

## Research Article

# Strategic Framework for Managing Non Communicable Diseases: Preventing Chronic Kidney Disease of Multifactorial Origin (CKDmfo / CKDu) as an Example

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**\*Corresponding author:** Sunil J Wimalawansa, Department of Medicine Endocrinology and Nutrition, Cardio Metabolic Institute, New Jersey, U.S.A**Received:** September 11, 2015; **Accepted:** December 30, 2015; **Published:** December 31, 2015**Abstract**

The incidence of non-communicable diseases is escalating worldwide, especially in developing countries. Meanwhile, the incidence of communicable diseases such as infectious and diarrheal diseases (except parasitic) has plateaued or decreased. Nevertheless, health departments in most countries do not have proactive, effective strategic plans for combating non-communicable diseases. Departments of health and the public sector organizations are challenged with escalating incidence of chronic diseases. Consequently, the increasing associated costs are not-matched by the available limited resources. Many health ministries and departments continue to maintain the failing, expensive, compartmentalized structures that are cost-prohibitive in controlling individual diseases. In general, these uncoordinated and fragmented approaches are inefficient, expensive, unproductive, and unsustainable. Further, most of the public health-sector groups, hospitals, health ministries and departments do not impose targets or implement performance improvement steps at individuals or organizational levels. In addition, because of the lack of accountability reference to expected outcomes and deliverables, administrations undertake no responsibility for the tasks. These lack of accountability and leadership qualities seriously affecting the credibility of the health ministries and other health-related organizations in many countries. These reduce the likelihood that chronic diseases are curbed. This article proposes a simple, seven-phase, step-wise approach for developing a country-specific strategic framework for the health ministries and departments of health. These can be easily adapt for combating, escalating incidences of any chronic disease. The index health crisis used in the discussion here is chronic kidney disease of multi-factorial origin, a deadly, pandemic disease, killing more than 5,000 rural farmers annually in Sri Lanka, and more in other equatorial countries.

**Keywords:** CKDmfo; Obesity; Diabetes; Economics; Environment; Quality of care; Premature deaths

**Abbreviations**

NCD - Noncommunicable Diseases; NCP - North Central Province; CKDmfo - Chronic Kidney Disease of Multi Factorial Origin; CKDua - Chronic Kidney Disease of Uncertain Etiology; GIS - Geographic Information System; WHO - World Health Organization

**Introduction**

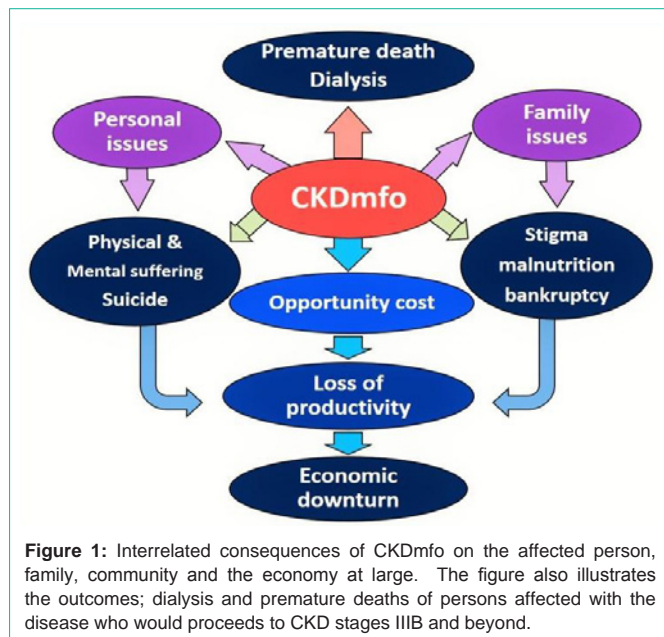
The incidences of chronic, Noncommunicable Diseases (NCDs) are escalating, particularly in developing countries [1], whereas those of common, infectious-based communicable diseases are decreasing. Noncommunicable diseases are increasing at an alarming rate, especially among economically deprived communities [2]. Yet most can be controlled by taking proactive, cost-effective steps and adopting methods that have been implemented successfully in countries [3].

Health care is a basic human right not a privilege. It should not depend on skin color, ethnic origin, having a credit card, the ability

to pay, or where one lives. Each country needs an effective health care system that is capable of providing for the needs of all its inhabitants [4]. In most countries, the health care delivery system is fragmented and needs revitalizing. This can be achieved through administrative changes, including the reallocation of funds from acute hospital medicine to nationwide preventive medicine and changing the way physicians practice medicine.

Worldwide, chronic diseases are responsible for approximately 70% of deaths; in the United States, almost 2.0 million people die of chronic disease each year. Death tolls are significantly higher in developing countries. Nations with emerging economies urgently need comparative effectiveness research that leads to solutions for early diagnosis and successful interventions. The next hurdle will be to provide this valuable information in a publicly accessible, and cost-effective manner.

Reducing surgical site infections has been achieved with simple measures, such as hand washing, and technology, including



redesigning operating theaters to have no-touch lighting, which have improved patient safety and reduced morbidity and costs [5-8]. All other preventative care steps must be looked at systematically in every medical discipline and incorporated as routine practices. This article outlines a strategic framework that can be adapted for the management of most chronic diseases worldwide. To illustrate this strategy, the author uses chronic kidney disease of multi factorial origin (CKDmfo) [9,10], also known as chronic kidney disease of uncertain etiology (CKDu or CKDuo), as an example.

### Chronic kidney disease of multi factorial origin in Sri Lanka

Latest among all NCDs in Sri Lanka is the Chronic Kidney Disease of Multi Factorial Origin (CKDmfo), also known as CKD of uncertain etiology (CKDu); it is the most rapidly escalating diseases in the country [11,12]. This deadly disease predominantly affects middle-age male farmers in the main rice-growing region in the country, the North Central Province (NCP) [13]. The incidence of the disease is doubling every 4-5 years [12,14]. As with environmentally induced chronic diseases in other agricultural societies, CKDmfo in Sri Lanka primarily affects people of low socioeconomic status (poverty is common across all affected communities), mostly male farmers who are exposed to this adverse environment, in rural communities with less access to clean water or modern amenities [9,12,15,16]. Figure 1 illustrates the multiple consequences of having CKDmfo.

This deadly renal disease is not unique to Sri Lanka but is also present in several other equatorial (tropical) countries in the world, including several Central American nations, Bangladesh, China, India, and the Balkan region in Southern Europe [9,10]. Ironically, all of the affected countries currently spend approximately 90% of their health budget on the “treating” the diseases; less than 3.8% of their GDP is spent on health care. Sri Lanka is no exception. For example, with reference to CKDmfo, the Sri Lankan health ministry spends more than 94% of the budget allocated for CKDmfo/CKDu on dialysis and associated costs. Thus, the most important aspect, the

“prevention of diseases”, is underfunded and neglected. Meanwhile, the cost of acute care continues to surge because little or nothing is being done to prevent the disease [9,12].

Consequently, the prevalence of CKDmfo is escalating. The cost of treatment consumes most of the governmental funds allocated for the disease, which represent approximately 4.4% of the annual health care budget in Sri Lanka. This approach of focusing primarily on the treatment aspects of CKDmfo, devoting most of the funds to expand dialysis and renal transplant facilities and building renal hospitals, is similar to tinkering to save a sinking ship and is a major policy error in public health [17].

### Negative impact of failure of policies

Similar policy-level errors are made by the health authorities in most countries. The key error is the disproportionate funding allotted to managing acute, hospital-base medicine and neglecting the preventive care. No matter how much is spent on acute medical care, it would not decrease the incidence of chronic diseases or disease burdens. Imbalanced funding will not prevent healthy people from acquiring diseases or improve the overall health outcomes of those with the disease [14,18,19]. If the goal is to prevent and eradicate a disease, the emphasis and resource allocation must be shift from treatment to the prevention; e.g., prevention of CKDmfo. In the absence of this, thousands of otherwise healthy young people will succumb to this preventable disease.

From extensive travels to developing countries, in particular the CKDmfo-affected regions in Sri Lanka, the author estimates that approximately half of the population has one or more of the common chronic conditions; this finding is similar to a previous observation by Ward and Schiller in other countries [17,20]. To control the escalating incidences of chronic disorders, it is essential to develop a coordinated approach to make the prevention and treatment efforts cost effective [21-23], which would lead to curtailing the disease burden, improving outcomes, and decreasing costs [20,24]. Separating prevention and treatment into isolated areas of focus for funding that are handled by different departments is a fundamental mistake in health policy that not only makes efforts ineffective but also costly.

### Right resource allocation and accountability are the cornerstones of successful disease control

The current efforts and resource allocation for prevention versus treatment do not aid disease prevention. Overall, the “minimum” needed to be spent on preventive health care to have a meaningful, improved outcomes is approximately 20% of the total health care budget. However, no country in Asia does that yet. This leads to annual increases in the costs of health care and the disease burden, including the need for expansion of the number of hospital beds, while having lack of productivity.

Therefore, the pressure continues to build for expanding healthcare facilities to deal with increasing numbers of people with various chronic disorders [4]. These measures include increasing the number of beds and building new hospitals and, in the case of CKDmfo renal dialysis facilities. Yet, only a small proportion of those who needed dialysis is taken care of. These escalating needs and costs are unsustainable, but implementing disease prevention strategies would prevent this.

For example, in 2015, Sri Lanka had a total of 245 dialysis machines (187 in the government sector and 58 in the private sector), and 13 nephrologists for a population of 21 million. Clearly this is insufficient for the more than 50,000 people with end-stage renal failure in the country. Nevertheless, the decision by the Department of Health to increase dialysis machines in the public sector to 1,000 (an increase of more than 5-fold in a year) in 2016, in the absence of safe infrastructure and not having (or planned to have) adequate number of trained dialysis nurses to operate this vital service is far fetched. Irrespective of whether this action is driven by public pressure, politics or commissions, the consequent negative outcomes of this poorly thought plan can be avoided by properly designed initiative, benefiting the persons with CKDmfo.

Importation of dialysis machines is important but should be done gradually, allowing time to train adequate number of dialysis nurses specialist, build the necessary infrastructure, and optimize the supply-chain management. Many of these existing (expensive) dialysis units run only one or two shifts a day, instead of using three shifts a day. If that single change were made, the country's capacity for dialysis could virtually double overnight [25]. Expansion of dialysis centers are essential to accommodate increasing number of people with end-stage renal failure, who are requiring renal dialysis). However, dialysis, transplant centers, or creating new renal hospitals (whether from donations or taxpayer funds) will not "prevent" the disease. Importation of previously used, malfunctioning dialysis units is also not an inferior solution. However, implementation of an effective preventative measures and long-term eradication programs would markedly reduce the risk of CKDmfo, eliminating the need for constructing, expensive renal hospitals [26].

If a country opted to allocate more than 20% (ideally around 30%) of its health care budget to disease prevention, the need to expand acute healthcare facilities would cease. In fact, when people maintain their health, the requirement for hospital beds decreases, so the costs of acute and short-term healthcare decrease. If more resources are (re)allocated to preventing a disease (i.e., shifting resources from acute health care to preventive medicine), the acute healthcare related to the needs of such a chronic emergency lessens. By focusing on prevention, funds can be reallocated appropriately, and efforts can be linked to implementing chronic disease self-management programs and region wide disease surveillance, prevention, and wellness programs [27]. However, it is necessary to estimate and document the cost savings (including the opportunity costs) from such intensive intervention programs in the region, so that the funds can be appropriately and proactively reallocated.

Meanwhile, culturally acceptable guidelines need to be established and incorporated into the chronic disease management programs in a given country. Such guidelines should include appropriate measures for educating medical, pharmacy, and nursing students, all healthcare workers, and persons working with health-related volunteer organizations on providing unified, practical, proactive, and cost-effective steps in disease prevention and treating patients with multiple chronic conditions, using broader approaches [28,29]. If the departments of health adopt these principles, there is no reason for continuing the expansion of acute care centers and hospitals, dialysis centers and such, because the disease burden will decrease markedly with time.

### **Prevention-clear understanding is necessary**

Prevention encompasses several key components. The first is primary prevention, which is controlling modifiable risk factors for the decrease, to prevent increasing incidence. The next component is secondary prevention, which includes early detection before clinical symptoms appear or manifestation of the disease. Tertiary prevention encompasses control of existing disease (s), with the intention of preventing additional complications. Part of palliative care overlaps with preventive care with reference to the tertiary prevention of complications [30,31]. Most of these prevention-focused actions that are needed can be categorized as (A) clinical preventive services or (B) community-based preventative services [32].

Institutional-based clinical preventive services should include various types of counseling and carrying out regular clinical examinations, blood tests, and imaging studies to screen with the view of identifying those with the disease at an early stages [32]. However, community-based, broader prevention programs are more effective than the hospital-based clinical preventative services because community programs capture groups of vulnerable people and larger communities and thus are a more cost-effective in preventing diseases and harm to people. Clinical preventive services include educating about healthy lifestyles (including reductions in smoking and alcohol use), HIV/AIDs, safe driving (e.g., prevention of texting, taking phone calls, and driving under the influence of alcohol), the prevention of injuries, violence, and accidents, and reducing exposure to harmful environments.

Preventative nutritional intervention is another key area that can be at the clinic or community level. It is a wide-ranging subject that includes development and implementation of policies for food fortification with micro-nutrients, workplace and school safety, banning indoor smoking, correct food labeling, avoidance of deceptive advertising, implementing a clean air and water act, and designing people-friendly green buildings, open-spaces, and parks to facilitate recreation, and encouraging physical activities. Most of these initiatives are geared to modify behavior in a sustainable manner.

### **How and who should be empowered on disease prevention?**

Establishing a strong, educational program and inter-professional health care activities are paramount among medical and other disciplines, including at the undergraduate and postgraduate levels of medical and nursing schools. These measures are needed to develop competence among all graduating health care workers with regard to managing the escalating incidences of multiple chronic conditions. The government needs to set priorities for such programmatic aspects; allocate appropriate funding; continue nursing, pharmacy, and medical education; develop simple, practical, and effective guidelines for healthcare workers and the private sector; and encouraging them to work synergistically for the programs to be successful.

The responsibilities and accountabilities for parasitic/mosquito-borne diseases, such as dengue and malaria, and waterborne diseases, such as CKDmfo, run across several ministries and departments. As a result, no single entity or agency is taking the responsibility and accountability for the prevention programs. In addition, several groups, industries, and individuals have vested financial interests and conflicts of interest, which further hinder the preventive efforts.

Therefore, for a successful prevention program, the implementing entity/authority must be independent of politics and government influences. When the implications of a chronic disease span several ministries and government departments, the most cost-effective way to achieve goals is to create a fully funded, legal entity that is independent of governmental and political influences.

For CKDmfo, the establishment of a focused “CKD-Eradication Authority” or handing over the adequately funded-responsibilities for combating the disease to a dedicated, effective philanthropic organization are the only two clear paths forward for preventing and eradicating the disease. Moreover, better science and research are needed when evaluating program outcomes, including statistical analysis of cost and benefits, so that proper investments can be made to create healthy institutional (schools and workplace) environment to complement individual-based interventions [33].

### **A broader approach is needed to control chronic diseases with escalating incidences**

Chronic diseases with escalating incidences in the NCPregion of Sri Lanka include type 2 diabetes, hypertension, abdominal obesity, chronic lung disease, cancer, and CKDmfo. Except for the latter, these are not that different from the diseases seen in other developing countries. In addition, other important public health problems also need to be tackled systematically, including smoking- and alcohol-related diseases, malnutrition, illegal drug use, the indiscriminate use of pain medications (NSAIDs and prednisilone use), high rate of school dropouts, suicides, and violence, including spousal, child, and sexual abuse and domestic violence.

Proposed solutions to these problems need to be based on root-cause analysis in a given country and carry out in a cost-effective manner. Combining several prevention programs would make it easier to manage and coordinate them, and the efforts would be synergized, leading to better outcomes with fewer resources.

The prevalence of chronic diseases increases with age, and so does the cost of care [34]. Rather than focusing on individual disease entities, which would be cost prohibitive for developing countries, scientists and governments need to identify the underlying root causes of chronic conditions and address them collectively [35]. Such an approach would benefit not only the affected regions (in the case of CKDmfo, the NCP region), but also in the entire country. These approaches would be cost-effective in reducing the healthcare and opportunity expenditures, and minimize the loss of productivity, secondary to chronic diseases, and increase the return on investment.

The descriptions, arguments, model, and strategies presented in this article address the alleviation of CKDmfo, but are equally applicable to most other chronic diseases in the region, country, and the world. The author urges the departments of health in all countries, particularly the preventive health services, to consider incorporating these guidance into the management of all chronic diseases, which would make the programs most cost-effective.

The author puts forward the following series of steps and recommendations for achieving a goal-oriented, positive health care outcomes [36], improving access to and the delivery of healthcare in the region, and preventing common chronic health conditions in a given country. The comments made are aimed at preventing

CKDmfo in Sri Lanka but easily can be adapted for other diseases and countries.

## **Steps Involved in Creation of an Effective Chronic Disease Prevention Program**

### **Process 1: Identify and promote fundamental and meaningful healthcare system changes**

- Identify, support, and conduct goal-oriented research that is applicable to the region and the country: gather data, summarize, and document evidence to support locally appropriate models.
- Identify gaps in knowledge and focus research on obtaining the missing data and information needed to understand the etiological factors and disease progress patterns that would facilitate implementing specific preventative strategies.
- Define appropriate and expected health outcomes and disseminate such information to all stakeholders, including researchers and healthcare workers engage in preventing chronic diseases, such as CKDmfo.
- Prevent new occurrences and the spread of chronic diseases (e.g., CKDmfo, type 2 diabetes, obesity, cancer, etc.) and minimizes the incidences of all chronic non-communicable disease (NCDs).

### **Process 2: Develop region-specific strategies to prevent disease spread**

- Because some chronic diseases are geographically demarcated, focus can be in the relevant sector of the community, village, region, or province, and geared to identify the root cause(s).
- Build effective media and delivery networks for education and awareness and to improve healthcare delivery. In the case of CKDmfo, make the provision of clean water and sanitation a priority.
- Develop and implement a region wide, real-time geographic information system (GIS) that maps patients with the disease entity (e.g., CKDmfo) with others strongly associated variables (in the case of CKDmfo, the locations of those with the disease and deaths due to the disease, with water quality-mapping sources of clean water and contaminated water sources). The system should be dynamic, robust, real-time and made available to anyone who is interested through “the cloud,” preferably using non-proprietary software for easy access of the public. Dynamic and interactive sites would allow constant updates and improvements with multiple complementary data sets and easy access with the least cost.
- Establish real-time data gathering mechanisms-effective and active surveillance programs.
- Implement operative, region-wide health and pollution prevention and environmental protection programs, while strictly enforcing environmental laws, countrywide.
- Identify and apply practical and cost-effective technologies for carrying out the aforementioned strategies, leveraging locally available manpower and material resources in a sustainable manner.

### **Process 3: Develop nationwide strategies to prevent diseases**

- When the NCD is affecting the entire country, one needs to take a much broader approach and nationwide preventive measures.

- Develop knowledge-based broader guidelines for early disease identification and containment within the traditional geographical boundaries.

- Develop a specific point of testing laboratory tests, clinical algorithms, and programs for early identification of persons with the disease. To develop timely and effective interventions aimed to revert renal functions back to normal in those affected with the disease. The goal is early identification and early innervation geared to reverse the disease process; CKDmfo is a classic example of this.

- Monitor disease progression and screen individuals for targeted disease. For CKDmfo, the goal is to detect the disease as early as possible, prior to the occurrence of renal damage (i.e., before the disease is progressing beyond stage 3), and implement focused and effective medico-social programs, including the provision of clean water, nutrition, and renal-protective basic medications with the intention of reversing the harm and curing the disease.

- Implement a sustainable, nationwide, education-based interventional plan to improve nutrition and physical and psychological health, and environmental protection.

- Enhance public-private partnerships and target cost-effective use of resources and leveraging the existing resources to improve outcomes.

- Create and manage broad, multidisciplinary and multidepartmental strategies for combating chronic diseases without segmenting by disease states (i.e., avoid compartmentalization).

- Implement a performance and outcome measurement systems for chronic diseases and make relevant legislatures to make the government officials accountable for the expected performances.

- Make ministers, ministry officials, and department heads accountable for achieving intended outcomes and milestones.

#### **Process 4: Coordinate and implement disaster preparation and disease-specific measures and enhance appropriate support services**

- Provide basic human needs to everyone in the affected regions (e.g., in the case of CKDmfo, provide clean water at an affordable cost in an environmentally and economically sustainable manner). This should be provided not only for affected villages, but also surrounding and other vulnerable villages, with the aim of curbing the spread of the disease and improving the quality of lives.

- Educate the public on proper sanitary habits and provide adequate, safe, sanitary facilities and safe disposal of waste in homes, industries, and in public places.

- Allocate and fund a long-term program to improve water quality and sanitary infrastructure, including the provision of a network of pipes (central water purification facilities, overhead tanks, etc.) to each house in the region and the entire country, supplying centrally purified, pipe-borne water to all inhabitants.

- Assure continuation of adequate social support (e.g., nutrition and education of children) for families in which the breadwinner has CKDmfo or has died of the disease or sick.

- Eradicate malnutrition, especially targeting pregnant

women, infants, and children.

- Exceed the millennium goals for immunizations for all communicable diseases across the country.

- Improve the infrastructure of all local healthcare facilities with regard to screening, diagnosis, and treatment of the index disease - CKDmfo and/or other NCDs.

#### **Process 5: Public health education and pollution prevention**

- Develop effective educational programs on the prevention of air, soil, and water pollution.

- Enhance basic preventative health care, including more than 95% coverage for immunizations.

- In the case of mosquito-borne disease, such as dengue, Japanese encephalitis, malaria and filariasis, concentrate on tight mosquito control, eliminating the primary root-cause (i.e., breeding sites), rather than concentrating on secondary interventions.

- Execute existing environmental protection laws without excuses and exceptions.

- Provide medium-term economic and other logistical assistance to financially deprived CKDmfo-affected families.

- Provide effective counseling for all families that are directly or indirectly affected by specific disease(s).

- Achieve appropriate and sustainable population control via health education, focusing on health and nutrition, development, and longevity, rather than the number of children.

- Develop and expand an evidence-based, community education on disease prevention, and wellness program in each village cluster, leveraging private-public partnerships.

- In parallel, seek improvement in countrywide healthcare education and healthy diets, and encourage people to rely on home-cooked food, avoid processed food (that contains preservatives and excess salt and calories), and enhance their physical activities.

- Set up a region wide, CKDmfo surveillance program for early identification of changing disease patterns/spread, which would enable taking timely, proactive steps to prevent the disease spread into other regions.

#### **Process 6: Empower at the individual level**

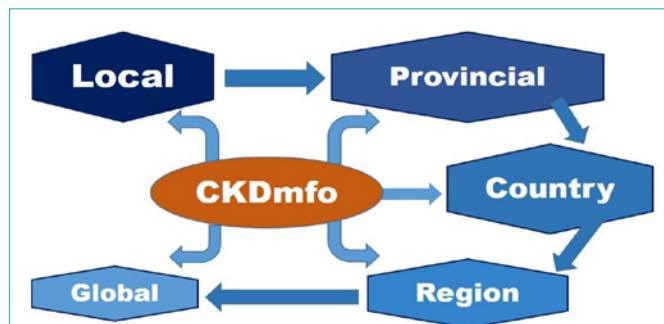
- Identify best practices and effective tools for disseminating educational and practical information to lay people and healthcare workers.

- Enhance professional educational training and networking with continual updates on changing disease patterns and situations.

- Combat chronic disorders using resources cost-effectively and developing, strengthening, and leveraging private-public partnerships.

- Develop opportunities to improve individuals and patient safety; a key contributor to quality of care.

- Develop simple and practical guidelines and provide them to all healthcare workers in the region or the country as appropriate,



**Figure 2:** The impact of escalating chronic diseases, such as CKDmfo on the local, provincial, national, and regional level. Although the negative socioeconomic impacts somewhat decrease when one moves out of the affected area, depending on the root cause(s) and because of the devastating effects on the economy, there can be serious long-term consequences, not only for individual persons and family units but also for the entire country.

enabling them to take leadership, addressing problems, and working toward eliminating the targeted NCDs.

#### **Process 7: Enhance and support research, focusing on the prevention of chronic diseases, such as CKDmfo**

- Determine research priorities and allocate funds to patient-centered, preventative research programs.
- Assess and implement novel, effective, simple methods for combating multiple chronic comorbidities.
- Providing affordable and safe water in a cost-effective and scalable manner to prevent acute or chronic disaster situations to control diseases; following disasters, such as CKDmfo, flooding, etc. (e.g., availability and the use of portable membrane-based water purification methods, such as reverse osmosis)
- In addition to real-time surveillance, establish a large-scale, region wide, multi-disciplinary, longer-term, pragmatic study that is focused on finding the root-cause(s) and the best practices and options for the management of multiple chronic conditions.
- Widely disseminate and implement cost-effective broader models for combating and managing chronic diseases.
- Establish a region wide, long-term, prospective, multidisciplinary, broad clinical study to capture all possible causes and complications.
- Develop common and unified research protocols and compatible data-gathering methods that can be later used for pooling data and for meta-analysis.
- Identify and fund the research with a valid hypothesis that can be tested experimentally that would lead to meaningful outcomes.
- Perform thorough, unbiased evaluation of all research proposals. Such evaluations should be done by an independent, multidisciplinary research committee consisting of senior retired scientists to eliminate inherent bias, personal favors, and conflicts of interests. Each committee must have a bio-statistician capable of evaluating the statistical validity and sample sizes, and ethical approvals must be obtained for all projects before a study is begun.
- Support and conduct studies that have adequate statistical

power (i.e., have mandatory power analysis data) to be carried out in the affected, endemic regions and include vulnerable people and groups, using methods such as stratified or cluster sampling and case-control studies, as appropriate to the study goals, objectives and the design.

- Coordinate all research programs to make them synergistic and assure compatibility, which would allow meaningful and relevant interpretation of outcome data.
- Support and conduct research that is practical and meaningful to the affected communities and addresses disparities and gaps of knowledge, facilitating the improvement in health outcomes.

Carrying out these seven processes would lay a strong foundation for the successful outcome of the intended research project(s) on preventing, curtailing, or eradicating chronic diseases. These processes are not mutually exclusive; certain overlaps are added intentionally added certain overlaps among are designed to minimize systematic errors; such measures are intended to strengthen the progress. Depending on the chronic disease in question, modifications of the strategy can be accomplished rapidly to enhance the effectiveness of the process and outcome. There are several regional- and nation-specific chronic, life-threatening NCDs, such as CKDmfo, that are prominent in local communities in a given province. However, the negative socioeconomic impacts of these chronic diseases go beyond the local areas and affect the entire country and perhaps the region (Figure 2).

#### **CKDmfo research outcome with respect to the seven processes**

In 2009, the Ministry of Health initiated a broader research project that was funded primarily by the National Science Foundation in Sri Lanka, with assistance from the World Health Organization (WHO); the results of that project was published [16]. This collaborative research project investigated the prevalence and etiology of the disease, with the goal of recommending certain preventative strategies [16]. This study contributed some knowledge [16], but for many reasons, it failed to identify a definitive causative factor, and some of the subsidiary studies were not completed; thus not reported.

Because of the sub-optimal study designs, statistical methods used (e.g., non-use of statistical power analysis, etc.) and sampling methods, and incorrect assumptions made in some of the independent studies [13], the validity of generated data are questionable [10]. Moreover, most of the independent studies were compartmentalized and still unpublished; thus, in spite of the time, efforts and public funds used, have added little value to the broader project. In addition to the lack of transparency, accountability, and other reasons for non-conclusions include, incoherent research components, refusal to share data or make them available to scientists and the public, and lack of collaboration between projects, co-investigators and scientists [9,10,37].

In future multidisciplinary studies, such major drawbacks must be overcome at the study design stage. In addition to being multidisciplinary, such studies must be monitored by an independent scientific data safety Data Safety Monitoring Board (DSMB) and guided by the above seven principles to assure successful outcomes.

### “An ounce of prevention is worth a pound of cure”

When a disease such as CKDmfo is affecting a specific geographical region, such as the NCP, and/or a specific social or economic segment of a country (i.e., farmers), it is essential to focus on group(s) of people who are at risk. This would allow the use of fewer study participants with meaningful outcomes. In addition, exploring and collecting data about the socioeconomic backgrounds of participants are essential to understanding the reasons for predisposition of certain people to diseases and what social and cultural dimensions and personal habits and/or etiologies would contribute to or protect them from newly contracting the disease.

These findings are important in constructing a dynamic and effective action plan for preventing diseases. In addition, for a public health-oriented program to be successful, it must be community focused, have appropriate sampling methods (e.g., use methods such as systematic and cluster sampling) and multi-disciplinary, allowing complete access to and open exchange of data. Isolated research programs that do not relate to the big picture or follow the seven processes are unlikely to generate useful data for disease prevention.

### Cost containment during increased demand for services

Both public and private health organizations are faced with the dilemma of escalating costs of care. This can be balanced with improving efficiencies and implementing preventative approaches, rather than cutting the quality of services. As a result of less-than-adequate funding (on average, 3% of the GDP) for health departments in developing countries, many non-government organizations have stepped up to fill the gap in services left by governmental budgetary decisions. Although many of these organizations have different goals and agendas, they provide varied, valuable, and complementary activities, including poverty alleviation through self-empowerment, education, and job creation.

In addition, they provide basic human needs and acute and preventive healthcare, education, and environmental protection, when governments are lagging behind. In most countries, there is a lack of process improvement in the healthcare sector, despite that healthcare is not that different from any other industries. Such a process should start from the top with management excellence, broader vision and care, and streamlining of administrative and operational processes.

Meanwhile, supporting strategic and efficient utilization of existing resources and assets is an essential part of quality improvement and cost reduction. Moreover, maximizing organizational collaborations are important for operational excellence. Such collaborations encompass research and data collection and analysis, timely and effective dissemination of information. In addition, taking culturally acceptable proactive actions are essential for not only for the effectiveness, but also for the maintenance of improvements. These require honest, committed and sustainable partnerships with all stakeholders.

### Lowering costs and improving outcomes

The increasing prevalence of chronic diseases warrants strategies for controlling the rising costs of health care. Nevertheless, controlling costs presents opportunities for proactive actions, including improving the quality of care. The World population is aging, in part

due to lower birth rates and increased life expectancy. In addition to ageing, in most countries, there is a true increase in the incidence of chronic diseases. The Combination of these factors contributes to escalating health care costs [38,39] and having a major impact on healthcare budgets. Care coordination programs without a strong transitional care component are unlikely to yield net savings [40]. Prevention is a powerful way to reduce costs [41,42], as is sensible palliative care [30,31].

The Departments of Health and public sector organizations are challenged in the face of escalating disease incidence. Nevertheless, the prevention of diseases continues to receive less attention in many countries. Unlike the private sector, which has a periodic performance evaluation of employee, the government sector does not have a meaningful performance evaluation of its employees. Thus, the private sector should inculcate performance improvement disciplines into the public sector, enabling public employees to understand not only expected priorities, but also intended deliverables and the importance of adhering to timelines and outcomes. It is always a challenge to move forward when available resources are perceived to be inadequate for completion of the task. Nevertheless, set goals must be achieved, with lower costs and improved efficiencies that do not endanger services and lives.

### Conclusion

The incidences of many chronic diseases are increasing worldwide, particularly in rural areas in emerging economies. CKDmfo is one such chronic disease; it has been identified in Sri Lanka since the mid-1990s [11,14-16], but no meaningful or effective preventive actions have been taken until recently [9]. A broader, long-term action plan is needed to effectively prevent the disease and eradicate it from the country. If the aforementioned process is followed with detailed, proactive action plans, the author believes that eradication of CKDmfo from Sri Lanka can be achieved within 15 years, at a cost that is 10% of the expenditure required to build one renal hospital in the country. Nevertheless, the lack of longer term vision and politically motivated short term decisions and actions, prevent such.

CKDmfo is an “environmentally acquired occupational disease” [9,14,43]. Previously found only in the NCP, CKDmfo is now spreading outside that province and into distant areas [9,13,15,16,44]. This is a condition for which the seven processes described can be applied effectively applied to prevent and eventually eradicate the disease from the country [41]. Political willpower, commitment, focused attention, the gathering of necessary resources (funds, data, plans, and expertise), and working together, can eradicate this deadly disease. Because of the increasing demands and the number of patients, treatments should be improved and expanded. However, prevention is the only way forward in eliminating this deadly disease from the region and the country.

Not only the quantity, but also the quality of care is important to all clinicians and patients. Self and institutional audits, practice and process improvements, feedback and redesign, and individual assessments and group education sessions all lead to patient satisfaction, minimizing medical errors, decreasing hospital length of stay and acquired infections, and overall improvement in the quality of care.

There are six additional important changes that are needed for major, cost-effective improvements in healthcare. These are (A) recognition of primary care (PSPs) and family practices as the main source of healthcare delivery, (B) develop an easy and sustainable means to keep the medical knowledge of GPs up to date, (C) re-establishment of the referral-based healthcare, with adherence to the important practice of patient referrals to specialists by primary care physicians [general practitioners, (GPs), internists, and family physicians] (D) development (or enhancement) of a mid-level practitioner group (similar to nurse practitioners or physician assistants) for the delivery of primary care (e.g., type 2 diabetes), (E) create a new category of liaison group, “community healthcare workers” to take care of patients in the community, and (F) enhancement of the preventive health and public health sectors.

These would not only markedly improve the quality of the health care sector and the delivery of care, but also improve patient access to the appropriate physician grade and specialists, eliminate inappropriate specialist consultations and thus, the associated costs, and improving the standard of care significantly. A win-win situation for all stakeholders. This is one of the most practical and cost-effective way to assure the quality of care, improve overall health outcomes, and reduce healthcare costs within a short period.

## Conflicts of Interest

The author, professor of medicine, endocrinology and nutrition, has no conflicts of interest. This work is not funded by any entity.

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