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Community Primary Healthcare Centre-Renal Centre Linkage Program for the Reduction in Burden of CKD/ESRD in Low and Middle income Countries

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Abstract In the Low and middle income countries (LMIC) CKD and ESRD constitute a major cause of morbidity and mortality affecting predominantly the young and middle age groups with far reaching socioeconomic implications. The exact data are not available, the prevalence of CKD and the incidence of ESRD in most LMIC jurisdictions are about 10-17% and over 1500 per million populations (pmp), respectively, though RRT prevalence averages 255pmp. The burden of human suffering is enormous and the financial burden of care is far beyond the reach of the individual sufferer and most LMIC countries are incapable of providing Medicare type of care for their subjects with ESRD. Thus the diagnosis of ESRD in most LMIC countries is synonymous with a death sentence. In the present state of practice in the LMIC countries, the unmet need of nephrology practice is the challenge of reducing the burden of CKD and ESRD in the communities through preventive nephrology approach. Even in developed countries with state of the art facilities for care, there is the prevailing need for reducing the burden of CKD in recent times. CKD and ESRD preventive programs such as the KEEP and similar programs are in place. KEEP-like programs are unfortunately not appropriate for LMICs on account of technology and IT attributes. Paradoxically, in most LMIC jurisdictions with the highest burden of ESRD and the least in access to care, there are no forms of structured sustainable CKD/ESRD containment programs. Some previous efforts in this direction could not be sustained because they were not integrative in nature and were funded by donor agencies. We propose the Community (PHC)-Renal Centre linkage program which would enable a permanent link between the rural based PHC centres with urban based Renal centres. This pivotal link will be achieved through the services of purpose trained Community Preventive Nephrology practitioner (CPN-P). The CPN-P identifies and manages CKD risk factors and early CKD cases at the PHC level and transfers advanced stages to the affiliate Renal centres in teaching and specialist hospitals. The CPN-P bridges the long missing nephrology care gap in the LMIC jurisdictions. With good record keeping Renal data from the communities would be used to develop Renal Registry in the area.

Keywords: *LIMC, CKD, community, renal centre, linkage, program*

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1. Introduction

Chronic kidney disease (CKD) and consequent ESRD, is a cause of global morbidity and mortality of public health importance. CKD afflicts about 10-16% of the world population, with a huge global burden of over 500million people globally. Over 2.5 million have ESRD of which 1.8million are on maintenance dialysis and over half a million persons living with renal allograft. ESRD accounts for 19% of global deaths annually [1,2].

The burden of the disease continues to increase with ageing population in the western countries and with increasing risk factor exposures in the low and middle income (LMIC) jurisdictions [1,2]. The human burden of suffering, financial costs of care and the demand on health services are enormous even in the high income jurisdictions with optimum facilities for care [3,4]. For most low and middle income countries (LMICs), ESRD is associated with over 80% mortality in the first year of diagnosis [5]. The diagnosis of ESRD in most LMIC jurisdictions is synonymous with death sentence.

Whereas in most developed country settings, public health awareness of CKD is relatively high, early detection and intervention is the norm and access to optimal care for CKD and ESRD is the norm, the reverse is the case in most LMIC jurisdictions.

In these countries, community awareness of CKD and ESRD is low. Early detection, and intervention is poor and

access to optimal renal care is extremely very poor [6,7]. The resultant effect is late presentations in advanced stages of kidney failure, inability to access treatment for a host of several cultural and economic reasons, with consequent severe morbidity early mortality. These include absence of PHCs, long and difficult terrains to the next PHC, finance, socio-cultural and religious impediments.

The prevalence of modifiable risk factors of kidney disease and kidney failure are quite high in most LMIC countries but due to low awareness, and failure of early risk factor detection and modification, there is insidious and progressive kidney damage by the risk factors and decline in kidney functions without detection. By the time patients become symptomatic disease has progressed beyond stage 3. Thus a large population of the early stages of CKD 1 to 3, are embedded in the communities, with only a small fraction of the population constituting the advanced stage 3 and 4 presenting to the hospital; the iceberg phenomenon of CKD) [8]. There is thus paucity of linkage between the rural communities and the Renal centres located mostly in teaching and specialist hospitals in the urban centres. Indeed there is no structured Preventive nephrology program in most LMIC jurisdictions.

This lack of linkage between the community based PHC centres and the urban based Renal(RC) centres is the long missing link in Nephrology practice in the most LMIC jurisdictions.

Thus there is gross deficit in early risk factor detection and intervention, early detection and intervention in early stages of CKD, respectively.

A sustainable and durable linkage program that is integrated into the health system of LMIC countries is envisaged to substantially reduce the burden of CKD and by extension ESRD in LMIC jurisdictions.

We therefore propose a Community(PHC)-Renal Center (RC) linkage CKD prevention program for LIMC countries as template for the reduction of the burden of CKD/ESRD in LMIC countries.

2. Literature Review

2.1. Epidemiology of CKD and the Burden of Human Suffering

Kidney impairment and kidney failure have globally assumed an increasing magnitude of public health concern in recent times. The world health organisation (WHO) has recently enlisted chronic kidney disease (CKD) among the six common causes of non -communicable disease (NCD) deaths worldwide for which long term strategy for their control is being developed for implementation [1,2].

The global prevalence of CKD is 10-16%, with 2.54 million people on RRT and about 1.68millon living with kidney grafts respectively. Whereas the annual global population growth rate is 1.1%, the global ESRD growth rate is 6-7% respectively [9].

In most LMIC accurate statistics are not available as most countries lack functional renal registries. Among SSA countries, only South Africa has a renal registry (the South African renal dialysis and transplant registry), which has 7082 ESRD patients enrolled as at 2015 [10].

Data from most LMIC countries are mostly hospital based, admissions prevalence data. These data however show high prevalence of dialysis requiring kidney failures in the region ranging from **3-16** per cent of hospital admissions [11,12,13,14].

In Nigeria, the most populous SSA country with a population of about 170 million people, 3-16 percent of medical admissions are due to ESRD. These figures tend to corroborate with a recent meta-analysis of publications of chronic kidney disease prevalence in SSA region by Stanifer et-al [15] who found CKD prevalence of 2-30% with an average prevalence of **13.9%** in the SSA region and **17.6%** prevalence for Nigeria, respectively.

Given the average population prevalence of ESRD of 0.02% in most populations, an estimated 34,000 persons/per annum have ESRD in Nigeria, while the value for SSA region with a population of about 600 million people would be 1.6milion per annum respectively.

Other LMIC countries have similar huge burdens though their RRT incident rates are reported low as only a small fraction of ESRD patients have access to RRT in the LMIC countries.

The community prevalence of risk factors of CKD based on community surveys from different parts of LMIC are relatively high with, Obesity (20-29%), hypertension (25-29%), Diabetes (8-9%), dyslipidemia (10-14%) respectively [12,13,14]**.** Data from most other LMIC countries such as Latin America, and the South East Asian countries and India show similar trends.

The actual contributions of HIV-kidney disease and nephrotoxin exposures as risk factors to ESRD, in LIMC countries have not been properly documented. Globally HIVAN is the 4th common cause of ESRD. HIV-Kidney disease is commonly encountered in medical admissions in SSA jurisdictions. HIVAN is associated with 15-58 percent of medical admissions in many SSA countries [16,17,18]. Toxic kidney exposures are quite common in LMIC countries but systematic studies of proven chronic toxic nephropathies (with exception of acute sub-epidemic exposures) are not readily available [19,20,21,22]. From the foregoing, the risk factor reserve for CKD and ESRD in LMIC countries is huge.

2.2 Financial Burden of CKD/ESRD Care

The financial costs of CKD and ESRD care in any given population is huge and far out strips the health budgets of most low and middle income countries.

The United States renal Registry data system (USRDS) provides perhaps the most reliable and comprehensive up to date source of information on the financial costs of CKD/ESRD care. Whereas, ESRD patients constitute just 9% of Medicare population, they account for 17% of total Medicare costs, indicating the high costs of ESRD care [9]. In 2015, the annual Medicare costs for CKD(1-4) was **$64.6 bn** (N19.7tn), while the Medicare costs for ESRD was **$33.9bn** (N10.3tn), respectively. These amounts constitutes far more than annual National budgets of most LIMC countries. In the US and other western countries, the financial costs of care continue to increase annually due to the ageing population and increasing prevalence of CKD/ESRD.

In most developing countries like Nigeria there are no functioning Renal registries, thus there is no accurate data on CKD, ESRD, RRT and costs of care. RRT services are not organized, and not readily accessible and affordable to the majority of patients. There is no Medicare type of insurance based payment system. Out of pocket payment at the point of care is the norm. The result is grossly sub-optimal care with attendant high one-year mortality rate over 80% in most centres. Thus the diagnosis of ESRD is tantamount to death sentence in most LMIC environments.

In our centre in Nigeria we estimated the average annual cost of RRT based on prevailing costs in our locality in 2010 as N706,240.00 ($4,414.0) per person per year for pre-dialysis treatment, N2,652,000.0 ($16,575.0) per person per year for maintenance dialysis and ESA expenses and 8million naira ($50,000.0) per person for kidney transplant and immunosuppressive agents for the first year, respectively.

The aggregate total cost of care per patient came to N11,358,204.0 ($70,988.8) a year. This is not very different from the $70,216.0 figure for USA in 2010. Further analysis of our data to determine the financial status and source of funds for treatment of our patients on maintenance haemodialysis showed that in over 50% of the patients, their annual income was less than half the cost of maintenance haemodialysis a year. Over 65 % of the patients sourced funds from direct family sources (out of pocket). None of the patients had any health insurance nor government aided social security support [22,23].

By our estimates, if, Nigeria with a population of 170million people is to provide Medicare- ESRD for the estimated 340,000 ESRD patients per year, the sum of N3.88tn ($10.8Bn) per annum would be required. This amount is about 46.7% of Nigeria Federal Budget for 2018 and 12.9 times (129%) the Federal annual health budget of N300bn for 2018, respectively.

These data show that neither individual Nigerian patients nor the Nigerian state can cater for their Medicare -like ESRD treatment for Nigerian patients. The situation of Nigeria is similar to that of most other LMIC countries.

As compared with ESRD patients in the developed countries, who are exposed to optimal RRT care, with reasonable health related quality of health (HrQoL) status, ESRD patients in LMIC jurisdictions have very poor access to RRT due unaffordable cost RRT, of out of pocket payment, inadequate facilities and personnel for RRT, long distance between the communities and the nearest RRT facilities, often located in the urban centres. Others are certain religious and sociocultural practices which impair proper health seeking behaviour. The resultant effects are poor state of clinical presentation.

They often present for the first time in states of acute pulmonary oedema, uraemic encephalopathy or coma [24,25,26,27]. For these reasons the RRT outcomes in most LMIC settings is abysmal.

The majority commence RRT as an emergency, while sustenance on maintenance dialysis is often short, with a median period of six months. Most patients receive no more than one dialysis session in a week others receive one session in two or more weeks. The outcome of this scenario is gross dialysis inadequacy, clinical instability, and high mortality rate of over 80percent within the first year of diagnosis [1,6].

From the foregoing therefore the CKD priority for LMIC jurisdictions therefore would be the reduction of the burden of risk factors of CKD in the LMIC communities. Unfortunately, at the present there are no structured CKD preventive programs in most LMIC countries.

3. Proposed Program for Reducing the Burden of CKD in LMIC Jurisdictions

The high burden of ESRD is on the increase with associated burden of human suffering. It is perhaps for this reason the authors of the 2017 Annual data report (ADR) of the United States, Renal data System (USRDS) stated as follows: “Why should we care about the trends and current state of kidney disease in the US? Research has established these as a disease continuum that holds great cost to both the individual and society. The key to success lies undoubtedly in the realm of prevention and optimal management of CKD in order to slow progression, with the goal of completely avoiding development of ESRD. This, for the most part, is an unmet challenge of the community focused management of advanced kidney disease or ESRD.” [28]. This need is more urgent in the LMIC countries.

One major reason for the increasing prevalence of CKD and ESRD and the late presentations to renal centres is the lack of sustainable linkage between the communities where most of CKD is generated and renal care services located in faraway urban centres.

In most PHCs in LMIC countries, facilities for basic urine examination for the detection of proteinuria, haematuria, etc, is not in existence [1,29]. Where they are available, the significance of urinary abnormalities and the renal implications of such findings is of alien to the PHC medical staff. Thus there is a combination of facility and knowledge deficit for the primary care of CKD at the community level. Also, there is no structured renal referral system between the PHCs and Renal centres in most LMIC jurisdictions.

The resultant effect is that modifiable risk factors of CKD remain undetected for a long time, and even when detected, no referrals are made to nearby Renal centres. So the CKD smoulders for a long time until late stages when patients become symptomatic. By which time the patients and the health system are unable to provide desired optimal care, with consequent high mortality.

To overcome this situation, there is the imperative need for LMIC countries to develop a sustainable PHC-Renal centre (PHC-RC) linkage programme to enable early detection, early intervention at the PHC/community level and early referral to Renal centres. To be successful the program must be sustainable on a long term and be made an integral part of the Nations’ Health care delivery system.

3.1. Program Concept and Philosophy

The primary health care (PHC) system is the health system closest to the people and the first port of entry of

most persons into the health care delivery system of any country. With an efficient PHC system, significant number of illness is encountered for the first time at the PHC level before referral to other levels of care.

Most chronic ailments especially the NCD disorders (hypertension, diabetes, stroke chronic lung disorders, CKD etc) [30] are often insidious in onset; remain asymptomatic for a long time before manifestation of symptoms. With simple tools most of the NCD's can be detected early at PHC level from where they are referred to other levels of care.

Integrating Kidney health promotion and prevention as well as an early CKD screening program into the PHC system would no doubt provide a very wide and sustainable coverage for CKD tracking in any SSA country. What is important is the strengthening of the PHC system to be functional and effective in each of the SSA countries. The program is similar to the WHO Community Midwifery program for the prevention and reduction of maternal morbidity and mortality in rural communities.

3.2. Aims and Objectives of the Program

The primary aim of the proposed program is to establish a sustainable renal care linkage between the communities and urban based Renal care centres.

Objectives of the Program:

- To ensure a structured in-built system of Kidney health promotion, CKD risk factor prevention, early CKD detection and early intervention at the community level.
- To link the community sources of CKD to the urban based Renal care centres for early intervention. **Thus bringing Nephrology care to the community** or the community as first level of nephrology care in LMIC countries.
- To establish a structured and sustainable renal referral system.
- To provide the opportunity for continued interaction between the PHC and the community for kidney health promotion and risk factor prevention.
- To enable the development of reliable **CKD data base** from communities for research, planning and eventual development of renal registry for the country.
- To enable collateral benefits for early detection and control of other NCDs

3.3. Strategies for Actualization of the Linkage Program

3.3.1. Proposed Operational Modality of Program

- All patients from the PHC-target community registered and attending PHC-clinic are screened for risk factors and markers of for CKD upon first entry into the PHC.
- All PHC patients with CKD risk factors and markers would be sorted for the attention of a visiting **Community Preventive Nephrology Practitioner (CPN- practitione**r) trained to detect and provide first line renal care for at risk subjects and those in the early stages of CKD at the primary care level.
- The CPN- practitioner evaluates all such subjects for determination of CKD status. Subjects with risk factors or in CKD 1-2 continue life style risk factor modification care and regular follow-up at the PHC level under the supervision of the CPN- practitioner.
- PHC registered patients who at first encounter are in CKD-3a or those who progress to CKD 3a, from CKD1-2 are then **transferred** to the collaborating nephrology service by the CPN-practitioner for further evaluation and care by the Nephrology Service.
- The CPN – practitioner thus serves as the first level CKD screening level at the PHC and the **linkage** between the community, the PHC-centre and a **Nephrology centre** nearest to the PHC.
- The PHC medical officers and nurses shall be given basic training on CKD-risk factor and CKD marker detection and **red flags** to initiate attention of the C-PNP
- Periodically the CPN-practitioner in conjunction with the Renal centre staff shall organize Kidney health education and CKD risk factor screening exercises in the catchment community of the PHC.
- Each CPN-practitioner would have jurisdiction over a cluster of PHCs (Figure 1) and target communities.

In this way the target community through the PHC is continuously linked with Renal centres for early diagnosis and intervention. The CPN-P plays the pivotal role of establishing an integrated preventive and early nephrology care at the community level which is presently lacking in most LIMC jurisdictions. This is illustrated in Figure 1.

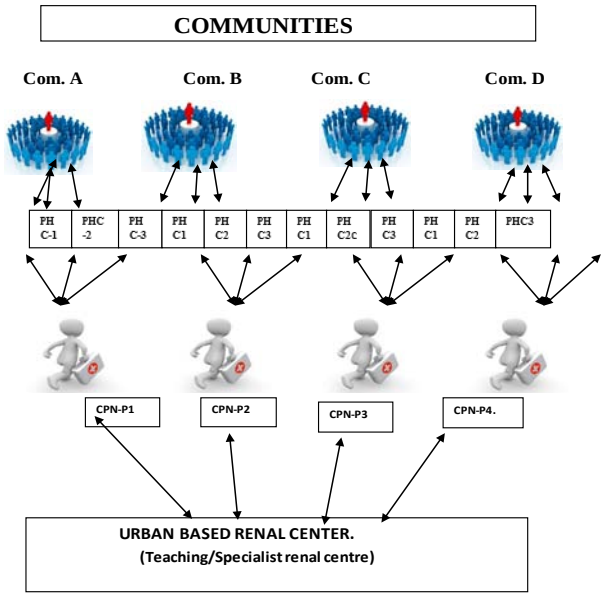

Figure 1. Shows the sketch of the operational modality for the proposed scheme

3.4. Requirements for the Proposed Program

As stated earlier the basic infrastructure for the program are the PHCs and the Renal centre infrastructure which are already in existence. So no new infrastructure would be required and similarly the staff to run the program are those of the referral Nephrology centre and the PHCs. The only new staffing requirement is the Community Preventive Nephrology - practitioner (CPN-P) who will be the fulcrum around which the program revolves. The CPN-P will be specially trained for the job.

Table 1. Summary of basic requirements for the program

Category	Requirements
Program Infrastructure	1. Primary health care centres (PHC) in the country 2. Referral Renal centres.
Personnel	1. Purpose trained Community Preventive Nephrology Practitioner **(CPN-P)** 2. The medical staff of PHC centres 3. Nephrologists and Nephrology nurses of the Renal centre
Managerial	Program management Committee
Funding	The SSA country Central and regional ministries of health. The Management of the hospital of the Renal centre, (e.g. Teaching hospital) International donors
Policy	Program ownership by the SAA government

3.5. The Community Preventive Nephrology Practitioner (CPN-P)

The Success of community PHC-RC linkage program revolves around the community preventive nephrology practitioner (CPN-P).

The CPN-practitioner has been the long missing link between the community, and the nephrology services (the teaching and specialist hospitals) in the delivery of renal services most LMIC jurisdictions.

The CPN- practitioner shall be a **full time staff** of the nephrology service, which coordinates the program in its area of jurisdiction.

The CPN-P shall undergo a basic community based nephrology care training course, with certification.

The program curriculum shall be developed by the Renal Society of the LMIC country in collaboration with the country central ministry of health.

Entry requirement into the program shall be MBBS or equivalent or Post basic qualification in Nephrology Nursing.

Panel 1. Training curriculum for the CPN-P

Course curriculum:

The community nephrology nurse practitioner shall be a **Medical officer or trained renal nurse.**

The training curriculum shall be designed to enable:

- Basic knowledge of anatomy physiology of the kidneys.
- The functions of the kidneys in health and disease.
- Approach to the patient with kidney disease.
- Basic Urine examination.(Proteinuria measurement and grading)
- Biophysical measurements.
- Basic laboratory tests in kidney disease.
- Common kidney disorders.
- Basic epidemiology of kidney disease and biostatistics.
- Risk factors of renal disease and their detection.
- Guideline based management principles of uncomplicated hypertension, diabetes, dyslipidaemia, and some kidney disorders)
- Kidney failure.
- Dietary and fluid management of renal impairment.
- Kidney failure metrics.
- RRT.
- Social support for renal disease patients.
- Principles of Preventive Nephrology.
- Community screening and monitoring for renal disease.

Course duration:

The recommended course duration shall be **12 calendar months** comprising the following:

- Didactic lectures: **(3months.)**
- Clinical attachment in a Renal unit (teaching or specialist hospital) under a consultant nephrologist: **(4 months)**
- Supervised Clinical attachment to **4** Primary health centres **(4months)**
- Revision and qualifying examination.: **(1 month.)**

Award Certificate/ Diploma: Post graduate diploma(PDG) in **Community Preventive Nephrology**

Designation: Community preventive nephrology-Practitioner. (CPN-P)

The program would be for a **12 months** (Panel 2). Successful candidates are awarded a diploma certificate equivalent to a postgraduate qualification.

The qualification should be made recognizable as a Postgraduate or advanced diploma for the purpose of employment into the LMIC- country public service or private sector. An appropriate career structure carved out for them in the establishments of their employers.

Their practice shall be confined to PHCs in linkage with Renal centres, under the close supervision of the Renal centre. They do not have independence of practice.

3.6. Training for PHC-medical and Nursing Staff

3.6.1. Basic Training Workshops for PHC Medical Staff for the PHC-RC Program

The medical staff of the PHCs (the medial officer, the nurse and laboratory staff) shall undergo sessions of training workshops to enable the understanding of the work of the CPN-P and to cooperate with them. The basic training will be in the form of workshop modules as outlined in Panel 2.

Panel 2. Training workshop for PHC medical staff

The basic training content shall include training workshops to enable:

Module1:

- General introduction to kidney failure.
- Creating awareness of the burden of Kidney disease and kidney failure, globally and especially in the sub-Saharan African countries.
- The common causes and risk factors of kidney failure in the tropical environment.

Module2:

- The promotion of healthy life styles that prevent kidney disease.
- The importance of early detection and early intervention in ameliorating and retarding disease progression.
- Role of the PHC Medical worker in CKD prevention.
- The techniques of early detection through the active search for risk factors.
- The techniques of basic urine examination for risk factor detection ,

the significance of proteinuria, glycosuria, and other urinary abnormalities.

- The techniques of bio-physical measurements relevant to kidney disease.
- Knowledge of cut-of levels of biophysical and urinary parameters for risk factors necessary to refer subjects to the visiting community nurse.
- Recognition of red flags for attention of the CPN-P.

Module 3:

- Role of the CPN in PHC and need for close cooperation.
- Early detection and intervention in early kidney disease to prevent progression.
- Early referral to Kidney specialist centres for adequate management.
- Link between the PHC and Kidney specialist centres.

3.7. Duties and Responsibilities of the CPN-P

- One CPN- Practitioner shall oversee a cluster of PHC centres.
- Provides training for the PHC medical staff on the recognition, and documentation of PHC patients with CKD risk factors
- Offers kidney health promotion and prevention services as well as manages uncomplicated CKD risk factors and early stage CKD1-2 at the PHC level.

- Transfers more complicated cases (CKD 3 and above) to the affiliate Renal centre (RC) for further care.
- Ensures proper records keeping at the PHC centres. Keeps track of all registered patients by phone and conducts periodic home visits for subjects who may abscond form clinic visits.
- Collates the PHC-derived data for onward transmission to the Nephrology service for the development of renal registry and research in the area.

Program ownership and managerial structure

The long term sustainability of the program will depend on the managerial structure of the program. The program should be part of the National non-communicable disease (NCD) control program and should be jointly **owned** by both the **National Ministry of health**, the **Regional/State ministries of health** and the **National Renal Societies** (e.g. Nigerian Association of Nephrology). In the teaching and specialist hospitals the program would be domiciled in the **renal department** as **Community preventive nephrology unit.** A hospital committee oversees the activities of the unit.

Funding

As stated earlier, the program shall operate within the existing infrastructure and personnel of the PHC therefore, the financial resource input shall be minimal.

The PHC staff and basic PHC operational requirements remain the responsibilities of the regional ministry of health.

The staff of the Renal unit and the operational requirements remain the responsibility of the teaching /specialist hospitals.

The only new personnel to be trained and employed by the teaching and specialist hospital is the community preventive nephrology practitioner (CPN-P).

The little extra funds that would be required for the program include:

- Funds for the operational activities of the CPN-P at the PHC level.
- Funds for training workshops for PHC staff as outlined above.
- Funds for annual World kidney day (WKD) community sensitization and CKD screening exercise.

Annual Reports

As with US-KEEP program the activities of the program shall be evaluated annually and annual reports issued. The data generated annually shall constitute the data base for CKD/ESRD in the operational area. Such reports shall be forwarded to state Ministries of health for kidney health services planning and policy formulation, as well as to the National Renal society for inclusion into the National renal register.

4. Discussion

The imperative for the introduction and practice of structured Preventive nephrology program in resource poor, low and middle income countries (LMIC) cannot be over emphasized.

In these jurisdictions, the risk factors of CKD and incidence of ESRD is on the increase, but ironically the necessary resources for care of people with ESRD are in severe short supply, expensive and not affordable. Also there is a wide gap in the referral system between the communities where the people reside and the urban area where few facilities for ESRD care is available. Thus patients with CKD risk factors and early CKD, in these jurisdictions, remain undiagnosed and untreated with consequent smouldering progression to advanced stages before seeking help in distant urban areas.

In developed countries of Europe and North America, in spite availability and access to most resources for care and optimal care for patients for CKD and ESRD, the increasing incidence and escalating costs of care had warranted the introduction of CKD/ESRD preventive measures.

Such programs include the National Kidney foundation (NKF), Kidney early detection and early intervention program (KEEP) introduced in US since 2003. This model have been adopted by other developed countries such as Canada, Japan an some Dutch countries [31,32,33]. In these programs patients are recruited from population data bases such as the NHANES I, NHANESS II and the Veteran Affairs populations health data bases. Baseline demographic and kidney related urine and biochemical indices are established. The subjects are then followed up annually for the progression of these indices over time. General lifestyle modification of diet for renal disease and risk factor modification, interventions as well as early CKD interventions are deployed as necessary. Referrals to nephrologists and further intervention data are captured. Similarly, time of commencement of RRT and subsequent outcomes are diligently captured and entered into the registry.

With this the overall progression of the subjects and time course are known for planning and future research. The success for programs of this nature requires a literate, enlightened and IT compliant population. The programs are resident within the catchment population of the participants.

In all of these programs there is a direct link between the CKD source community and the Renal centres, through self-reporting, telephone communications and other IT systems. All patients are captured in a data base/Registry for ease of access of information. Thus such programmes are integrated into the health systems of the countries of operation. The programme guarantees early access to nephrologists.

These types of programs are however not feasible or sustainable in most LMIC countries which are characterized by challenges of low literacy, poor communications, poverty, sociocultural barriers and poor or no electricity.

In some LMIC countries preventive nephrology programs had been introduced in the past but could not be sustained due to lack of sustainability. Most importantly such programmes ran parallel with the National health system.

Examples include the Guatemala FUNDAINER program, the Indian SEEK program, the Jalosco city, Mexico programs [32,33,34]. These programs were funded by some Trusts and other humanitarian funding agencies that could not sustain over a long period of time.

One community based CKD control program that approximates our proposed program was the population

health for CKD and diabetes program in American Indians and Alaskan natives with diabetes. The Indian Health Service (IHS) in collaboration with the Centers for Disease Control (CDC) and Prevention, recently reported a 54% decrease in the incidence of ESRD in diabetic subjects [35]. They focused on Diabetes kidney disease as diabetes is the commonest cause of CKD and ESRD among the Indian and Alaskan populations. This decrease in ESRD incidence was associated with a population health approach to diabetes care based in the community and the primary clinical setting. This category of patients were managed over a long period based on guideline recommended adequate health care, glycaemic control, adequate blood pressure control with ACEI or ARB and statin for dyslipidaemia control.

This experience emphasises the role of community based approach to lifestyle measures and medication adherence to prevention of progression of incidence of CKD and ESRD.

Our proposed program is unique and most appropriate for the LMIC jurisdictions as it will be an integral component of the health systems of the LMIC countries. It is therefore integrated, sustainable, operates at low cost and establishes a direct link between the rural CKD generating communities and the nephrology centres located in urban centres through the activities of the CPN-P. ***This is the long unmet need in Nephrology practice in most LMIC jurisdictions. That is bringing nephrology care to the community level.***

The program will serve as a continuous and sustainable window for the promotion of kidney health, primary prevention of risk factors of kidney diseases, early identification of risk markers, early detection of CKD and early intervention at community level. These activities will translate to long term reduction in the burden of CKD and by extension burden of ESRD in the community.

The Program shall create an efficient renal referral system between the community, the PHC centres and the city based nephrology services, thereby promoting early referral to nephrologist.

It will also provide an authentic community renal data-base which can coalesce into a National renal data base, and renal Registry for planning and policy formulation. Importantly, the mechanism for preventive nephrology service can simultaneously be used for the prevention and control of other non-communicable diseases (NCD's) in the SSA region in line with the WHO NCD control program.

5. Conclusion

LMIC countries have the highest burden of CKD and ESRD but ironically the least prepared to cope with rising epidemic with the highest burden of human suffering and premature death.

In the present state of knowledge and practice, the only viable means of coping with scourge in LMIC countries is in the strategies to reduce the burden of CKD risk factors and CKD through primary prevention, early detection and early intervention (Preventive nephrology).

The unmet need in nephrology practice in most LMIC jurisdiction is the absence of structured and sustainable preventive nephology program. There is lack of nexus between the rural communities and the urban based nephrology centres.

The success of the proposed program is the LMIC governments domestication and ownership of the program for sustainability.

This program has the potential of contributing immensely to the progressive decline in CKD and subsequently ESRD in the LMIC jurisdictions as well as collateral benefit of reduction of the morbidity and mortality of cardiovascular disorders.

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