Facilitating Rational Drug Usage – An Illustrative Example

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Introduction:

"Essential Medicines are those that satisfy the priority health-care needs of the population. They are selected with due regard to disease prevalence, evidence on efficacy, safety and comparative cost-effectiveness. Essential Medicines are intended to be available within the context of functioning health systems at all times in adequate amounts, in the appropriate dosage forms, with assured quality, and at a price the individual and the community can afford." (NRHM, 2002) (WHO, 2011)

Various prescription audits and monitoring and evaluation studies done in India have revealed factors attributing to irrational drug usage as poly-pharmacy, inappropriate prescription (inadequate dosage), over prescription (injections), non-compliance to clinical guidelines, under use of life extending drugs for illness such as hypertension, heath disease, asthma, and other chronic illness, choice of more expensive drugs, prescribing towards placebo, inadequate consultation time, very short dispensing time and poor communication of information regarding drugs (NRHM, 2002).

The consequences of irrational drug usage are ineffective treatment leading to serious morbidity and mortality, iatrogenic diseases caused by the choice of hazardous drugs, or by side effects of essential and inessential drugs, high out-of-pocket expenditure by patients, stimulating inappropriate patient demand, and increased antimicrobial resistance (NRHM, 2002).

The *Tamil Nadu Medical Services Corporation* (TNMSC) set up in 1994 is a global benchmark in promoting rational drug usage in the public sector with regards to drug procurement and distribution system (TNMSC, 2011). The centralized procurement aimed at quality drugs and transparent tender-system with well defined pre-qualification criteria result in substantial reduction in procurement costs due to economies of scale, in addition to enhanced availability of drugs at health facilities (TNMSC, 2011).

The *Jan Aushadhi Program*, a public-private partnership aims to establish pharmacies in every district providing quality generics and surgical products at affordable prices 24 hours a day. The first store was started in 2008, and as of March 2010 there were 44 such functioning stores (The Jan Aushadhi Program, 2011) (Reddy, 2011).

The Drugs and Cosmetics Act, 1940, gives both the central and state governments the authority to regulate drugs. The Central Drug Standard Control Organization (CDSCO, 2011) located in Delhi and functioning under the Directorate General Health Services (DGHS, 2011) is vested with the task of approving new drugs and clinical trials, laying down standards, control over the import of medicines, and overall coordination with the State Drugs Control Organizations. The state entity is responsible for regulating the manufacture, sale and distribution of drugs.

Except the Employees' State Insurance Scheme (ESIS) and Central Government Health Scheme (CGHS) no other scheme provides for drug reimbursement (Selvaraj & Nabar, 2011). A progressive drug pricing policy is critical to ensure accessibility and affordability of drugs. In 1979, 347 bulk drugs came under price control, which came down to 166 in 1987 and further to 142 in 1995. The Drug Price Control Order (DPCO) of 1995 limits the control to just 76 drugs (Selvaraj & Nabar, 2011). The DPCO delineates certain benchmarks on which price control is based: (a) sales turnover, (b) market monopoly, and (c) market competition. The current practice of using monopoly and market dominance measures need to be replaced with the criteria of *'essentiality'* (Selvaraj & Nabar, 2011).

Aspirin was introduced as the first synthetic pharmaceutical in 1897; the first modern antibiotic in 1941, the first commercially formulated anti-malarial in 1943, and the first anti-tubercular in 1944. The 1950s saw the first clinical use of oral contraceptives, and the emergence of drugs for diabetes and mental illness. WHO published, the first Model List of Essential Drugs in 1977, identifying 208 individual medicines which together could provide safe and effective treatment for the majority of communicable and non-communicable diseases (WHO, 2011).

International Guidelines for Drug Classification:

In 1981, the WHO Regional Office for Europe recommended the ATC/DDD system for international drug utilization studies (Norwegian Institute of Public Health, 2010). The WHO Collaborating Centre for Drug Statistics Methodology was accordingly established in Oslo in 1982, and was directly linked to the WHO Headquarters in Geneva in 1996 (WHOCC, 2011). The purpose of the ATC/DDD system of classification is to serve as a tool for drug utilization research in order to improve quality of drug use. In the Anatomical Therapeutic Chemical (ATC) classification system, the active substances are divided into different groups according to the organ or system on which they act and their therapeutic, pharmacological and chemical properties (Norwegian Institute of Public Health, 2010).

The Defined Daily Dose (DDD) is the assumed average maintenance dose per day for a drug used for its main indication in adults (WHOCC, 2011). DDDs are a statistical measure of drug consumption, and are used to standardize the comparative usage of various drugs between themselves or between different health care environments.

ICTPH Health Systems Approach:

ICTPH is a not-for-profit research organization with its vision to innovate health-systems designs for remote rural populations (ICTPH, 2010) (ICTPH Epidemiology Data Set, 2010). The Health Systems approach at ICTPH aims to redefine primary healthcare towards an inclusive continuum, accommodating evolving chronicity (Johar, ICTPH Health Systems Approach, 2010). The four elements defining the ICTPH Health Systems approach are human resource, infrastructure, technology, and financing.

Provisioning enhanced diagnostic capability through the village-based Rural Micro Health Centre (RMHC) allows for optimum condition management. Basic haematology, biochemistry, ophthalmology, curative care, intervention management are provisioned through a RMHC for a population of 10,000 people through a village-based nurse and a network of health extension workers (Johar, Financing Health Systems, 2010) (Johar, Provisioning Ophthalmic Care for Remote Rural Indian Populations, 2010) (Mor, 2010). The village-based RMHCs anchor multiple functions, wherein establishing a relationship focused on '*Wellness*' with the household is of utmost importance. Wellness as defined within the ICTPH Health Systems context, not only provisions curative services for management of acute conditions but also *risk-profiles populations* targeting secondary prevention at a population level. Identified *high-risk groups* are then exclusively targeted for provisioning specific interventions e.g. iron/folic acid supplementation through sprinkles for 6 month – 24 month old infants.

Objective:

This paper aims to detail the *ICTPH Essential Drug List* as implemented through the network of nurse-managed, medical-practitioner supervised Rural Micro Health Centres in close collaboration with its Thanjavur, Tamil Nadu based partner SughaVazhvu Healthcare (SughaVazhvu Healthcare, 2010). This paper also draws a comparison between the *ICTPH Essential Drug List* and the WHO, India's *Essential Drug list for Primary Healthcare, Manual for Healthcare Workers* (WHO, India, 2000)

ICTPH Essential Drug List:

The *ICTPH Essential Drug List* is an adaption of the ATC/DDD classification methodology, wherein the drugs are categorized based on their *target system* e.g. cardiovascular system; *therapeutic activity* e.g. anti-hypertensive; *class* e.g. calcium channel blocker; *nucleus of the active drug* e.g. dihydropyridine; molecule (primarily identified through the non-proprietary name) e.g. Amlodipine; *formulation strength* e.g. tablet (5 mg and 2.5 mg). Unlike the ATC classification methodology as indicated for facilitating standardized usage across multiple providers the unique coding principle is replaced by a primitive classifier, eventually leading to a non-proprietary identifier (also refer *Appendix-1* for an introduction to general pharmacological terminology).

Fig. 1 presents a snapshot of the *ICTPH Essential Drug List* for the endocrine and cardiovascular systems primarily determined by clearly defined disease protocols as implemented within the RMHC network through the ICTPH Health Management Information Systems (HMIS) (Rajanna, 2011). Following the Subjective Objective Assessment Plan (SOAP) methodology integrated with the disease-specific protocols, the differential diagnosis for the patient is linked with a pre-defined standard therapeutic treatment protocol. The invoked treatment protocol is then fulfilled at the RMHC by dispensing the medication. Within the HMIS the dispensing and billing components are linked with the RMHC drug inventory. Pre-defined drug specific thresholds govern the RMHC specific inventory, and automated

alerts linked with minimum stocks are sent to the in-house licensed Drug Distribution Centre (DDC). The DDC manages the external centralized procurement and distribution within the internal RMHC network.

With the aim to supplement the public health systems, available to the local populace and provide for the emerging chronic care disease burden within the Indian sub-continent, the design of the RMHC is not equipped to manage obstetric-care. In its early days of evolution of primary-care disease protocols and the complimenting drug-inventory a focus on chronic conditions e.g. diabetes, cardiovascular diseases, chronic obstructive pulmonary disorder, cataract has been prioritized.

ICTPH Essential Drug List				
THERAPEUTIC ACTIVITY	**CLASS**	**NUCLEUS**	**MOLECULE**	**FORMULATION STRENGTH**
ENDOCRINE SYSTEM				
Anti Diabetic	Biguanide	Biguanide	Metformin HCl	Tablet (500 mg)
Anti Diabetic	Sulfonyl Urea	Sulfonyl Urea	Glibenclamide	Tablet (5 mg)
Anti Diabetic	Sulfonyl Urea	Sulfonyl Urea	Glimepiride	Tablet (1 mg; 2 mg)
CARDIO VASCULAR SYSTEM				
Anti Anginal			Isosorbide trinitrate	Tablet (10 mg)
Anti Hypertensive	Calcium Channel Blocker	Dihydropyridine	Amlodipine	Tablet (5 mg; 2.5 mg)
Anti Hypertensive	Angiotensin II Antagonist		Losartan pottassium	Tablet (50 mg)
Anti Hypertensive	Beta 1 Receptor Blocker	Napthalene	Atenelol	Tablet (50 mg)
Diuretic / Anti Hypertensive	Loop Diuretic	Anthranilic Acid	Frusemide	Tablet (40 mg); Injection (10 mg / ml)
Diuretic / Anti Hypertensive	Sodium Chloride Symporter	Benzothiadiazine	Hydrochlorthiazide	
Hyperlipidemia	HMG-CoA Reductase	Statin	Atorvastatin	Tablet (10 mg)

Figure 1: A snapshot of the *ICTPH Essential Drug List* designed to provide for primary healthcare needs of the service population of a RMHC. The drugs on the *Essential Drug List* corroborate with the primary care disease specific protocols implemented across the RMHC network.

As indicated in *Appendix-2* within the *ICTPH Essential Drug list*, twelve broad categories of classification have been listed – endocrine system, cardiovascular system, NSAID (non-steroidal anti-inflammatory drugs), respiratory system, gastro-intestinal tract, immune system, anti-infectives, nutritional, vaccines, local anesthetics, CNS (central nervous system), skin. A total of 67 single formulation drugs (barring a few exceptions e.g. ORS, IV-electrolytes, RL, DNS, D5, NS and Vitamin B-Complex capsules) have been categorized in the sections listed above.

WHO – Essential Drug List:

The WHO, India's Essential Drugs for Primary Healthcare Manual for Healthcare Workers, illustrates guidelines for the use of essential drugs by community health workers and auxilliary health personnel (WHO, India, 2000).

As indicated in *Appendix-3* the *WHO (India) Essential Drug List for Healthcare Workers* was also classified using the format as used for the *ICTPH Essential Drug List*. A total of 35 drugs, were categorized in eight broad categories of classification - NSAID (non-steroidal anti-inflammatory drugs), respiratory system, gastro-intestinal tract, immune system, anti-infectives, nutritional, vaccines, skin and ANS (autonomic nervous systems).

Comparison of Drug Lists:

The Indian public healthcare delivery system places a village-based Primary Health Centre (PHC) servicing a population of approximately 25,000 people. The Essential Drug Lists as defined for the PHC is elaborate, given their extensive focus on immunization, reproductive and child healthcare services (also provisioning for essential obstetric care), emergency management and AYUSH drugs used by AYUSH doctor posted at PHC (IPHS, 2010).

Hence, for reasons of simplicity and organic evolution within the ICTPH Essential Drug list a comparison was drawn with the WHO Essential Drug list for Healthcare Workers, as detailed in *Appendix – 4*, broadly categorizing drugs based on their availability within the ICTPH List, marking as available, along with available variants of standard recommendations.

Detailed below are additional drugs (non-overlapping with the WHO List) in the *ICTPH Essential Drug list*, derived from primary-care disease treatment protocols as implemented through the RMHC network, defining standardized provisioning of primary care (Tripathi, 2010):

- **Diabetes** – The comprehensive diabetes management protocol as implemented within the ICTPH Health Systems Approach risk-profiles population through a PISP Tool, (Johar, Population based – Individual Screening Protocol for Rural Indian Populations, 2011) using age, family history, smoking history, waist circumference, body mass index and blood pressure. Based on an evaluation risk-matrix high-risk profiles are referred to the Rural Micro Health Centre (RMHC) for phase-2 examination, pertaining to a glucose tolerance test. On confirming diabetes, primarily a protocolized drug (excluding insulin administration) regimen is followed compiling of sulfonylurea, meglitinide/phenylalanine analogues, biguanides, thiazolidinediones, and α-glucosidase inhibitors as broad drug treatment classes. The current *ICTPH Essential Drug List* only provides for biguanides, and sulfonylurea. As a recommendation the additional three drug classes, should also be incorporated in the standard formulary.

- **Hypertension (primary)** – As for diabetes a similar individual based assessment, will allow referral of high risk patients to the RMHC. The treatment protocol primarily entails usage of ACE-inhibitor, diuretic, β-blocker, and calcium channel blocker as four main classes of drugs for the hypertension treatment protocol as administered at the RMHC.

- **Hyperlipidaemia** – Statins are the first choice of drugs for primary hyperlipidaemias with raised LDL and total cholesterol levels, with or without triglycerides. The induction of statins within the populations also follows the same risk-profiling protocol as described above for diabetes and hypertension.

- **Emergency (CVD)** – Isosorbide trinitrate (sub-lingual) is administered in the RMHC for patients presenting with angina before being referred.

- **Gastrointestinal (GI) Tract** – Antibiotics for GI bacterial infections, and oral and intravenous (IV – RL, DNS, D5, NS) rehydration interventions for diarrhea, peptic ulcers and Acid Peptic Disease (APD) primarily Gastroesophageal reflux (GERD) are protocolized for treatment at the RMHC. The drug classes used for the above mentioned conditions are H_2 antihistamines, proton-pump inhibitors, anti-spasmodic, antiemetic and antacids.

- **Anti Histamines** – Additional to the *WHO Essential Drug List* recommendation of Pheniramine Maleate, additional anti-histamines without the sedative side-effect i.e. Cetrizine and Levocetrizine are also included. Cinnarizine is used as an anti-vertigo drug, and pheniramine maleate as an injectable anti-histamine.

- **Antibiotics** – The *WHO Essential Drug list* recommends three antibiotics Penicillin, Amoxycillin and Ampicillin. Within the *ICTPH Essential Drug* list currently there is an additional provision for Azithromycin (broad-spectrum macrolide antibiotic); Cefotaxime (third generation cephalosporin); Ciprofloxacin (First Generation Fluoro Quinolone); Ofloxacin (First Generation Fluoro Quinolone); and Gentamycin (aminoglycoside antibiotic). Currently, as ICTPH protocols are being evolved to follow the process of protocol based inclusion to refine the antibiotic inventory further, the main conditions that will be dealt at a primary-care setting through treatment protocols are respiratory tract infections, gastrointestinal infections, urinary tract infections, reproductive tract infections, and skin, eye and ear infections.

- **Anti-fungal** – Additional to miconazole and fluconazole, as per the WHO Essential Drug List recommendation, Whitfield's Ointment (Benzoic acid (6%) + Salicylic Acid (3%), may also be included for treatment of scabies and ringworm type fungal infections.

- **Additional** – Vaccine (Tetanus Toxoide), Local Anesthetic (Lignocain HCl), Anti-epileptic (Phenytion), Sedative & Hypnotic (Alprazolam) drugs have also been included within the *ICTPH Essential Drug List*. This component of the drug list will streamline as the emergency management protocol, along with other disease condition protocols e.g. mental health evolve.

Conclusion:

Provisioning comprehensive primary-care forms the core of the ICTPH Health Systems approach. Rational drug usage as guided through treatment protocols is critical. Optimal supply chain-management regarding best price, quality, and generic usage can also be ensured through a centralized distribution network, as demonstrated in this model. As the treatment protocols evolve, following the inclusion criteria additional drugs may be introduced within the inventory. Similarly, as the interventions e.g. iron-supplementation etc. are implemented will also be integrated in the list. As the ICTPH Drug List evolves, detailed comparative studies will be conducted with the recommended guidelines for a PHC (IPHS, 2010) and other standardized primary healthcare delivery systems.

Core interventions applicable within the ICTPH Health Systems context to ensure rational drug usage as adapted from Rational Drug Usage Guidelines under the NRHM are listed below (NRHM, 2002):

- Essential Medicines List
- Standard Treatment Guidelines
- Drug and Therapeutic Committees
- In-service Continuing Education
- Supervision, Monitoring and Audits
- Public Education
- Procurement and Logistics within the Health System

The aim of this exercise is to methodologically establish a process promoting organic growth of the *ICTPH Essential Drug list*, within an environment where-in evolving clinical treatment protocols and community based interventions compiling the suite of services offered to the population, will be integrated at a health-systems level through a standardized inclusion criterion within the drug inventory.

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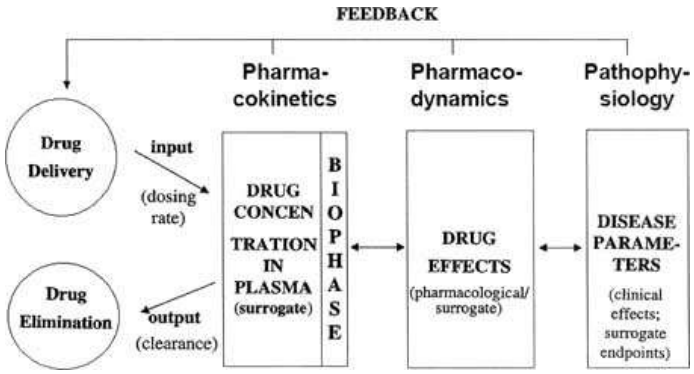
Appendix – 1: General Pharmacological Terminology

*"**Drug** is the single active chemical entity present in medicine that is used for diagnosis, prevention, treatment / cure of a disease. The WHO (1966) has given a more comprehensive definition – Drug is any substance or product that is used or is intended to be used to modify or explore physiological systems or pathological states for the benefit of the recipient"* (Tripathi, 2010).

Pharmacology is the science that deals with interaction of an exogenously administered chemical molecule within a living system. **Pharmacodynamics** *(What the drug does to the body)* is the study of the biochemical and physiological effect of drugs and their mechanism of action at organ systems / sub-celluar / macromolecular level. **Pharmacokinetics** *(What the body does to the drug)* refers to the movement of the drug in an alteration of the drug by the body, includes absorption, distribution, metabolism (binding/localization/storage, biotransformation) and excretion (ADME) of bioactive compounds in a living organism (Tripathi, 2010).



Schematic illustration of the complex inter-relationships of factors that influence drug response – pharmacokinetics, pharmacodynamics and pathophysiology (Leucuta, 2006)

Drug-drug interactions occur when one therapeutic agent either alters the concentration (pharmacokinetic interactions) or the biological effect of another agent (pharmacodynamic interactions). Pharmacokinetic drug-drug interactions can occur at the level of absorption, distribution, or clearance of the affected agent. **Drug-food interactions** explain the interactions of the food with drug.

- **Nomenclature of Drugs** (WHO, 2011)

Chemical name: A **chemical nomenclature** is a set of rules to generate systematic names for chemical compounds. **IUPAC nomenclature** is worldwide the most used chemical nomenclature. It is developed and kept up to date under the auspices of the International Union of Pure and Applied Chemistry (IUPAC).

Non-Proprietary name: International Nonproprietary Names (INN) identifies pharmaceutical substances or active pharmaceutical ingredients. Each INN is a unique name that is globally recognized and is public property. A nonproprietary name is also known as a generic name. Since its inception, the aim of the INN system has been to provide health professionals with a unique and universally available designated name to identify each pharmaceutical substance. The INN system as it exists today was initiated in 1950 by a World Health Assembly resolution WHA3.

Brand name / proprietary name: Trademark under which a proprietary product is marketed. A **proprietary drug** - a drug that has a trade name and is protected by a patent (can be produced and sold only by the company holding the patent).

APPENDIX - 2

ICTPH Essential Drug List

THERAPEUTIC ACTIVITY	CLASS	NUCLEUS	MOLECULE	RMHC INVENTORY FORMULATION (STRENGTH)
ENDOCRINE SYSTEM				
Anti Diabetic	Biguanide	Biguanide	Metformin HCl	Tablet (500 mg)
Anti Diabetic	Sulfonyl Urea	Sulfonyl Urea	Glibenclamide	Tablet (5 mg)
Anti Diabetic	Sulfonyl Urea	Sulfonyl Urea	Glimepiride	Tablet (1 mg; 2 mg)
CARDIO VASCULAR SYSTEM				
Anti Anginal	Short Acting Nitrate	Nitroglycerine	Isosorbide trinitrate	Tablet (10 mg)
Anti Hypertensive	Calcium Channel Blocker	Dihydropyridine	Amlodipine	Tablet (5 mg; 2.5 mg)
Anti Hypertensive	Angiotensin II Antagonist		Losartan pottassium	Tablet (50 mg)
Anti Hypertensive	Beta 1 Receptor Blocker	Napthalene	Atenelol	Tablet (50 mg)
Diuretic / Anti Hypertensive	Loop Diuretic	Anthranilic Acid	Frusemide	Tablet (40 mg); Injection (10 mg / ml)
Diuretic / Anti Hypertensive	Sodium Chloride Symporter	Benzothiadiazine	Hydrochlorthiazide	
Hyperlipidemia	HMG-CoA Reductase	Statin	Atorvastatin	Tablet (10 mg)
NSAID				
Analgesic	μ-opioid Receptor Agonist		Tramadol Hydrochloride	Injection (50 mg / 2 ml)
Analgesic	COX (Cyclooxygenase) Inhibitor		Diclofenac Sodium	Tablet (50 mg; 100 mg); Ointment (1% W/W); Injection (25 mg / ml)
Analgesic / Anti Inflammatory	COX (Cyclooxygenase) Inhibitor	P-amino Salicylic Acid	Paracetamol	Suspension (120 mg / 5ml); Tablet (500 mg); Injection (150 mg / 1 ml)
Analgesic / Anti Inflammatory	Enzyme		Seratiopeptidase	
Analgesic / Anti Rheumatic	COX (Cyclooxygenase) Inhibitor		Mefenamic acid	
RESPIRATORY SYSTEM				
Anti Asthma (Bronchodilators)		Xanthine Derivative	Etophylline	
Anti Asthma (Bronchodilators)	Phosphodiesterase Inhibitor	Xanthine Derivative	Theophylline	
Anti Asthma (Bronchodilators)	CNS Stimulant	Xanthine Derivative	Caffeine	
Cough	Expectorant & Mucolytic	Biphenyle	Bromhexine	
Anti Asthma (Bronchodilators)	β2 Sympathomimetic	Dihydroxy Benzene	Terbutaline	
GASTRO INTESTINAL TRACT				
Antacid		Aluminium Hydroxide	Aluminium Hydroxide	
Antacid		Magnesium Hydroxide	Magnesium Hydroxide	
Antiemetic	Serotonin 5-HT3 Receptor Antagonist	Imidazol	Ondansetron	Injection (2 mg / ml)
Antiemetic	D2 Antagonist	Benzimidazole	Domperidone	Tablet (5 mg); Suspension (1 mg / ml)
Anti Spasmodic	Anticholinergic	Cyclohexane	Dicyclomine HCL	
Anti Ulcer	Proton Pump Inhibitor	Benzimidazole Derivative	Omeprazole	Capsule (20 mg)
Anti Ulcer	Proton Pump Inhibitor	Benzimidazole Derivative	Pantoprazole	Injection (40 mg)
Anti Ulcer	Proton Pump Inhibitor	Benzimidazole Derivative	Rabeprazole	Tablet (20 mg)
Anti Ulcer	H2 Receptor Antagonist		Ranitidine	Tablet (150 mg); Injection (25 mg / ml)
Laxative	Stimulant Purgative	Diphenylmethane Derivative	Bisacodyl	Tablet (5 mg)
IMMUNE SYSTEM				
Anti Histamine / Anti Allergic	H1 Receptor Blocker		Levocetrizine	Tablet (5 mg)
Anti Histamine / Anti Allergic	H1 Receptor Blocker		Cetrizine	Tablet (10 mg)
Anti Histamine (Adrenergic Drug)	Nasal Decongestant		Phenylephrine	Tablet (5 mg)
Anti Histamine/Anti Allergic	H1 Receptor Antagonist		Pheniramine Maleate	Tablet (25 mg); Injection (22.75 mg)
Anti Histamine / Anti Hypertensive / Anti Vertigo	Labyrinthine Suppressants		Cinnarizine	Tablet (25 mg)
ANTI INFECTIVES				
Anthelmintic	Cestodes Inhibitors	Benzimidazole	Albendazole	Suspension (200 mg); Tablet (400 mg)
Antibiotic	Inhibitor of Cell Wall Synthesis	Penicillin Derivative	Amoxycillin	Capsule (250 mg; 500 mg); Dry Suspension (125 mg / 5 ml)
Antibiotic (Broad Spectrum)	Protein Synthesis Inhibitor	Macrolide	Azithromycin	Tablet (250 mg; 500 mg); Suspension (100 mg / 5ml)
Antibiotic (Third Generation Cephalosporin)		Cephalosporin	Cefotaxime	Injection (1 gm; 250 mg; 500 mg)

Antibiotic (First Generation Fluoro Quinolone)	Protein Synthesis Inhibitor	Fluoro Quinolone	Ciprofloxacin	Tablet (500 mg); E/E Drops (0.3 %W/W)
Antibiotic (First Generation Fluoro Quinolone)	Protein Synthesis Inhibitor	Fluoro Quinolone	Ofloxacin	Tablet (200 mg)
Antibiotic	Protein Synthesis Inhibitor	Amino Glycoside	Gentamycin	E/E Drops (0.3 %W/W); Injection (80 mg / 2 ml)
Antibiotic		Sulfonamide	Silver Sulfadiazine	Oinment (1 %W/W)
Antibiotic (mainly topical)	Protein Synthesis Inhibitor	Amino Glycoside (mainly topica	Neomycin	Cream (0.5 %W/W)
Anti Amoebic / Antimicrobial	Protein Synthesis Inhibitor	Imidazole Derivative	Metronidazole	Tablet (200 mg; 400 mg); I.V. Fluid (500 mg / 100 ml)
Anti Amoebic		Imidazole Derivative	Tinidazole	Tablet (500 mg)
Anti Fungal	Cutaneous Mycoses	Imidazole Derivative	Clortimazole	Cream (1 % W/W); Suppository (100 mg)
Anti Fungal	Cutaneous Mycoses	Imidazole Derivative	Miconazole	Cream (2 % W/W)
Anti Fungal		Imidazole/Triazole Derivative	Fluconazole	Tablet (150 mg)
Anti-Malarial		Aminoquinoline	Chloroquine	Tablet (250 mg); Suspension (50 mg)
Anti Septic / Disinfectant		Poly Vinyl Pyrrolidone	Povidone Iodine	Oinment (5% W/W); Solution (5%W/V)
NUTRITIONAL				
Dietary Suppliment		Ascorbic Acid	Vitamin C	Tablet (300 mg)
Dietary Suppliment			Ferrous Sulphate	
Dietary Suppliment			Folic Acid	
Dietary Suppliment			Vitamin B-Complex	
Dietary Suppliment			Calcium	Tablet
Electrolyte	RL (Ringer Lactate)			Intra Veneous Fluid
Electrolyte	DNS			Intra Veneous Fluid
Electrolyte	D5	Glucose	Glucose	Intra Veneous Fluid (5% W/V)
Electrolyte	NS (Normal Saline)	Sodium Chloride	Sodium Chloride	Intra Veneous Fluid (0.9 gm / 100 ml)
Electrolyte			Oral Rehydration Salt	Powder
VACCINES				
Tetanus			Tetanus Toxoide	Injection (1.5 mg / 0.5 ml)
LOCAL ANESTHETICS				
Local Anesthetic		Dimethyl phenyl derivatives	Lignocain HCL	Injection (21.3 mg / ml); Oinment (2% W/W)
CNS				
Anti Epileptic		Imidazolidine derivative	Phenytion	Tablet (50 mg)
Sedatives & Hypnotic		Benzodiazepines	Alprazolam	Tablet (0.25 mg; 0.5 mg)
SKIN				
Protectives		Zinc Carbonate	Calamine	Lotion (8% W/V)
Ectoparasiticides		Cyclohexane derivative	Gama benzine hexa chloride	Lotion (1% W/V)

APPENDIX - 3

WHO Essential Drug List for Primary Healthcare - India

THERAPEUTIC ACTIVITY	CLASS	NUCLEUS	MOLECULE	ESSENTIAL DRUG INVENTORY FORMULATION (STRENGTH)
NSAID				
Analgesic	COX (Cyclooxygenase) Inhibitor	Acetyl Salicylic Acid	Aspirin	Tablet (300 mg; 500 mg)
Analgesic	μ-opioid Receptor Agonist	Methy Morphine	Codeine	Suspension (15 mg/5ml); Tablet (15 mg)
Analgesic / Anti Inflammatory	COX (Cyclooxygenase) Inhibitor	P-amino Salicylic Acid	Paracetamol	Suspension (125 mg/5ml); Tablet (500 mg)
RESPIRATORY SYSTEM				
Anti Asthma (Bronchodilators)	β2 Sympathomimetic	Dihydroxy Benzene	Salbutamol	Tablet (2 mg; 4 mg); Suspension(2mg/5ml); Aerosol (100 mcg/dose)
IMMUNE SYSTEM				
Anti Histamine/Anti Allergic	H1 Receptor Antagonist	Pyridin Derivative	Chlorpheniramine	Tablet (4 mg); Syrup (2mg/5ml)
GASTRO INTESTINAL TRACT				
Laxative	Stimulant Purgative	Anthroquinone Derivative	Senna	Tablet (7.5 mg)
Laxative	Bulk forming	Herbal	Ispaghula	Powder (2 teaspoon)
Antacid		Magnesium Hydroxide	Magnesium Hydroxide	Tablet (300 mg); Suspension (8% W/V)
ANTI INFECTIVES				
Anthelmintic	Nematodes Inhibitors	Pyrimidine Derivative	Pyrantel	Suspension (50 mg/5ml); Tablet (250 mg)
Anthelmintic	Cestodes Inhibitors	Benzimidazole	Mebendazole	Suspension (100 mg/5ml); Tablet (100 mg)
Antibiotic	Inhibitor of Cell Wall Synthesis	Penicillin	Penicillin	Tablet (125 mg; 250 mg); Syrup (125mg/5ml)
Antibiotic	Inhibitor of Cell Wall Synthesis	Penicillin Derivative	Ampicillin	Capsule / Tablet (250 mg, 500 mg): Syrup (125 mg or 500 mg / 5ml)
Antibiotic	Inhibitor of Cell Wall Synthesis	Penicillin Derivative	Amoxycillin	Capsule / Tablet (250 mg, 500 mg): Syrup (125 mg or 500 mg / 5ml)
Antibiotic (Topical)	Protein Synthesis Inhibitor	Amino Glycoside (mainly topical)	Neomycin	Cream (5mg/gm)
Antibiotic /Antimicrobial	Folate Synthase Inhibitor	Pyrimidin Derivative	Sulphadimidine	Tablet (0.5gm); Suspension (500mg/5ml)
Anti Amoebic / Antimicrobial	Protein Synthesis Inhibitor	Imidazole Derivative	Metronidazole	Tablet (200 mg; 400 mg); Suspension(100 mg/5 ml)
Antibiotic (Broad-Spectrum)	Protein Synthesis Inhibitor	Polycyclic Naphthalene Derivative	Tetracycline	Eye Drops (1%W/V); Eye Ointment (1%W/W)
Anti Fungal	Cutaneous Mycoses	Imidazole Derivative	Co-Trimoxazole (Sulphamethoxazole + Trimethoprim)	Tablet (400 mg + 80 mg); (100 mg + 20 mg); Syrup (200 mg+40 mg/5 ml)
Anti Fungal	Dermatophytosis		Whitefields Ointment	Oinment {(Benzoic Acid (6%)+ Salicylic Acid (3%)}
Anti-Malarial	Erythrocytic Schizontocide	Aminoquinoline	Chloroquine	Tablet (250 mg); Suspension (50 mg/5ml)
Anti-Malarial	Erythrocytic Schizontocide	Aminoquinoline	Primaquine	Tablet (7.5 mg; 15 mg; 45 mg)
Anti Bacteria / Anti Fungal		Dye	Gentian (Crystal) Violet	Solution (0.5%W/V)
Anti Septic	Membrane disruption	Biguanide	Chlorhexidine	Solution (20%W/V)
Anti Septic / Disinfectant		Poly Vinyl Pyrrolidone	Povidone Iodine	Oinment (5% W/W); Solution (5%W/V); Suppository (200 mg)
NUTRITIONAL				
Dietary Suppliment	Ferrous Salt		Ferrous Sulphate	Tablet (200 mg); Oral Solution (25mg/ml)
Dietary Suppliment		Pteridin Derivative	Folic Acid	Tablet (1mg; 5mg); Syrup (2.5mg/5ml)
Dietary Suppliment	Vitamin		Vitamin B-Complex	Tablet {Thiamine (1-2mg) + Riboflavin (1-2mg) + Nicotinamide (15-20mg) + Pyridoxine (1-2mg)}
Dietary Suppliment	Vitamin		Vitamin A	Capsule (25,000 IU); Drops (50,000 IU/ml)
Dietary Suppliment	Vitamin		Vitamin D	Tablet(50,000 IU); Solution (10000 IU/ml)
Electrolyte		Mixture of Salts	Oral Rehydration Salt	Powder
SKIN				
Protectives			Calamine Lotion	Lotion {Calamine (15gm) + Zinc Oxide (5gm) + Bentonite (3gm) + Sodium Citrate (0.5gm) + Phenol (0.5gm) + Glycerol (5ml)}
Ectoparasiticides			Benzyl Benzoate	Emulsion (25%W/V)
Ectoparasiticides		Cyclohexane derivative	Gama Benzene Hexa Chloride	Lotion (1% W/V)
ANS				
Anti Cholinergic(Antidote)	Cholinergic Receptor Antagonist		Atropine	Tablet (1mg); Injection (0.5 mg/ml or 1 mg/ ml)
Oral contraceptive Pill				

APPENDIX - 4

	WHO Essential Drug List for Primary Healthcare - India	ICTPH Essential Drug List
THERAPEUTIC ACTIVITY	**MOLECULE**	**AVAILABLE AT RMHC**
NSAID		
Analgesic	Aspirin	Not Available
Analgesic	Codeine	Not Available
Analgesic / Anti Inflammatory	Paracetamol	Available
RESPIRATORY SYSTEM		
Anti Asthma (Bronchodilators)	Salbutamol	Variant
IMMUNE SYSTEM		
Anti Histamine/Anti Allergic	Chlorpheniramine	Available
GASTRO INTESTINAL TRACT		
Laxative	Senna	Not Available
Laxative	Ispaghula	Not Available
Antacid	Magnesium Hydroxide	Available
ANTI INFECTIVES		
Anthelmintic	Pyrantel	Not Available
Anthelmintic	Mebendazole	Variant
Antibiotic	Penicillin	Not Available
Antibiotic	Ampicillin	Not Available
Antibiotic	Amoxycillin	Available
Antibiotic (Topical)	Neomycin	Available
Antibiotic /Antimicrobial	Sulphadimidine	Not Available
Anti Amoebic / Antimicrobial	Metronidazole	Available
Antibiotic (Broad-Spectrum)	Tetracycline	Not Available
Anti Fungal	Co-Trimoxazole (Sulphamethoxazole + Trimethoprim)	Available
Anti Fungal	Whitefields Ointment	Not Available
Anti-Malarial	Chloroquine	Available
Anti-Malarial	Primaquine	Not Available
Anti Bacteria / Anti Fungal	Gentian (Crystal) Violet	Not Available
Anti Septic	Chlorhexidine	Not Available
Anti Septic / Disinfectant	Povidone Iodine	Available
NUTRITIONAL		
Dietary Suppliment	Ferrous Sulphate	Available
Dietary Suppliment	Folic Acid	Available
Dietary Suppliment	Vitamin B-Complex	Available
Dietary Suppliment	Vitamin A	Not Available
Dietary Suppliment	Vitamin D	Not Available
Electrolyte	Oral Rehydration Salt	Available
SKIN		
Protectives	Calamine Lotion	Available
Ectoparasiticides	Benzyl Benzoate	Not Available
Ectoparasiticides	Gama Benzene Hexa Chloride	Available
ANS		
Anti Cholinergic(Antidote)	Atropine	Not Available
Oral contraceptive Pill		Not Available