Financing Health Systems

Pattukkottai Block, Thanjavur District, Tamil Nadu – An Illustrative Example

by

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Introduction:

The fundamental step towards achieving health equity is universal coverage, i.e., universal access to the full range of personal and non-personal health services including social health protection (The World Health Report 2008 - Primary Health Care, Now More Than Ever, 2008). Universal Health Coverage (UHC) means a well functioning accessible system with financial protection and a well defined set of health services (Bump, 2010).
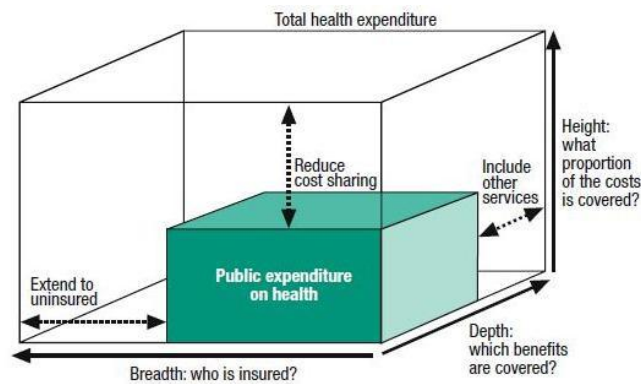

Figure 1
The three dimensional approach towards achieving Universal Health Coverage
(The World Health Report 2008 - Primary Health Care, Now More Than Ever, 2008)

Fig. 1 highlights the three dimensional technical challenge associated with provisioning UHC. Breadth – inclusive coverage, with safety net protection for the poorest and most vulnerable. Depth – expanding the range of essential services. Height – healthcare costs covered through pooling and pre-payment diminishing reliance on out-of-pocket expenditures (The World Health Report 2008 - Primary Health Care, Now More Than Ever, 2008).

Important evolutionary lessons for UHC emerge from the Germany's Social Health Insurance (SHI) System (the "Bismarck Model" initiated in 1883 and achieving 100% coverage in only 1995) and the British National Health Services (NHS or the "Beveridge Model"). SHI evolved to provide universal health coverage primarily by expanding in two directions, mandatory enrolment and mandatory minimum benefits expansion (Bump, 2010). NHS standardized benefits across the population through direct ownership or coordinating authority, and maintained equity in financing by supporting the system with general taxation revenues (Bump, 2010). As in Germany, the basic economic factors leading to an expanded government role in health were largely driven by industrialization (Bump, 2010) but the Second World War played a very important role in the development of the NHS in the UK while the political power of Trade Unions was an important influence in the development of the Bismarck Model.

The Alma-Ata conference (1978) laid the global foundation for provisioning comprehensive primary healthcare elsewhere the world. However, the anxiety to prioritize breadth, missing details, low-incomes and short time-lines led to the emergence of Selective Primary Health Care (SPHC) – to maximize effectiveness, primarily encouraging vertical programs e.g. GOBI (launched by UNICEF in 1982) promoting four interventions – Growth Monitoring, Oral Rehydration, Breastfeeding and Immunizations (Bump, 2010). There is clearly an urgent need to go beyond GOBI and make substantial progress along the Depth (range) and the Height (financing-cost) dimensions of the UHC Box as shown in *Fig. 1,* even in low income economies. The key question is how these systems will be designed, what they will cost and how will they be financed.

Health systems are generally designed to serve people at the primary, secondary and tertiary levels. Given the maturity of insurance markets in India it is perhaps possible to use insurance premiums to estimate the implied costs of the provision of secondary and tertiary care at a population level and depending upon the range of services sought to be offered the premium charged by an insurance company (suitably adjusted for administrative costs and profit margins) could serve as a good proxy for the cost of provision. However, at the primary level no such markets exist in the country and unlike in the case of secondary and tertiary care where there is at least some level of supply at a good quality level, at the primary level there is need for a clearer definition of what constitutes good primary care and then to estimate how much it would cost.

Our vision for primary healthcare using three dimensions of infrastructure, human resources and healthcare interventions is detailed in the paper (Johar, ICTPH Health Systems Approach, 2010). This paper now attempts to assign costs to each of these three dimensions in the context of the Pattukkottai block of the Thanjavur district of Tamil Nadu (also refer *Annexure-1*), based on the experiences of SughaVazhvu Healthcare – a programme partner of ICTPH.

Insurance is an effective mechanism to pool random, infrequent and unpredictable risk associated with catastrophic healthcare events (Adigozel, Pellathy, & Singhal, 2009) (Mor, 2010). High deductible health plans and health savings accounts (HSAs) are some examples of mutual risk sharing, aligning incentives towards healthy behaviour, promoting value conscious consumption along with reasonable financial security, allowing reimbursement instruments to manage all medical expenses (Adigozel, Pellathy, & Singhal, 2009) (Mor, 2010). These financing products are generally conceived of in an unbundled fashion, however, Kaiser Permanente (KP) the largest non-profit health plan in the United States closely coordinates primary, secondary, and hospital care, placing a strong emphasis on prevention and extensive use of 'care pathways' and electronic medical records (EMR). *'Care Pathways'* at KP, as developed by multidisciplinary teams use evidence-based medicine to facilitate integrated care (Wolf, 2009). The KP vision is closer to the overall health-systems vision of ICTPH and this paper makes an attempt also then to compute what the overall cost of such an integrated model would look like. It uses

its estimates from Pattukkottai to assess both costs of primary care as well as the actual disease burden and then combines that with estimated insurance premiums to arrive at the cost of integrated care.

Cost of Primary Care:

The Health Systems approach at ICTPH allows redefining primary healthcare with pertinent human resource, technology and financing solutions (Johar, ICTPH Health Systems Approach, 2010). *Productizing* primary care protocols will allow standardized scale-up elasticity. As an example, a clearly defined ophthalmic solution defining care pathway from primary to surgical referral will allow optimal management of associated disease burden (Johar, Provisioning Ophthalmic Care for Remote Rural Indian Populations, 2010). The health extension worker as an ICTPH Guide carefully provisions population level screening, follow-up and individual focused health interventions.

Fixed Cost: Expenditure heads detailing infrastructure and diagnostic provisioning are listed below:

1. **Haematology:** ICTPH-RMHC as the primary- healthcare touch-point for rural population needs to provision basic diagnostic and curative capabilities. Haematology – Complete Blood Count (CBC) provisioned through a Sysmex KX-21 Autoanalyzer (Sysmex: KX-21 Haemotology Autoanalyser, 2010) allowing for Haemoglobin, WBC, RBC, Haematocrit, MCV, MCH, MCHC, Platelets along with other relevant CBC parameter assessment through 2ml of venous blood, with a turnaround time of less than a minute. The optimal daily sample load for KX-21 is appropriate to manage diagnostic volumes across a population of 50,000 people; henceforth, allowing cost sharing across five RMHCs (cost implication as shown in *Fig. 2: Haematology*).

2. **Biochemistry:** Multiple biochemical parameters – blood glucose (random, fasting, post prandial, GTT), urea, creatinine, uric acid, lipid profile (triglycerides, total cholesterol, HDL), Liver Function Test (LFT) (SGOT, SGPT, Albumin, bilirubin total, bilirubin direct), HbA1C, Magnesium are all performed on a semi-autoanalyser CHEM-7 (Erba Mannheim CHEM-7, 2010) requiring 5ml venous blood. The optimal daily sample load for CHEM-7 is appropriate to manage diagnostic volumes across a population of 50,000 people; henceforth, allowing cost sharing across five RMHCs (cost implication as shown in *Fig. 2: Blood Biochemistry*).

3. **Strip Tests:** For malaria, pregnancy, urine strip analyses are also available at the RMHC.

4. **Ophthalmology:** Ophthalmic capability for refractive error correction, cataract detection and basic fundus examination are also available at the RMHC. (Johar, Provisioning Ophthalmic Care for Remote Rural Indian Populations, 2010). All RMHCs are equipped with a Snellen chart, trial lens set/trial frame, streak retinoscope, direct ophthalmoscope. A slit-eye lamp for a detailed fundus examination for a population of 50,000 individuals is provisioned at every fifth RMHC (cost implication as shown in *Fig. 2: Ophthalmoscopy*).

5. **Microscopy:** Basic microscopy capability for malaria parasite detection, WBC level, sputum examination, peripheral smear for iron-deficiency anaemia and stool examination is provided for at all RMHCs (cost implication as shown in *Fig. 2: Microscopy*).

6. **Dentistry:** Oral hygiene services - ultra-sonic plaque removal, temporary filing along with best practices for oral hygiene management at a household level are provisioned at all RMHCs (cost implication as shown in *Fig. 2: Dentistry*).

7. **Drugs:** Protocolized care substantiated with evidence based prescription aid towards rational drug usage and standardized care across the RMHC network. The prime components of the ICTPH – RMHC drug inventory are – *Antibiotics* (amoxicillin, azithromycin, ciprofloxacin, ofloxacin, gentamycin); *NSAID* (Non-Steroidal Anti Inflammatory Drugs) (paracetamol, diclofenac sodium, seratiopeptidase); *Antidiabetic* (metformin HCl, glimepride, glebenclamide); *Antihypertensive (*amlodipine, losartan potassium, atenolol); *Antiulcer* (antacids, ranitidine, pantaprazole, omeprazole, rabiprazole); *Antimalarial* (chloroquine); *Anthelminthics* (albendazole); *Antiemetics* (domperidone); *Antispasmodic* (mefenamic acid + dicyclomine hydrochloride); *Laxatives* (bisacodyl); *Local Anaesthetics* (lignocaine hydrochloride); *Dietary Supplements* (multivitamins, calcium and vitamin-C) (cost implication as shown in *Fig. 2: Drug Inventory*).
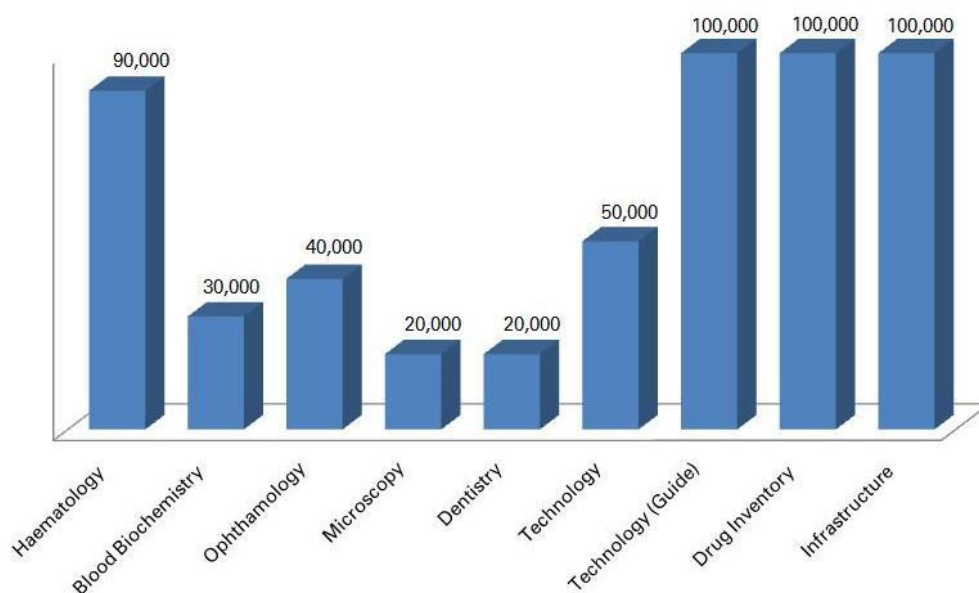

Figure 2

Fixed Cost (as in Indian Rupees) associated with establishing an ICTPH – Rural Micro Health Centre (provisioning diagnostics and drugs)

8. **Infrastructure & Technology:** All ICTPH-RMHC's are equipped with internet connectivity (at least 256 kbps), computer/laptop (Linux OS, 1GB RAM and >1GHz CPU), printer, bar-code reader for diagnostic sample identification. All RMHCs manage patient related information through an Electronic Health Record System (EHR) built on LAMP (Linux, Apache, MySQL and PHP) storing information locally, synchronizing periodically with a master database hosted on an Amazon EC2 cloud (cost implication as shown in *Fig. 2: Technology*).

9. **ICTPH Guide**: The primary task for an ICTPH Guide is to provision individual health assessment protocol currently utilizing Optical Mark Recognition (OMR) technology. Java-enabled mobile phones with GPRS connection will transition her population level interaction for screening/assessment, follow-up care and intervention implementation establishing real time link with the above mentioned EHR (cost implication as shown in *Fig. 2: Technology (Guide))*.

Variable Cost:

The amortized ICTPH-RMHC fixed cost along with the monthly operational expenditure (rent, connectivity, consumables, water + electricity, uniforms) is shown in *Fig. 3: Fixed Cost + Operational Cost*. The health extension workers referred as *ICTPH Guides* (Lakshmanan, 2010) are full time volunteers primarily performing four tasks - House Hold (HH) level individual screening for chronic and acute conditions, follow-up care as directed by the RMHC nurse, community intervention implementation and management for enrolees, and clinical assistance at the RMHC under the supervision of RMHC Nurse (Johar, ICTPH Health Systems Approach, 2010).
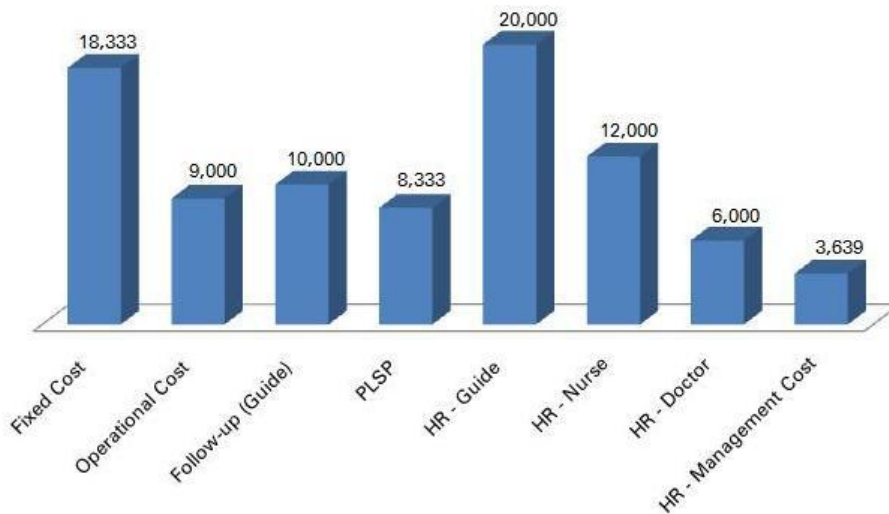

Figure 3

Monthly Variable Cost (as in Indian Rupees) associated with a Rural Micro Health Centre

The ICTPH Guides are entitled to a monthly honorarium of INR 1,000/- along with other benefits e.g. uniform, free basic primary healthcare at the RMHC including diagnostics, hospitalization (family floater) insurance up to INR 50,000/-, along with accident and life insurance. *Fig. 3: HR-Guide* highlights the monthly ICTPH Guide related expenditure. The HH based individual level screening (referred as Population Level Screening Protocol (PLSP)) based on validated tools e.g. FAST for alcohol dependence (Hodgson, 2002) and Fagerstrom test for nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) along with other parameters like BMI, BP, visual acuity, acute illness, immunization etc. for four broad age categories infant, child, adolescent and adult is implemented annually by the Guide for her catchment population of a 1,000 people (amortized monthly cost associated PLSP is listed in *Fig. 3: PLSP).*

The RMHC is managed by one qualified nurse, supervised by a network doctor. Apart from provisioning curative interventions, the RMHC Nurse closely supervises the Guides and anchors community interventions e.g. iron supplementation for 6 month – 24 month old infants, cervical cancer screening for the eligible populace. The practice of a RMHC Nurse is guided through pre-defined protocols implemented through the EHR (discussed previously) guiding assessment/diagnosis and treatment plan. The supervising doctor manages a network of five RMHCs, monitoring real time patient assessment through the EHR based case summary prepared by the RMHC Nurse on patient examination. A core management team associated with managing the drug supply chain, human resource management, technology management, cash management and other related ancillary activities are also accounted for in modelling the proposed health system intervention. *Fig. 3: HR-Nurse, HR-Doctor, HR-Management Cost* highlights the above mentioned expenditure.

Health Financing Simulation Model:

As shown in *Fig. 4*, the Health Systems simulation aims to estimate optimal healthcare requirement at the level of a village. The estimate obtained from the ICTPH Census Epidemiological Survey (ICTPH Epidemiology Data Set, 2010) detailed in *Annexure – 2*; highlight the large quantum of episodic primary care expenditure (i.e. Rs 445 per episode) with 40% attributed to drugs, 18% to Loss-of-Wage (LoW) and 11% towards transportation. The simulated primary-care expenditure in the Health Systems Approach provisions periodic screening of an individual, along with enhanced access to local diagnostic capability through frequent interaction with a healthcare provider as shown in *Fig. 4: Health System (Hypothesis) (1)* wherein the utilization is projected to increase to 2.3 visits per person / per year. Standardized evidence based prescriptions, and enhanced diagnostic capability available at the village level will drastically impact the episodic primary care expenditure on availing services at the Rural Micro Health Centre (RMHC). The Health System simulation, computes a single visit cost at the RMHC to Rs 200/- (Consultation: Rs 50/-; Diagnostics: Rs 30/-; Drugs: Rs 50/-; LoW: Rs 50/-; Misc.: Rs 20/-). The reported/diagnosed chronic disease burden is also expected to increase to 20% as highlighted in *Fig. 4: Health System Hypothesis (3),* given enhanced screening and management capability for chronic

conditions e.g. mental health screening & ophthalmic services. The enhanced diagnostic and curative care provisioning at the village level will not only reveal the under-diagnosed disease burden in the community but will also influence the annual chronic disease management expenditure increasing the same to Rs 500/- per annum, as shown in *Fig. 4: Health System Hypothesis (4)*.
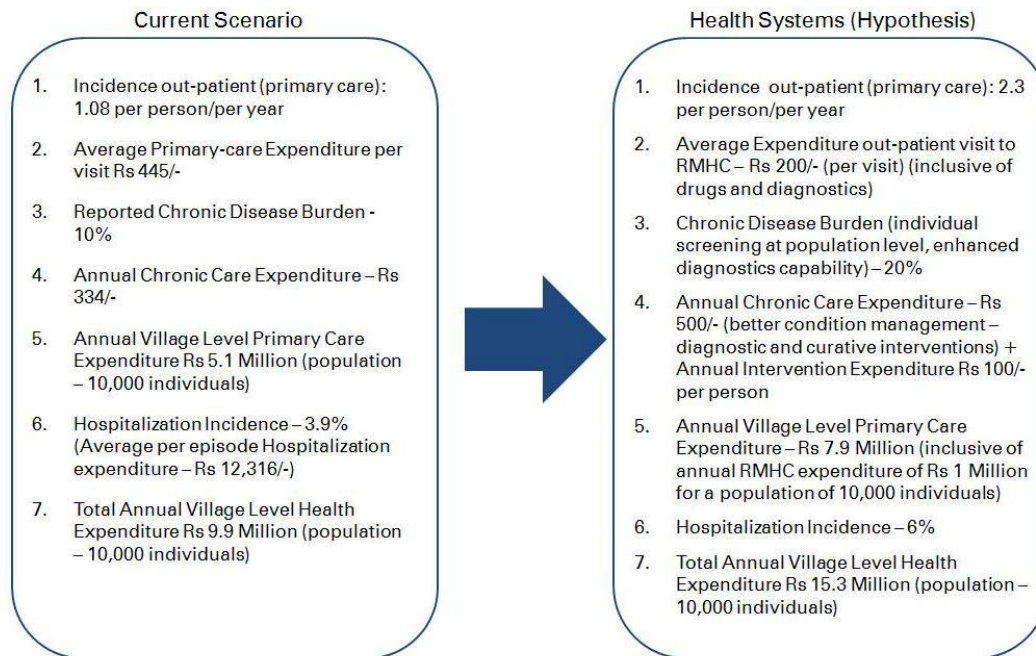

Figure 4

The hypothesis (assumptions) guiding the simulation for estimating village level health expenditure inclusive of preventive, primary, secondary and tertiary care requirement for a village with a population of 10,000 individuals.

Conclusion:

Expenditure smoothening financial interventions (as discussed later) and appropriate referral pathways will directly influence the health-seeking behaviour of the population. The annual RMHC expenditure provisioning primary care services to a population of 10,000 people is estimated at Rs 1.0 Million primarily accounting for curative services for both acute and chronic conditions along with hamlet based preventive/screening and intervention services. The episodic cost of seeking care at the RMHC within the Health Systems approach is estimated at Rs 200/- as opposed to Rs 445/- in the current scenario, primarily impacting expenditure on drugs (direct medical expenditure) and transportation costs (indirect medical expenditure). Financial instruments enhancing access to higher levels of healthcare services will directly impact utilization, assumed at 6% hospitalization in the Health System approach. This assumption is highly sensitive towards inclusion of pregnancy, at an average incidence of 2%.

The estimated per capita health expenditure of Rs 1,534/- attributes 51% expenditure towards preventive and primary care services (RMHC network servicing 78% of out-patient visits), and 49% expenditure towards secondary and tertiary care services (managed through insurance based referral network).
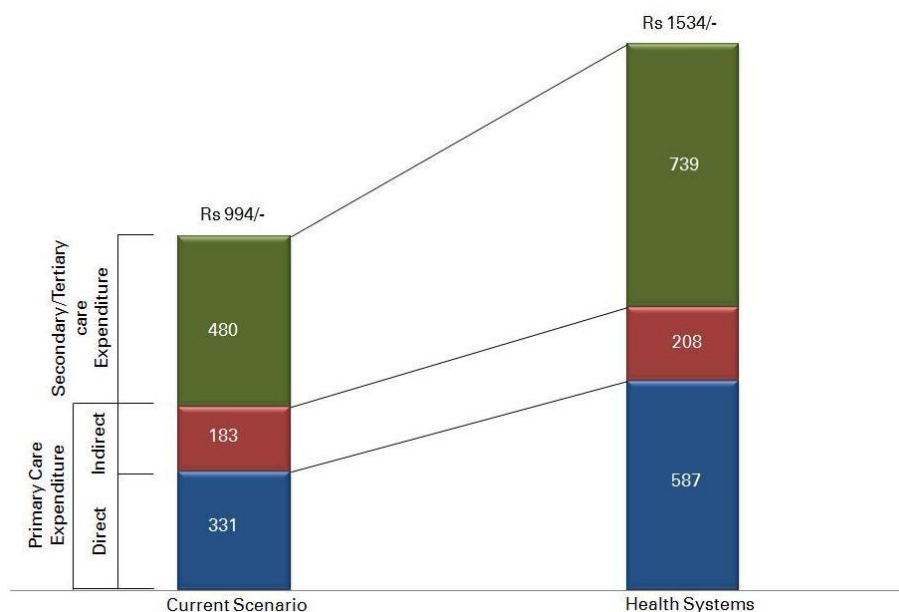

Figure 5

Current expenditure on Healthcare as estimated from the ICTPH socio-economic census survey (ICTPH Epidemiology Data Set, 2010). Simulated healthcare expenditure for a rural resident, assuming supplemented provision of primary-care through a network of Rural Micro Health Centres (RMHC).

As shown in *Fig. 6* of the proposed 51% expenditure on preventive/primary care (projected at Rs 795/- per person / per year within the Health Systems approach), 60% expenditure is towards directly seeking facility based primary care services e.g. acute condition management (annual expenditure of Rs 268/- for services availed at the RMHC and Rs 223/- towards services availed from other healthcare providers). Chronic disease management accounts for 12% of primary care expenditure in the Health Systems approach. Within primary-care the village based RMHC is expected to anchor three functions, provide optimal acute and chronic condition management services, appropriate preventive / screening services and targeted community focussed interventions. Within the Health Systems simulation 20% of primary care expenditure is attributed towards above mentioned preventive, screening and community intervention services. The simulated village-level total health expenditure (for a population of 10,000 individuals) is 15.3 Million within the Health Systems approach, seeing an upward increase from the estimated current village level expenditure at Rs 9.9 Million.

Within the Indian context, provisioning universal healthcare expresses the need for an inclusive strategy wherein direct provisioning through appropriate infrastructure facilitation, human resource innovation

and technology incubation are pertinent. Primary prevention strategies such as immunization have demonstrated their cost effectiveness. With the transitioning epidemiological disease burden from infectious to chronic evaluating the cost-effectiveness of periodic individual screening for relevant risk factors offers tremendous potential. Also, unlike acute illness, local management of chronic conditions through provisioning diagnostic services and follow-up curative-care will impact both the direct and indirect outcomes.
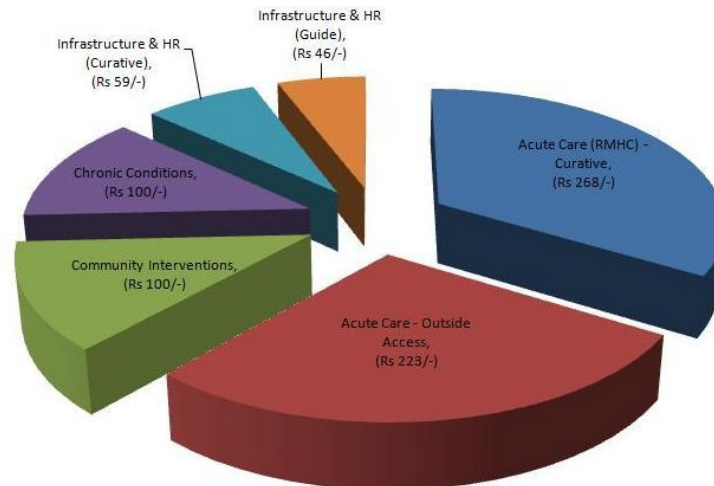

Figure 6

The break-up for the simulated primary-care expenditure within the Health Systems approach as presented in Fig. 5 estimated at Rs 795/- per annum

As shown in *Fig. 7,* the *fixed-price* healthcare strategy as envisaged in this paper aims to consolidate existing models of financing within the Indian context e.g. insurance for secondary and tertiary-care and proposes to innovate towards direct provisioning of primary-care through a village based nurse-managed rural micro health centre (RMHC) and a network of health extension workers for a population of 10,000 people, and within walking distance from served hamlets/villages.
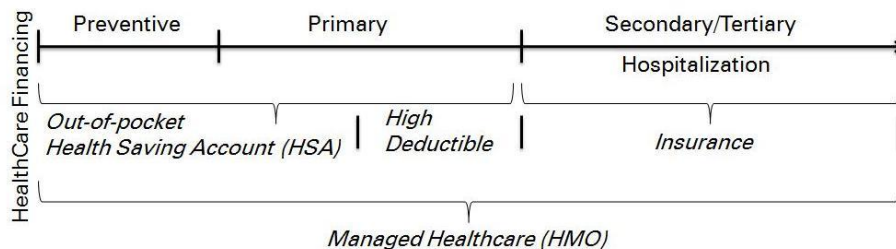

Figure 7

Instruments to finance healthcare - Managed Care: Fixed-price healthcare provisioning primary, secondary and tertiary levels of care, Insurance: Provisioning catastrophic + hospitalization related healthcare expenditure, Out-of-pocket / Health Saving Account / High Deductible Insurance to smoothen primary care expenditure.

Direct primary-care provisioning will also allow in establishing an effective gate keeping mechanism, learning from established similar models such as Kaiser Permanente (Wolf, 2009). Various financial instruments can be explored to provision the projected per capita cost for primary care. As discussed previously with as high as 20% of primary care expenditure directed towards population level screening and community interventions, out-of-pocket expenditure either through a health saving account (HSA) or a high deductible insurance premium can be explored.

Annexure 1
The Pattukkottai Context

With 81% immunization (urban and rural), IMR of 31 (urban:23, rural:37) and an average of 90% institutional deliveries Tamil Nadu clearly presents progressive general health of the population (The National Family Health Survey (NFHS-III), 2010). Thanjavur (block), Tamil Nadu has HDI (Human Development Indicators) and GDI (Gender Development Indicators), per Capita Income and life expectancy at birth ranking amongst the bottom five amongst all districts in Tamil Nadu (Tamil Nadu - Human Development Report, 2003)**.** Thanjavur reported a literacy rate between 70 - 80%, poverty ratio range of 30 - 40%, a total population of 2.2 million with 1.4 million rural inhabitants (Tamil Nadu Census , 2001). Thanjavur has 16 modern medicine hospitals, 16 dispensaries, 58 primary health centres & 309 health sub-centres. The major important Government Hospitals are Thanjavur Medical College Hospital and Raja Mirasudar Hospitals located in Thanjavur and a Government Head Quarters Hospital at Kumbakonam.

Pattukottai block has six PHC's placed at Enathy (approximate population 16,219), Karambayam (16,466), Nambivayal (24,369), Nattuchalai (23,635), Rajamadam (37,363) and Thamarankottai (24,154).
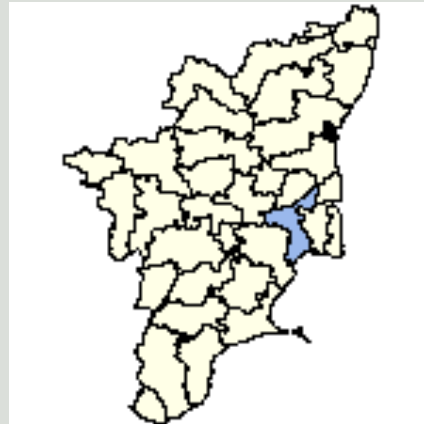
Highlighted – Thanjavur District, Tamil Nadu, India

Thanjavur District has a total of 14 Blocks. Highlighted – Pattukkottai Block

Pattukkottai Block has a total of 43 Panchayat Villages

Annexure 2
ICTPH Epidemiological Survey:

IKP Centre for Technologies in Public Health (ICTPH) conducted a cross-sectional census socio-economic survey in three villages (Alakkudi, Nattuchalai and Karambayam – interviewing a total of 9221 individuals (2150 House Holds)) in Thanjavur District, Tamil Nadu in 2008-2009 (ICTPH Epidemiology Data Set, 2010). At the time of survey a total of 1587 (17.2%) individuals recalled seeking out-patient treatment in the last two months. The reported top five illnesses for which treatment was sought excluding 597 (6.5%) cases reported as general symptoms were, ENT (250 individuals, 2.7%), musculoskeletal (211, 2.3%), gastrointestinal (140, 1.5%), cardiovascular (124, 1.3%) and diabetes (66, 0.7%). Of the 1587 individuals, 647 (40.7%) sought care at the government provisioned primary health centre (PHC).
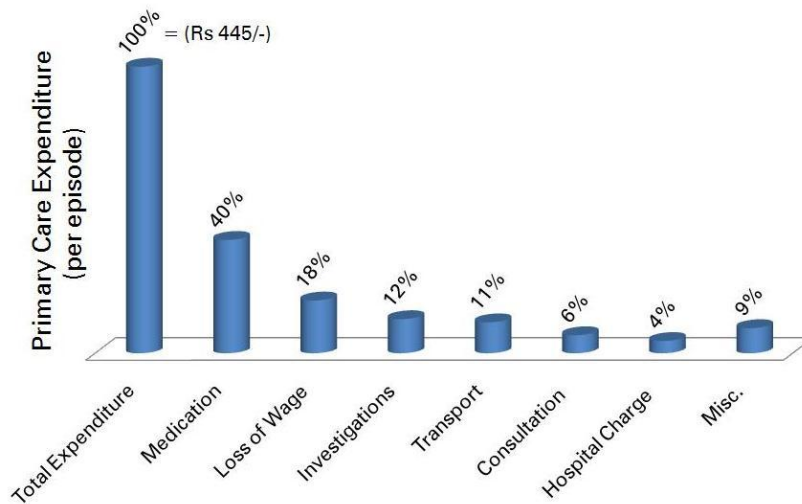
Highlights:

Primary care (out-patient) incidence 1.08 per person per year

Primary care (out-patient) expenditure Rs 445/- per episode

Secondary/Tertiary care incidence 3.9% (hospitalization)

Secondary/Tertiary care expenditure Rs 12,316/- per episode of hospitalization

Chronic Illness burden 10%

Average monthly expenditure on chronic disease management Rs 334/-

Figure-1/(Annexure-2): Health Expenditure on one episode of primary (out-patient) care in government and/or private healthcare facility. (ICTPH Epidemiology Data Set, 2010)

At the time of survey a total of 361 (3.9%) individuals recalled receiving in-patient care (hospitalization) in the previous one year. The reported top five illnesses for which the treatment was sought were gastrointestinal (53 individuals, 0.6%), accident and injury (38, 0.4%), child birth related (37, 0.4%), cardiovascular (27, 0.3%) and fever (24, 0.3%). Of the 361 individuals, 142 (39.3%) sought care at the government provisioned in-patient facilities (district hospital, medical college hospital, taluk hospital,

primary health centre, community health centre, government general hospital, railway hospital). The weighted class average per episode hospitalization expenditure was INR 12,316/-.

At the time of survey a total of 910 (9.9%) individuals reported of a chronic illness in the previous one year. The reported top five chronic illnesses were cataract (303 individuals, 3.3%), arthritis (250, 2.7%), blood pressure (184, 2.0%), diabetes (174, 1.9%), and heart disease (56, 0.6%). A total of 714 (7.7%) individuals reported seeking treatment for the reported chronic condition. The weighted class average per month expenditure of INR 334/- was reported.

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