

# Chronic Kidney Disease in the Caribbean

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## ABSTRACT

*Globally, diabetes mellitus and hypertension are major causes of chronic kidney disease (CKD) and end-stage renal disease (ESRD). Reports from the Caribbean renal registry have also identified diabetes mellitus and hypertension as the leading causes of chronic kidney disease and end-stage renal failure. Chronic non-communicable diseases including chronic kidney disease continue to be a major financial challenge in the Caribbean. Patients with chronic kidney disease have high rates of healthcare utilization, morbidity and mortality, and hence constitute a significant economic and clinical burden to the healthcare system. Emphasis should be placed on ways to reduce the incidence of kidney disease and the progression to dialysis. The most economically feasible form of renal replacement therapy that offers the best quality of life should be sought.*

**Keywords:** Caribbean renal registry, chronic kidney disease, burden of CKD/ESRD, renal replacement therapy

## La Enfermedad Renal Crónica en el Caribe

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## RESUMEN

*Globalmente, la diabetes mellitus y la hipertensión se reportan como las causas principales de la enfermedad renal crónica (ERC) y la enfermedad renal crónica terminal (ERCT). Los informes del registro renal caribeño han identificado a la diabetes mellitus y la hipertensión como las causas principales de la enfermedad renal crónica y la enfermedad renal crónica terminal. Tanto las enfermedades crónicas no comunicables como la enfermedad del riñón continúan siendo un reto financiero mayor en el Caribe. Los pacientes de enfermedad de riñón crónica tienen altas tasas de utilización de cuidado de la salud, morbilidad y mortalidad. Por lo tanto, el manejo de la carga económica y clínica representa un importante reto para el sistema de salud. Debe ponerse énfasis y concertar todos los esfuerzos sobre la búsqueda de formas de reducir la incidencia de la enfermedad renal y disminuir la progresión del requerimiento de diálisis. Urge hallar una forma factible de terapia de reemplazo renal que sea la más económica posible y ofrezca al mismo tiempo la mejor calidad de vida.*

**Palabras claves:** Enfermedad renal crónica, registro renal caribeño, carga de la ERC/ERET, enfermedad renal en etapa terminal, terapia de reemplazo renal

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## BACKGROUND

The two major causes of chronic kidney disease (CRD) and end-stage renal disease (ESRD) globally as well as in the Caribbean are lifestyle related chronic diseases – diabetes mellitus and hypertension (1–3). The prevalence and incidence of both are on the rise globally. These chronic non-communicable diseases (NCDs) are a major financial burden to the emerging developing countries, such as the Caribbean.

Renal replacement therapy (RRT) is not available in all Caribbean countries and when available, haemodialysis (HD) is the commonest modality. The cost of HD could be prohibitive. The objective, therefore, must be to reduce the incidence of CKD and slow the progression to end-stage renal failure requiring replacement therapy, as well as provide financially feasible options of RRT. The magnitude of the problem, which relies on the true burden of chronic kidney disease, cannot be realized without an adequate attempt at quantifying and qualifying it.

It is imperative that the pattern of CKD in the English-speaking Caribbean be determined and the common causes evaluated to determine the reasons for differences that occur.

There is growing need to improve the availability of modalities of RRT in the Caribbean. The financial burden of CKD in the Caribbean region cannot be sustained by most, if any, of the countries. Data from renal registries within the Caribbean will provide information on the prevalence and incidence of CKD/ESRD in the region. Importantly it will allow for monitoring of the impact of any form of intervention instituted.

Over the years, data from renal registries have provided valuable information on patients with chronic diseases. The first registry report of the European Renal Association (ERA) was published in 1965 (1). The first renal registry report from the English-speaking Caribbean – the Caribbean Renal Registry (CRR) – was first published in 2007 and later in 2009 (2, 3). The registry initially identified only end-stage renal patients, but subsequently included the different stages of renal disease (3). The population of patients being treated for ESRD world-wide has continued to grow since the establishment of dialysis and kidney transplantation. This growth is reported to be five times the world population growth of 1.3% (1). The Caribbean is no exception to this rapid growth. The increasing number of dialysis units across the English-speaking Caribbean countries has also seen a disproportionate increase in the number of patients needing the life-sustaining therapy. The number of haemodialysis units across Jamaica and Trinidad and Tobago has increased between 2006 and 2011 to almost double or more in capacity. However, there is still a growing number of patients who cannot access dialysis treatment. Apart from the longer life expectancy of treated ESRD patients and increasing access of the paediatric and elderly patient population to treatment in countries in which access was previously limited, there are several reasons contributing to the growth of CKD/ESRD patients worldwide and in the Caribbean. Globally, the reasons contributing to this growth are an increased ageing population, increased incidence of CNCs, improved infectious disease control and treatment, and locally, the increasing prevalence of lifestyle related diseases especially obesity, diabetes mellitus and hypertension. Tobacco smoking, including both first hand and passive smoking, also increases the risk of CKD (4). In the developing countries,

increasing access to healthcare and improved availability of healthcare related services have contributed to this growth.

#### **Global burden of chronic non-communicable diseases**

Chronic diseases are the largest cause of death in the world. In 2002, the leading CNCs – cardiovascular disease, cancer, chronic respiratory disease and diabetes – caused 29 million deaths worldwide (5). The World Health Organization (WHO) in 2003 estimated that there were 56 million deaths globally, with 60% due to chronic diseases. Despite growing evidence of the epidemiological and economic impact of CNCs, the global response to the problem remains inadequate from various stakeholders (6). Stakeholders include governments, the WHO and other United Nations bodies, academic and research groups, non-governmental organizations and the private sector. Lack of financial support retards capacity development for prevention, treatment, and research in most developing countries. Reasons for this include: lack of up-to-date evidence related to the nature of the burden of chronic diseases among decision-makers, and strong beliefs persist that chronic diseases afflict only the affluent and the elderly; that they arise solely from freely acquired risks, and that their control is ineffective and too expensive and should wait until infectious diseases are addressed (1, 7, 8). The influence of global economic factors on chronic disease risks impedes progress, as does the orientation of health systems toward acute care (8).

#### **Chronic non-communicable diseases and chronic kidney disease**

Disease profile in the world has taken a different turn with CNCs accounting for the majority of global morbidity and mortality, rather than infectious diseases (7–9). The changes observed between the 20<sup>th</sup> century and 21<sup>st</sup> century are reflected in the causes of CKD and ESRD. Diabetes mellitus and hypertension have been the major causes of CKD/ESRD around the world, including the Caribbean (2, 3). Review of renal registry data reflects an increase in the number of diabetic patients entering end stage renal failure: United States Renal Data Systems (USRDS), European Renal Association – European Dialysis and Transplant Association (ERA-EDTA), Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) and the Caribbean Renal Registry (CRR). The global dialysis population for ESRD was estimated at 2 million for 2010 (10).

#### **Renal registry in the Caribbean**

Since the development of the CRR in 2006, there has been a continuous and still on-going attempt to advise several Caribbean communities on the usefulness of the registry and the major impact it can play on chronic kidney disease in the Caribbean. Primary care prevention programmes developed for chronic diseases are based on epidemiological data. Development of the concept of “herd immunity” was based on epidemiologic observation coupled with an understanding

of the pathosociophysiological mechanism of the disease. There has been a tremendous amount of research effort on CKD/ESRD-specific complications (anaemia, mineral bone disease) and CKD/ESRD-related complications (obesity, hypertension, dyslipidaemia) consequently leading to recommendations and guidelines on the management of CKD/ESRD and its complications, some of which are based on epidemiological report. While on the other hand, there is an increase in the prevalence of chronic diseases causing CKD/ESRD, it would then seem reasonable that the focus, especially in resource constrained developing countries, should be on measures to reduce these causative events.

A blanket approach would certainly not apply to all Caribbean countries though there are major similarities reported in causes of CKD/ESRD. There are important trends also noted in the prevalence of the causes of CKD/ESRD. These important similarities and differences can be further teased out with development of national renal registries throughout the Caribbean. It is equally important that when such national registries are developed, there should be standardization in the reporting format. The continued development of the CRR has far reaching consequences and benefits.

Registries provide an aid in understanding treatment practices and policies and have implications for the well-being of patients. The information that can be obtained from a registry can provide knowledge of value to both the medical communities and policy-makers throughout the Caribbean and the world. There is a major deficit in data availability on CKD in the Caribbean. The already developed web-based CRR hopes to fill this void.

#### **Pattern of chronic kidney disease and end-stage renal disease in developing countries**

The pattern of CKD/ESRD has changed in some developing countries from infectious diseases being the major cause to the CNCs. However, the pattern is still different when comparing developing countries in Asia, Africa and the Caribbean. Reports from the CRR implicate diabetes mellitus and hypertensive nephrosclerosis as the leading causes in more than seven English-speaking Caribbean countries (2, 3). Chronic glomerulonephritis (CGN) is the third most common cause but the reports suggest primary glomerular diseases rather than secondary glomerular diseases. From the histology review of renal biopsies performed in Jamaica for over 20 years, focal segmental glomerulonephritis (FSGS), membranous glomerulonephritis (MGN) and minimal change disease (MCD) were the most common identifiable causes of CGN (11, 12). Secondary glomerular diseases were largely due to systemic lupus erythematosus [SLE] (11–13). In other developing countries in the world, chronic glomerulonephritis and interstitial nephritis are reported as the major causes of CKD. However, the underlying problems were largely due to bacterial, viral and parasitic infections (14). Some reports have diabetes mellitus as the

most prevalent disease causing CKD in the developed countries (USRDS) and the Caribbean (CRR), however, this is not as prevalent in some developing countries (15).

#### **Chronic kidney disease and end-stage renal disease in the Caribbean**

Patients with chronic kidney disease have high rates of healthcare utilization, morbidity and mortality (16). Managing the economic and clinical burden of CKD will be a significant challenge for the healthcare system. The burden of CKD/ESRD-specific and CKD/ESRD-related complications are major reasons for accessing the healthcare services. CKD/ESRD-specific complications tend to occur later in the course of the disease and may be best treated by a nephrologist. The emphasis would be to identify and monitor these complications before or as they arise. CKD/ESRD-related complications, though treatable by a nephrologist, can be easily treated by primary care physicians and internists. There are not enough nephrologists in Caribbean countries and some countries may lack a nephrology service. Coordinating patient care between specialist and primary care physicians is essential in managing the burden of this growing disease. Increasing rates of CNCs suggest that the expected numbers of patients with CKD will continue to rise. This needs urgent attention and curtailment.

#### **Pattern of renal failure and causes of CKD/ESRD in the Caribbean**

Globalization has become a prevalent agenda since the 1980s. Many view it as a process that is beneficial to the development and growth of a country and its region, while others perceive it as a means to increase inequality within and between countries, a threat to employment and living standards and a hindrance to social progress. The one thing that is clear is the direct relationship between globalization and the pattern of CNCs, and more so the pattern in the causes of chronic and end-stage renal failure.

Barton *et al*, in an epidemiological survey of chronic renal failure in Jamaica, reported a crude point prevalence of 327 per million population. This was thought to be a least prevalence but the leading reported causes of CKD were hypertension and diabetes mellitus (17). The relative contribution of these two diseases is different among Caribbean countries. Hypertension was the most prevalent cause of CKD/ESRD in Jamaica, Barbados, British Virgin Islands (BVI), Cayman Islands and Turks and Caicos Islands, while diabetes mellitus was more prevalent in the Bahamas, Antigua and Barbuda and Trinidad and Tobago. The pattern could reflect the prevalence of these CNCs in the different islands. In the Jamaica Health and Lifestyle Survey II, the prevalence of hypertension was 25% with diabetes mellitus at 8% (18). A review of reported data on chronic diseases in the Caribbean revealed that hypertension is more prevalent in most Caribbean countries than diabetes mellitus and is a major cause of CKD/ESRD (2, 3, 18). Countries that have

diabetes as a more prevalent cause of CKD/ESRD do have hypertension more prevalent than diabetes mellitus in the general population. Some of the reasons to explain this are variable.

There is a significant number of persons with unknown causes of CKD/ESRD and this can be as high as 30%. In the report from the CRR 2006 and 2007, there is a significant number of persons labelled as CKD/ESRD secondary to diabetes and hypertension “combo”, without a clear distinction. As screening programmes and diagnostic awareness improve, the incidence of CKD due to this “combo” should be on the decline while the specific prevalence due to either diabetes or hypertension will be more accurately known. Another confounder is the diagnosis of CKD/ESRD secondary to hypertension or chronic glomerulonephritis. An acute primary glomerular disease that goes unrecognized or undiagnosed may later present with hypertension. Therefore, the presentation, in the late stage, with hypertension as the only identifiable presenting finding can lead to the hypertension being labelled as the primary cause of CKD. Likewise, in diabetic kidney disease with proteinuria and hyperfiltration, as the glomerular filtration rate (GFR) declines, hypertension becomes a presenting feature, clouding the primary cause of CKD/ESRD. A true combination can occur where development of hypertension as GFR declines results in further accelerated decline in GFR in the setting of uncontrolled hypertension.

### **Haemodialysis in the Caribbean**

As we strive to slow the progression of CKD to ESRD in the Caribbean, there should also be adequate provision for RRT. Patient selection for RRT modalities in the Caribbean is limited by availability, financial constraint and co-morbid conditions. Haemodialysis is the most common form of RRT available in the countries where it is offered in the Caribbean (2, 3).

Haemodialysis treatment is not available in most of the Caribbean countries due to limited expertise in managing units and unavailable financial resources and support from both government and private sector. Most allocation of the government budget for healthcare is spent on dealing with CNCs and their complications, immunization programmes, health education and trauma. The proportional impact of these on healthcare budgets vary from island to island.

Access to HD is prohibitive largely due to financial limitations in countries where access is not supported by the government partly or in whole. In countries like Trinidad and Tobago, Jamaica, Cayman Islands, BVI, Barbados and the Bahamas, HD treatment is covered by the government. Dialysis treatment can be accessed by patients through the public or government hospitals, and when space availability prohibits access, other alternative arrangements are made such as access to private HD units with support from government in part or whole, or funding from non-governmental agencies *eg* National Health Fund (NHF) or

the Culture, Health, Arts, Sports and Education (CHASE) Fund in Jamaica or fully funded by patient and family. Insurance companies are now increasingly compensating for HD treatment and also include CKD as part of illness covered, though the coverage is still limited when compared to insurance policies in developed countries.

In Trinidad and Tobago, an initiative by the government to improve the access to long-term RRT is the proposed establishment of two HD centres which will accommodate 200 patients each with the cost for dialysis funded by the government. Since 2009, there has been the establishment of two additional HD units in Jamaica at public hospitals bringing the total public units to four and the cost of dialysis is borne by the government. Though this has helped to improve access to dialysis, the number of persons needing this life-sustaining treatment continues to rise exponentially. This rise far out-paces the availability of treatment.

### **Peritoneal dialysis in the Caribbean**

In the reports from 2006 and 2007 CRR data, peritoneal dialysis (PD) seems to be offered in only very few countries in the Caribbean, like Trinidad and Tobago, Jamaica and the Bahamas. In the countries where it is available, the number of patients utilizing it is disproportionately lower when compared to HD. This is similar to global trends where there are more patients on HD compared to PD and kidney transplantation. The importance of PD and its economic advantage over HD has been demonstrated in trials and meta-analysis of studies (19, 20). Despite this proven economic advantage and reduced hospitalization rate (19), PD is underutilized in the Caribbean. Most strategies being looked at by Caribbean countries without RRT involve HD and not PD. Therefore, it is important that the economic feasibility of both PD and HD be considered carefully along with the attitude and behaviour of the population under study. A great effort should be made to make both modes of treatment available and have patient selection based on clinical and behavioural selection, rather than availability. The pattern of mortality is similar, and cardiovascular death is the leading cause of mortality regardless of type of dialysis (3, 21).

There have been efforts to improve the number of patients on PD programmes, however, this has been met with pecuniary constraints. Most patients receiving PD in Jamaica are hospital based, while in Trinidad and Tobago the converse is true, where the majority of patients on PD are on home-based programmes. St. Maarten also offers PD, but more in-centre based with less than a quarter receiving home-based peritoneal dialysis.

### **Kidney transplantation in the Caribbean**

The first transplantation in Jamaica was carried out in 1971 and since then kidney transplantation has been offered as an option for RRT. However, there have been major challenges to continuation of this treatment modality, mostly as a result of the cost of immunosuppressives. Trinidad and Tobago has

a well-developed transplant programme with over 74 persons who have undergone living donor kidney transplantation through the national programme from January 2006–April 2011. There are persons who have travelled outside the country to receive transplantation. In most of the other countries like Barbados, Cayman Islands, the Bahamas and the British Virgin Islands, potential recipients are transplanted mostly in US territories, whether from living related or unrelated donors.

The government of Trinidad and Tobago has continued to strengthen the transplantation programme by increasing the multiple resources required to sustain such a programme. In Jamaica, renal transplantation is expected to increase in 2011 as cheaper, efficacious immunosuppressives become available.

### **Organ donation in the Caribbean**

In the Caribbean, organ procurement programmes are lacking or are not well established. In Trinidad and Tobago, the transplant programme is supported by living donors and therefore limits the number of organs available for transplantation. Jamaica, during its active stage of kidney transplantation, utilized both living and cadaveric donors, but this was limited by the cost of immunosuppression therapy which was then mostly borne by the patient and resulted in the virtual collapse of the kidney transplantation programme in the country. Therefore, a successful organ donation and procurement programme will have to begin with massive public campaigns geared at changing the public views and attitudes towards organ donation. Other supporting systems will need to be put in place and operating in order to complement the programme of kidney transplantation in the Caribbean. An organ sharing system can be developed between the Caribbean countries to improve the transplantation pool. In places where the expertise to perform kidney transplantation is not available, a memorandum of understanding could be established to facilitate the way forward. In developing organ transplantation programmes, there should be considerable awareness of the organ trade where organ donation is done with financial gain being the motivating factor. In such cases, there is the potential for exploitation by salespersons and for unscrupulous ways to be found for organ procurement. A successful programme will have to take such aspects into consideration.

### **Immunosuppressive drugs in the Caribbean**

Since the introduction of kidney transplantation, graft survival has been improved by the use of immunosuppressive drugs. The use of such drugs has facilitated transplantation between relatively incompatible pairs. The current immunosuppressive armamentarium and protocols have allowed for effective and safe transplantation. The availability of these immunosuppressive agents in the Caribbean has been a major challenge. The high cost of anti-rejection drugs has been antagonistic to any transplantation programme. However,

with the introduction of effective generic and bio-similar drugs and agents, there is hope for increasing kidney transplantation in the Caribbean. Partnering with various non-government organizations and pharmaceutical companies will no doubt help reduce the financial burden. Also, there has been little large-scale research on the effectiveness of immunosuppressive agents in the Caribbean population, and the development of an active transplant programme, coupled with good data of the population, may improve this.

### **Support systems for CKD/ESRD and RRT patients**

The Caribbean Institute of Nephrology (CIN), affiliated to the Department of Medicine at the University of the West Indies, Mona, has as one of its mandate to reduce the burden of kidney disease and to slow progression to end-stage renal failure by continued research in the epidemiology of kidney disease in the region. The information will then be used by various personnel including policy-makers to make informed decisions on the growing epidemic of chronic kidney disease in the Caribbean territories. The CIN has partnered with various institutions both locally and abroad to provide educational fora to educate the public on diseases causing renal failure and the effect of screening methods. The institute has partnered with the International Society of Nephrology (ISN) through its “sister” programme with the University of Michigan and has been able to organize annual conferences and inaugural lectures providing cutting-edge information on management issues related to chronic renal failure, hypertension, diabetes mellitus and cardiovascular diseases.

Other organizations throughout the Caribbean have joined in the fight against kidney disease and continue to provide support for kidney patients and their relatives in the Caribbean. The Grenada National Patients Kidney Foundation (GNPKF), a registered charity, was established in 2007 with the goal of supporting patients on dialysis. They have joined forces with the Ministry of Health, healthcare providers and various agencies to improve the provision of care to renal failure patients and their families.

The Caribbean Islands Kidney Centre (formerly known as the Virgin Islands Kidney Centre) has committed the facility to reducing the number of persons in the territory who require dialysis as a result of kidney failure. This will be achieved through its emphasis on the early detection and intervention in patients with renal disease. Because the prime cause of renal disease in the territory is hypertension and diabetes mellitus, persons with these conditions have been especially targeted for aggressive treatment and education. Malvina C Gardiner Institute for Renal Medicine, a non-profit organization, is also dedicated to providing education to renal patients and will have this objective as its primary *raison d’être*.

Executive board members of the Nevis Renal Society hold the conviction that the money being spent by kidney failure patients outside the territory can sustain a dialysis centre in the Federation of St Kitts and Nevis, therefore on-

going discussion is taking place to provide such care within the country itself and slow the progression to ESRD.

There are three nongovernmental organizations in Trinidad and Tobago which are directly involved in the support of patients and families with CKD. Their intervention without a doubt is a pillar in the management of these cases but they must scale-up their emphasis on prevention and slowing the progression to ESRD.

### **Burden of kidney failure in the Caribbean**

The true burden of CKD/ESRD in the Caribbean is far from being established. However, with continued education and awareness of healthcare providers, the true prevalence and incidence will be unravelled. The development of the national renal registries will no doubt result in significant advancement in realizing the true burden of the disease.

Aggressive blood pressure management and tight glucose control, married with lifestyle modification, obesity control through healthy eating and increased physical activity will help reduce the exponentially increasing and overwhelming burden of renal failure in the Caribbean.

### **Cost-effective analysis of renal replacement therapy**

Renal replacement therapy imposes an additional financial burden on the healthcare system of any country. However, the cost-effective analysis of all RRT modalities suggests that living-related donor transplantation is the most cost-effective modality (22). Another study suggested, from a cost minimization perspective, that the number of patients on PD be increased compared to other modalities (23). Cost-effective analysis of RRT modalities should take into account the actual treatment cost and quality of life gained. With improved quality of life, patients are less likely to be absent from work and also more likely to be gainfully employed.

### **CONCLUSION**

Information gathered thus far from the CRR showed that lifestyle-related diseases, diabetes mellitus and hypertension, are the major causes of CKD/ESRD in the Caribbean. The Registry provides an aid in understanding treatment practices and policies and has implications for the well-being of patients. Information that can be obtained from the registry will provide knowledge of value to the medical communities and policy-makers throughout the Caribbean and the world.

There are several policy devices to address these barriers: elevating chronic diseases on the health agenda of key policy-makers, providing them with better evidence about risk factor control, and persuading them of the need for health systems change. A more concerted, strategic, and multi-sectoral policy approach, underpinned by solid research, is essential to help reverse the rising trend in the incidence of CNCs, including chronic kidney disease, diabetes mellitus and hypertension in the Caribbean.

Partnerships with appropriate societies such as CIN, University Diabetes Outreach Programme (UDOP), Carib-

bean Cardiac Society (CCS), Caribbean Association of Nephrologists and Urologists (CANU), government and non-government organizations as well as international organizations such as ISN, WHO and National Kidney Foundation (NFK), are essential in order to influence national and global health policy and decision-makers as to the magnitude of the problem of this chronic disease.

Detection and prevention programmes, including screening of communities for diabetes and diabetic kidney disease (DKD), hypertension and chronic diseases of the kidney, have to be implemented in order to avert the enormous problem of chronic kidney disease. Development of national kidney registries will help in detailing the extent of the problem and would also provide an objective measure of effectiveness of various interventions such as policies, screening programmes, and would also direct the focus of government strategies by identifying the problems as they arise.

There has been a substantial rise in the number of individuals developing chronic kidney disease in the Caribbean. The economic and social costs of chronic kidney disease are enormous to the individual and the entire health system. It is imperative that we urgently develop preventative programmes for CKD as well as for the two leading disorders that cause kidney damage, namely diabetes mellitus and hypertension. Lifestyle changes, as well as a massive and sustained community education initiative which has a screening aspect as an integral part, will be needed.

### **REFERENCES**

1. Moeller S, Gioberge S, Brown G. ESRD patients in 2001: Global overview of patients, treatment modalities and development trends. *Nephrol Dial Transplant* 2002; **17**: 2071–6.
2. Soyibo AK, Barton EN. Report from the Caribbean Renal Registry 2006. *West Indian Med J* 2007; **56**: 51.
3. Soyibo AK, Barton EN. Chronic kidney disease in the English speaking Caribbean countries. *West Indian Med J* 2009; **58**: 596–600.
4. Jones-Burton C, Seliger SL, Scherer RW, Mishra SI, Vessal G, Brown J et al. Cigarette smoking and incident chronic kidney disease: A systematic review. *American Journal of Nephrology* 2007; **27**: 342–51.
5. Yach D, Hawkes C, Gould, CL, Hofman, K. The global burden of chronic diseases: Overcoming impediments to prevention and control. *JAMA* 2004; **291**: 2616–22. DOI: 10.1001/jama.291.21.2616
6. Beaglehole R, Yach D. Globalization and the prevention and control of non-communicable disease: The neglected chronic diseases of adults. *Lancet* 2003; **22**: 1763–4.
7. Grassman A, Gioberge S, Moeller S, Brown G. ESRD patients in 2004: Global overview of patients, treatment modalities and development trends. *Nephrol Dial Transplant* 2005; **20**: 2587–93.
8. Hinkfuss A, Sherwin A, Hu C, Kirac I, Murray M. Dialysis in emerging economies. *Organ Replacement Therapy in Emerging Economies Website* 2006. Available from: <http://biomed.brown.edu/Courses/BI108/2006-108websites/group04emergingeconomies/esrd.html>
9. Atkins RC. The epidemiology of chronic kidney disease. *Kidney Int Suppl* 2005; **94**: S14–8.
10. Atkins RC. The changing pattern of chronic kidney disease: The need to develop strategies for prevention relevant to different regions and countries. *Kidney Int Suppl* 2005; **98**: S83–5.
11. Soyibo AK, Shah D, Barton EN, Williams W, Smith R. Renal histological findings in adults in Jamaica. *West Indian Med J* 2009; **58**: 265–9.

12. Williams W, Sargeant LA, Smikle M, Smith R, Edwards H, Shah D. The outcome of lupus nephritis in Jamaican patients. *Am J Med Sci* 2007; **334**: 426–30.
13. Soyibo AK, Shah D, Barton EN, Williams W, Smith R. Renal biopsies done in Jamaica in 2006. *West Indian Med J* 2007; **56**: 309–10.
14. Barsoum RS. Chronic Kidney Disease in the Developing World. *N Engl J Med* 2006; **354**: 997–9.
15. Ulasi I, Ijoma C. The Enormity of Chronic Kidney Disease in Nigeria: The Situation in a Teaching Hospital in South-East Nigeria. *Journal of Tropical Medicine* 2010; 2010: Article ID 501957. DOI: 10.1155/2010/501957.
16. Thorp ML, Eastman L, Smith DH, Johnson ES. Managing the burden of chronic kidney disease. *Disease Management* 2006; **9**: 115–21.
17. Barton EN, Sargeant LA, Samuels D, Smith R, James J, Wilson R et al. A survey of chronic renal failure in Jamaica. *West Indian Med J* 2004; **53**: 81–4.
18. Wilks R, Younger N, Tulloch-Reid M, McFarlane S, Francis D. Jamaica Health and Lifestyle Survey 2007–8: Technical Report. Kingston: Tropical Medicine Research Institute, University of the West Indies, Mona; 2008.
19. Berger A, Edelsberg J, Inglese GW, Bhattacharyya SK, Oster G. Cost comparison of peritoneal dialysis versus haemodialysis in end-stage renal disease. *Am J Manag Care*, 2009; **15**: 509–18.
20. Li P, Cheung W, Lui S, Blagg C, Cass A, Hooi L et al. Increasing home-based dialysis therapies to tackle dialysis burden across the world: A position statement on dialysis economics from the 2<sup>nd</sup> Congress of the international Society for Haemodialysis. *Hemodialysis International* 2011; **15**: 10–4.
21. Lawal CO, Soyibo AK, Frankson A, Barton EN. Characteristics, complications and outcome of patients treated with automated peritoneal dialysis at the Peritoneal Dialysis Unit, University of the West Indies. *West Indian Med J* 2010; **59**: 312–8.
22. Haller M, Gutjahr G, Kramar R, Harnoncourt F, Oberbauer R. Cost-effectiveness analysis of renal replacement therapy in Austria. *Nephrol Dial Transplant* 2011; [Epub ahead of print].
23. Villa G, Rodríguez-Carmona A, Fernández-Ortiz L, Cuervo J, Rebollo P, Otero A et al. Cost analysis of the Spanish renal replacement therapy programme. *Nephrol Dial Transplant* 2011. First published online March 21, 2011. DOI: 10.1093/ndt/gfr088