of three simple and inexpensive tests to detect CKD: urine for protein, serum creatinine and eGFR. It seems that despite the availability and validity of this approach, the task of developing widespread detection and management programs for CKD that produce improved outcomes at a reasonable cost is formidable. It is unlikely that even developed countries have adequate financial and human resources for whole-population screening programs for CKD, and there is no substantial evidence that these measures are cost-effective.

Based on current information, Shah and Feehally (2008), on behalf of the World Kidney Day Steering Committee, have recommended that all countries endorse targeted screening programs.

Steps for Health Care Professionals to Take to Establish an Effective Screening Program for CKD

1. Report estimated GFR in all laboratories measuring serum creatinine.
2. Measure eGFR and proteinuria in people at highest risk of CKD, including all those with diabetes, hypertension, coronary heart disease and cerebro-vascular disease, who constitute the majority of patients with CKD and with ESRD.
3. Regularly measure blood pressure, eGFR and proteinuria in people identified with CKD.
4. Establish targets for blood pressure control in people with CKD and appropriate use of drugs blocking the renin-angiotensin system.
5. Agree on guidelines for identifying the minority of people with CKD who would benefit from the advice of a nephrologist, as well as from the routine care of a family physician.

Conclusion

Many developing countries are grappling with the issue of health care funding for renal failure. In a 2002 review, Barsoum collaborated with leading nephrologists in 10 developing countries in filling out a 103-item questionnaire that addressed epidemiology, etiology and management of ESRD in their respective countries. Through this joint effort, it was possible to identify a number of important trends, including the expected high prevalence of renal failure and limited access to RRT. Glomerulonephritis, rather than diabetes, was the main cause of CKD, while the implementation of different modalities of RRT was inhibited by the lack of funding. Hemodialysis was the preferred modality in most countries, with the exception of Mexico, where chronic ambulatory peritoneal dialysis took the lead. In several other countries, dialysis was available only for those on the transplant waiting list. Dialysis was associated with a high frequency of complications, particularly HBV and HCV infections; data on HIV were lacking, and aluminum intoxication remained a major problem. Treatment withdrawal was common for socioeconomic reasons, while transplantation was offered to an average of only 4 pmp.

The opinion that kidney transplantation is far cheaper than prolonged dialysis is near unanimity, and the benefit to the recipient is significant in terms of the years of life saved and the improved quality of life. It is interesting to note that physicians in most developing countries rely on less expensive medications (e.g., use of azathioprine instead of mycophenolate mofetil) as part of their immunosuppressive regimen [<http://www.kidneybangla.org/>]. Withdrawal of calcineurine inhibitor medications (e.g., tacrolimus and cyclosporine) is done routinely to reduce cost.

The authors believe that pre-emptive living-kidney transplantation with reduced cost immunosuppressive medications from generic pharmaceuticals may be more effective than long-term dialysis. Clearly evident is the need to develop a national strategy for treatment of ESRD, taking into account the unique economic conditions of individual nations. A combination of private-governmental partnership with assistance from developed countries may be a solution. The creation of a national registry for RRT within each country will surely help in assessing needs. Finally, equal importance should be given to preventive measures and public education on the subject.

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