Focus Area 3 : Health

Introduction

Sri Lanka boasts an outlier status compared to countries of comparable economic development in respect of the important health indicators such as life expectancy at birth, maternal mortality rate, infant and pre-school mortality rates. We are well above other countries of the South Asian region. This is despite a relatively low per capita expenditure on health, even below the minimum recommended by the WHO. This pattern of adult morbidity and mortality do not leave room for complacency. Due to increased life expectancy there is significant change in our demography with a rapidly increasing proportion of elderly. This coupled with the nutritional transition from traditional diet to a more refined, sugar and animal fat rich diet, with reduction of physical activity at both work and leisure and increased consumption of alcohol and tobacco has led to an increase in non-communicable diseases such as obesity, diabetes, metabolic syndrome, ischemic heart disease, cerebrovascular diseases, chronic kidney disease, chronic obstructive respiratory disease and cancer in epidemic proportions. In spite of the rising prevalence of obesity amongst all social classes, under nutrition has not been eliminated. Energy protein malnutrition in childhood and iron deficiency anemia in all age groups continue to be significant public health problems.

Although most vaccine preventable diseases have been almost eliminated newly emergent infections such as Dengue pose a major threat to health and life. Though malaria and polio are under control at present eternal vigilance is needed, especially in view of our close proximity to the Indian sub-continent, to prevent their re-emergence. The same can be said of our present low rates for HIV infection. The widening network of motorable roads and even more rapidly increasing number of motor vehicles has resulted in rapid increase in road traffic accidents as a major cause of morbidity and mortality. Though the incidence of rabies has declined the number of stray dog bites requiring prophylactic post exposure vaccination are large thus incurring huge costs. Snake bites continue to be an important cause of mortality among the rural population. The most distressing new entity affecting the rural agricultural population in some parts of the country is Chronic Kidney Disease of unknown aetiology (CKDu). There is a strongly dissenting view point which claims that no specific link to an agro –chemical has yet been made. All these health problems have resulted in a rapid escalation of health care expenditure which is being met in roughly equal proportions by the state and out of pocket expenditure by the public. While the state accounts for a major part of the inpatient care costs, the out of pocket expenditure by the public accounts for a major portion of the outpatient care costs. This pattern however is changing with more and more of the middle and upper classes seeking inpatient care in the private sector where a highly cost intensive model of health care is being delivered with very little regulation.

We have a rich tradition of indigenous knowledge for health which has not been adequately exploited. We need to leap-frog into the future and be competitive by identifying technologies that are most appropriate for our needs. We have presented the technologies that need to be introduced and strengthened for the desired outcomes.

We have also identified certain catalytic activities that are likely to have multiplier effects in generating new research funding in areas of relevance and importance to Sri Lanka. These are strategic investments in research infrastructure and systems that will greatly strengthen the health research capability of the country by enabling Sri Lankan scientists to access hitherto untapped sources of funding from developed country research funding agencies which fund research for global health needs.

Sub Areas, Issues and Relevant Interventions

Table 1: Sub Areas and Justifications

Sub Areas	Justifications
1) Reliable, affordable and equitable healthcare	Addresses equity and access to healthcare across systems
2) Prevention Control and Management of Non Communicable Diseases	High burden of NCD in the country and need for alternative therapeutic and preventive modalities which are affordable
3) Improved Utilization of IT in Health care	Addresses the use of mathematical modeling and risk mapping in planning and decision making
4) Public health innovation for improving nutritional status	Malnutrition in Infants and Young Children up to 3 years Childhood malnutrition in rural and estate sector
5) Local & export market for indigenous medicine	Use of indigenous knowledge and herbal resources to develop new drugs of quality
6) Prevention ,Control and Management of Vector Borne Diseases	Use novel technologies in vector control, understanding disease transmission and pathogenesis and drug development
7) Control of Common Tropical Diseases	The establishment of GMP certified antibody production plant for the first time in Sri Lanka and this can be applied to any of the future needs in infectious diseases.
8) Utilizing Modern Technology for Health promotion and Community empowerment in Health	New technologies for dissemination of health information eg mobile platforms Innovative social technologies for health promotion and community empowerment eg in resisting tobacco& alcohol
9) Enhanced R&D activities on Genomics	Lack of a National Genome Centre with a National Genome Data Repository
10) Develop facilities for Stem Cell research and Regenerative Medicine	It's a therapeutic modality worth exploring for previously incurable conditions. Addresses the needs of a rapidly ageing population.
11) Seed funding for National Health Cohort studies	Health changes over a long time in developing countries undergoing demographic, epidemiological and nutritional transition have not been adequately studied. They will provide data for long-term health planning.
12) Research for better understanding of Sri Lanka`s exceptional achievements in health.	SL was and remains a global health outlier but our achievements are largely unknown or unappreciated in the global community, and not well understood even in SL

Table 2: Issues/Problems, R&D Needs and Relevant Interventions

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
1) Reliable, affordable and equitable healthcare	I) Need for national health systems research center which could also function as a health observatory to monitor equity and access. II) Address equity across systems	i) A fully equipped and adequately resourced Health systems research center cum health observatory ii) Research to improved equity and access to health care across systems	**Innovations** a) Establishing a National Health Systems Research Centre cum Health Observatory. b) Identifying priorities for study eg palliative care for terminally ill Monitoring access and equity related data c) Study the feasibility of providing integrated 'western' and ayurvedic care in a carefully selected list of conditions in which such potential is identified.
2) Prevention Control and Management of Non Communicable Diseases	I) Ageing population High disease burden from chronic NCDs and escalating costs of treatments II) High burden of CKDu amongst farmers in NCP. III) High disease burden due to cancer. IV) Need for accurate epidemiological data on cancer V) High morbidity and mortality due to oral cancer VI) Role of HPV in oral and	i) Making available low cost Devices, Diagnostics, Drugs and Complementary medicines ii) Low cost population screening and surveillance tool iii) Evaluate ayurvedic/herbal therapies for CKDu iv) A web based national cancer registry in to which all stakeholders upload data. v) Develop feasible model for early detection of oral pre-cancer vi) Identify prognostic indicators of oral cancer	**Innovations** a) Development of low cost devices for weight reduction, home based oxygen delivery, diabetic foot care, wound healing devices, devices for bronchial asthma, self-operated infusion devices for iron chelating thalassemia, appliances for the elderly/disabled b) Development of low cost diagnostics glucometers, simple population screening diagnostic tools for NCDs sleep study diagnostics c) Establishing a central mechanism for developing, validating and marketing such devices Develop a urinary biomarker for CKDu

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	cervical cancer	vii) Develop herbal preventive agents/ therapies for oral cancer viii) Serotyping high risk groups for HPV	**Indigenous Knowledge & Intellectual Property Right** a) Identify ayurvedic/ herbal recipes with potential and further develop them and progress to clinical trials Establishing a web based National Cancer Registry b) Development of topical anti-oxidant preparations from herbal ingredients for the prevention of oral and pharyngeal cancers
			Popularization a) Identifying molecular markers Validating model /marker in high risk populations. b) Studying cost benefit of HPV vaccine in high risk groups
3) Improved Utilization of IT in Health care	I) Methods to better understand disease epidemics should include data from a range of sources (e.g. spatial data) and novel methods of analyses	i) Improved IT in health sector	**Pure and Applied Research** Development of mathematical models
			Information and Communication Technologies a) Satellite images b) Risk mapping
4) Public health innovation for improving nutritional status	I) Poor complementary feeding in infants and young children up to 3 years II) Lack of information on Childhood malnutrition in rural and estate sector	i) Development of low cost complementary food for infants and young children ii) Use of mobile technology to improve Infant and young Child Feeding practices	**Innovation** Development of low cost complementary food for infants above 6 months and developing a social marketing mechanism for same
			Information and Communication Technologies Establishing a mobile phone platform for advising Infant and Young Child Feeding practices

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
5) Local & export market for indigenous medicine	I) Developing ayurvedic drugs of high quality II) Developing infrastructure for standardization and quality testing of ayurvedic /herbal medicines III) Cultivation and use of herbal materials through direct contacts between farmers and manufactures	i) Improved Ayurveda Medicine based healthcare system for Sri Lankans (Note: Ayurveda shall mean Ayurveda, Sidda, Unani and Deshiya Chikithsa systems)	**Testing, Standardization & Accreditation** a) Validation of drugs/Drug regime as per prioritized schedule b) Standardization of raw materials and drugs c) Setting up testing facilities for herbal drugs
			Popularization Popularization and active intervention in the cultivation of herbal plants in suitable agro-climate zones.
	IV) Exploiting the full potential of indigenous knowledge for better health	ii) Further research into indigenous medicine, especially Deshiya Chikithsa, using texts and oral traditions prevalent in the country (hitherto untapped)	**Indigenous Knowledge & Intellectual Property Right** Research into ancient texts and oral traditions in the country in order to identify or recognize other forms of treatment.
	V) Lack of a credible regulatory mechanism for ayurvedic/herbal medicines meant for export		**Policy Studies** Develop the relevant policies and establish a credible regulatory body for ayurvedic/herbal medicines
	VI) Use of indigenous knowledge in medicine for income generation	iii) Promote medical tourism in the sector (Indigenous Medicine based treatment systems for foreign tourists and visitors)	**Testing, Standardization & Accreditation** Validation and Standardization of services (Physical environment of service providing Institutes, HR and other facilities)

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	VII) Use of indigenous knowledge blend with novel technology	iv) Clinical herbal product development	**Innovation** Reverse pharmacological approach and identified effective herbal medicines
			Pure and Applied Research Herbal clinical product development through clinical research - crude form, fractional form and single molecular level
		v) Update and validate the current Ayurveda pharmacopeia	**Testing, Standardization & Accreditation** a) Authentication of herbs , minerals and other ingredients in formulas of current Ayurveda pharmacopeia b) Develop standards for finished products c) Include possible adverse reactions or any other complications
	VIII) High burden of NCD in the country and need for alternative therapeutic modalities	vi) Identifying candidate herbal recipes for DM treatment and transforming it to modern dosage form	
	IX) Development of the methodologies that considerably shorten drug discovery process using reverse chemical biology.	vii) Functional protein microarray technology in herbal drug research	**Innovation** Development of target specific isolation techniques to isolate and characterize biologically active therapeutic molecules from Ayurveda herbal extracts which are toxicity and time tested, and clinically verified.

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	X) Preparation of comprehensive national level database for the country	viii) Molecular level to pharmacopeia level development of comprehensive electronic databases for indigenous medicine.	**Information and Communication Technologies** With the help of the Dept. of National Archive, preserving the traditional medicinal knowledge as databases using high performance server facility.
6) Prevention ,Control and Management of Vector Borne Diseases	I) Use novel technologies in vector control, understanding disease transmission and pathogenesis and drug development	i) Vector control	**Innovation** a) Larval control using innovative methods (e.g. nanotechnology, biotechnology, biological control) b) Use of new and existing techniques to understand vector biology in order to understand transmission dynamics of VBDs and to coordinate these activities by a dedicated centre/institute
		ii) Diagnostics	**Innovation** a) Develop novel, rapid, easy- to- use, diagnostic methods (e.g. saliva based tests, dip-stick tests, finger-prick methods) for diagnosis of leishmaniasis, WNV, JEV, Malaria, b) Immunoassays: To identify biomarkers or prognostic markers for VBDs
		iii) Mapping transmission patterns of VBDs for early intervention during epidemics and better control	**Pure and Applied Research** Research on immunoepidemiology of dengue infections in order to understand dengue transmission dynamics and immune correlates of protection in implementing dengue vaccines

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
			Information and Communication Technologies Use of GIS technology for understanding environmental factors contributing to VBD transmission
		iv) Drug development	**Nanotechnology** Drug development using Nano-technology
			Innovation Understanding the pathogenesis of common VBDs such as dengue, leishmaniasis, JE so that already existing drugs could be used in the treatment of these diseases (e.g. many existing drugs that are used for other diseases can be effectively utilized for treatment of dengue if we can determine the mediators that cause severe disease, liver injury etc...)
7) Control of Common Tropical Diseases	I) The establishment of GMP certified antibody production plant for the first time in Sri Lanka and	i) Development of vaccine candidates, monoclonal antibodies, peptides and protein therapeutics.	**Pure and Applied Research** Production of high quality dengue specific monoclonal antibodies and virology reagents for research and diagnostics.

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
	this can be applied to any of the future needs in infectious diseases. `		**Innovation** a) Development and of vaccine candidates for rabies b) Production of monoclonal antibodies for snake venum. c) Improvement of currently clinically failed vaccines (e.g. malaria) using a newly established proteomics technique
		ii) Development of contact lenses disinfection system.	**Innovation** One-pot neutralization technique for hydrogen peroxide based disinfection.
8) Utilizing Modern Technology for Health promotion and Community empowerment in Health	I) Innovative social technologies for health promotion and community empowerment using IT as needed	i) New technologies for dissemination of health information ii) Study social technology, ,potential for scaling up and cost-benefit of community based health promotion interventions for a variety of problems	**Information and Communication Technologies** Mobile phone based health information platform to disseminate health information
			Pure and Applied Research Study the interventions for following Tobacco use ,Reducing underweight in young children, Reversing obesity Minimizing alcohol induced aggressive behavior, Improving school performance

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
9) Enhanced R&D activities on Genomics	I) Need for regulation of the ethical aspects of bio-medical research II) Need for comprehensive genetic testing and a central facility for Sri Lankan scientists to us. for both service and research	i) Need for a bio-ethics regulatory framework at national level. ii) Establishment of a fully equipped National Genome Centre with a National Genome Data Repository	**Policy Studies** Establishment of a National Bio-ethics Authority with wide ranging regulatory powers.
			Biotechnology Establishment of a fully equipped National Genome center
	III) Need for a central repository to obtain information about genetic variations of Sri Lankans when planning research.		**Information and Communication Technologies** Establishment of a National Genome Data Repository
	IV) Enabling equitable access to the facilities to all Sri Lankan scientists.		**Policy Studies** Establishment of a Governing Mechanism and Policies for accessing the National Genome Centre and the National Genome Data Repository.
			Pure and Applied Research Conducting a comprehensive study to map the genetic diversity of the Sri Lankan population.
	V) Reduce unnecessary expenditure on import of drugs that are harmful and/or ineffective for Sri Lankans because of their unique genetic makeup.	iii) Incorporation of the pharmaco genomic profile of Sri Lankans in the regulatory approval process for medicinal drugs used in Sri Lanka and facilitate the availability of pharmacogenomic testing in Sri Lanka.	**Information and Communication Technologies** Cataloguing the prevalence of pharmaco genomically important genetic variations in the Sri Lankan population

Sub Areas	Issues/Problems	Research and Development Needs	Relevant Interventions
10) Develop facilities for Regenerative Medicine	I) Aging is a rising problem in Sri Lanka. This reduces the workforce efficiency and affects the country's economic progress.	i) Developing anti-ageing agents using antioxidants	**Innovations** a) Use of antioxidants as potential anti-aging agents targeting mitochondrial dysfunctions and biochemical changes associated with ageing. b) Use of antioxidants as agents preventing mitochondrial DNA damages associated with ageing.
11) Seed funding for National Health Cohort studies	I) Health changes will occur differently in developing countries experiencing demographic and health transitions. They need to be monitored over a long period.	i) Funding to support establishment and recruitment of national cohorts at birth and also in early adult hood and their long-term monitoring.	**Pure and Applied Research** Recruit national cohort at birth and early adult hood and track long term changes in health status, disease and their determinants
12) Research for better understanding of Sri Lanka`s exceptional achievements in health	I) SL was and remains a global health outlier but our achievements are largely unknown or unappreciated in the global community, and not well understood even in SL	i) Fund research that will lead to better understanding and global awareness of Sri Lanka's health miracle, its achievements, explanations, and those that provide lessons to rest of world	**Innovations** Develop a mechanism to award competitive grants for research into this aspect.

***Table 3: Interventions and Key Performance Indicators**

Sub Areas and Issues/ Problems	Interventions/Activities									
	Policy Studies	**Pure & Applied Research**	**Innovation**	**Information and Communication Technologies**	**Nanotechnology**	**Biotechnology**	**Indigenous knowledge & Intellectual Property Rights**	**Testing, standardization & Accreditation**	**Capacity Building**	**Popularization**
1. **Reliable, affordable and equitable healthcare**										
Issue: Need for national health systems research center which could also function as a health observatory to monitor equity and access										
Activity: 1. Establishing a National Health Systems Research Centre cum Health Observatory. Identifying priorities for study eg palliative care for terminally ill Monitoring access and equity related data										
Time Frame (I, S, M)	I	I	S	I					I	S
KPI	No. of polices	No. of research,							PhDs, etc.	
Lead Institute	MoH[1]/IHP	IPS							MoH	

Please note that this is only a sample page

[1] *MoH-Ministry of Health, IHP-Institute for Health Policy, IPS-Institute of Policy Studies*