

# IKP Centre for Technologies in Public Health<sup>†</sup>

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A concept note –

Pilot Project on integrated Rural Health Care Solutions in  
Thanjavur district of Tamil Nadu<sup>‡</sup>

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<sup>‡</sup> **DRAFT NOT TO BE QUOTED**

***Plan Statement:*** *To pilot a nurse practitioner-led, technology-enabled, comprehensive ‘fixed price health-care’ with equitable access provided through innovative organizational and financing mechanisms in the Thanjavur district of Tamil Nadu.*

The note reflects on the need for the venture, assumptions underlying the venture, key features of the venture, role of different partners, and the vision for evolution and scale-up for the Venture.

## **Healthcare in India**

The Health Sector in India is at crossroads. The scenario is fairly complex and challenging, with successful reductions in fertility and mortality offset significantly and growing communicable as well non-communicable disease burden, persistently high levels of child under-nutrition, increasing polarization in the health status of the rich and the poor and inadequate primary health care coexisting with burgeoning medical tourism. This situation is further complicated by the presence and practice of multiple systems of medicine and medical practitioners (several of whom are not formally certified and recognized) and very limited regulation. The health system is faced with a range of challenges relating to the financing and provision of health services. These challenges vary with context, on the basis of geography, community, class, etc. The diversity of the contexts and problems makes it difficult to comprehensively present the problems and challenges for India's health system in a few sweeping statements. For instance, a state like Kerala<sup>3</sup> compares well with certain developed countries<sup>4</sup>, while states like UP and Bihar have worse indicators than most developing countries<sup>4</sup>. Issues with India's health system can be seen at multiple levels. Though shortage of resources, particularly financial and human resources is a concern, an equally big concern is the way these resources are deployed. India produces one of the largest number of doctors, is one of the largest producers and exporters of drugs, and one of the highest ranking countries on health expenditure as a percentage of GDP<sup>5</sup>. These aggregate facts do not mean much when they are detailed out.

## **Health Financing in India**

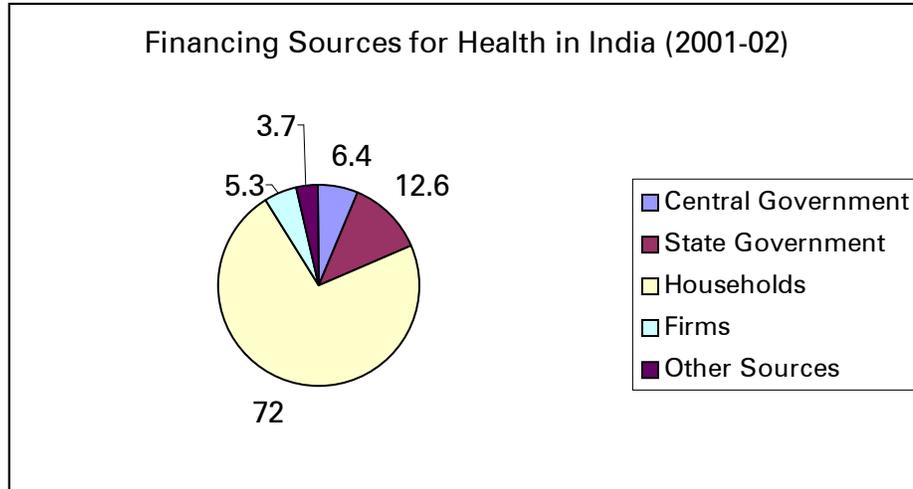
Financing of health is one of the fundamental pillars of a health system. In India, though the total financial spending on health as a percentage of GDP (at 4.63%) compares well with many countries that have managed to improve systems and health outcomes, large majority of it is incurred by the households (3.33% of GDP) in form of out-of-pocket expenditure<sup>5</sup>. Public spending, at 0.94% of GDP, is one of the lowest in the world. So, there is very little risk pooling happening through either tax or insurance mechanisms.

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<sup>3</sup> IIPS – NFHS III

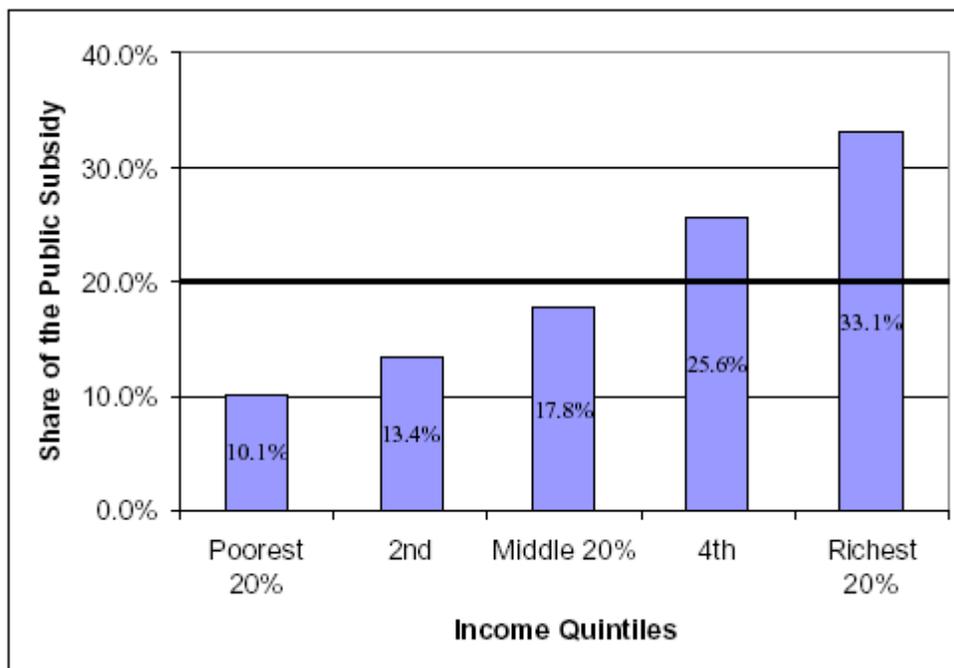
<sup>4</sup> World Health Statistics, WHO (2007)

<sup>5</sup> National Health Accounts of India 2001-02. (MOHFW, 2005)



**Figure 1:** Various financing sources for health in India (*Source: National Health Accounts of India 2001-02*)

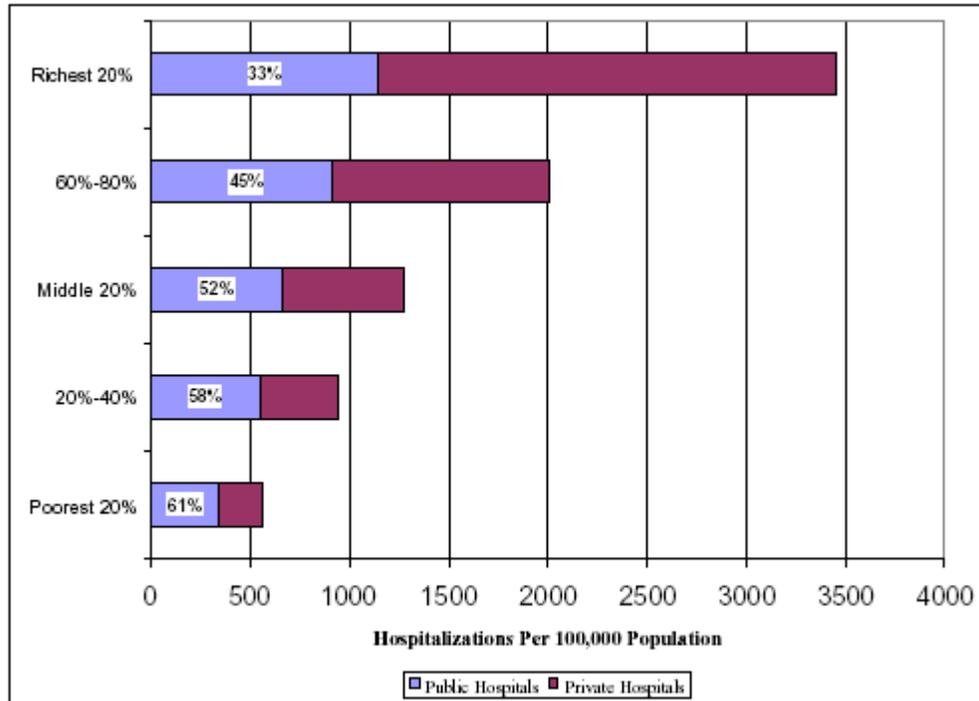
*Fig. 1* indicates how the financing of health is being channelised through different mechanisms. Most of the financing is in the form of out-of-pocket expenditure by the households. Additionally, even the inadequate public spending is presently skewed in favor of the rich, with 33% of public spending going to the richest quintile of the population and just about 10% to the poorest quintile (*Fig. 2*).



**Figure 2:** Share of public subsidy as compared with the income quintiles (*Source: Mahal et al, 2001*)

The distribution of private services is even more skewed towards the rich. As shown in *Fig.*

3 the poor don't access as much in-patient care as the rich, they prefer the public systems more than the private. The chart also indicates how the utilization of both public and private services is far greater for the rich than for the poor.



**Figure 3:** Utilization of Hospitalization services per 100,000 populations. Preferential distribution of public versus private hospital facilities in reference to economic segment (*Source: Mahal et al 2001*)

The problem with the way health sector is being financed in India has led to a situation of inequitable distribution of services and risks. In India, one incident of hospitalization is estimated to cost about 58% of per capita annual expenditure<sup>6</sup>. This cost of care, in absence of insurance coverage or good tax-based systems, creates a political economy where access to care depends on ability to pay at the time of need. It is not surprising therefore that health expenditure pushes 2.2% of India's population below the poverty line, and during the decade of 1986-96, 40% of households could not meet their health care expenses without borrowing money or selling assets. Many who cannot organize for funds just forgo the treatment. Poorest quintile of Indians is 2.6 times more likely than the richest quintile to forgo medical treatment when ill<sup>6</sup>. Richest quintile is six times more likely than the poorest quintile to have been hospitalized<sup>7</sup>. Thus, broadly there is a need to: 1) make health-care more accessible to the poorer segment; 2) develop and implement models that deploy innovative mechanisms of financing that pool the households' risks and bring down the costs of purchasing by economies of scale and collective bargaining. *The project is an*

<sup>6</sup> Peters et al (2002)

<sup>7</sup> Mahal, Singh et al (2001)

*attempt to address both the issues.*

## Human Resource Deficit in the Health Sector

Health sector is a highly human resource intensive sector, where the workers' knowledge, skills, and attitudes make a great deal of difference in the outcomes. India still has a long way to a strong human resource force for the health sector. The lowest rung in the public health system is comprised of the multi-purpose workers (MPW), male<sup>8</sup> and female (ANM)<sup>9</sup>. With little in-service training, and over 60% of posts lying vacant, the male multi-purpose cadre is the most neglected<sup>10</sup>. Though the cadre of Female MPWs (ANMs) does not face as much shortage as the Male MPWs, they are also rendered ineffective due to near absence of in-service training and the resultant erosion of nursing and midwifery skills. A Survey of ANMs found poor knowledge and wide skill gaps among them<sup>10</sup>. This gap in the human resource at the frontline of the battle against disease and mortality is closely linked with the health status of the rural population of India. For instance, preventing neonatal deaths requires effective obstetric and essential newborn care skills among ANMs. The mortalities can be easily avoided by efficient obstetric and newborn care.

Overall, there is a shortage of nurses and midwives in India. In 2004, the nurse to population ratio in India was 1:1264, while that in Europe is 1:100-200. The nurse to doctor ratio of about 1.3:1 is inadequate compared to a ratio of 3:1 in most developed countries. As of March 2003, there were 839,862 nurses registered with State Nursing Councils, of whom only about 40% were active because of the small number of sanctioned posts, poor working conditions, low pay scales and migration, retirement or death<sup>10</sup>. Compared to many developed countries, nursing as a profession is not as lucrative in India. Perhaps this is the main reason for their migration to other countries, where their skills are better utilized and they are paid well.

There are issues with the paramedic workforce as well. There is a shortfall of 48.9% in the number of sanctioned posts for Lab Technicians for Primary Health Centers and Community Health Centers. Of the sanctioned posts, 15.2% were vacant in 2002. There is a ratio of pharmacist to population of 1:1840 (500,000 registered pharmacists), which compares very poorly with the average ratio in industrialized countries (1:2300). There are wide inter-state variations (1:567 in Pondicherry to 1:43,725 in Madhya Pradesh) and in terms of skills, these diploma-trained pharmacists are at best equivalent to pharmacy assistants or technicians in developed countries but perform a variety of tasks normally reserved for registered pharmacists. In the public sector there is a shortfall of 25.8% in sanctioned posts in PHCs and CHCs; 10.7% of the sanctioned posts lay vacant in 2002.

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<sup>8</sup> 6 months' training in public health.

<sup>9</sup> ANM – Auxiliary Nurse Midwifery is a 18 months' training program in public health, with special emphasis on maternal and child health

<sup>10</sup> Mathur and Dua (2005)

Country	Physicians	Nurses	Midwives	Pharmacists	Nurse: doctor ratio
Australia	249.1	774.8	60.2	72.1	3.1:1
Canada	209.5	1009.9	1.2	79.7	4.8:1
China	164.2	104.2	INA	29	0.6:1
Cuba	590.6	744.2	INA	INA	1.3:1
India	59.7	79.1	47.4	52.7	1.3:1
Sri Lanka	42.8	79.1	41.9	4.5	1.8:1
Thailand	30.1	161.7	INA	INA	5.0:1
United Kingdom	166.5	496.6	43.3	58.9	3.0:1
United States of America	548.9	772.6	INA	68.8	1.4:1

Source: WHO website [www.who.int](http://www.who.int), updated figures obtained from MCI and INC used for India  
Reference year: 2004

**Figure 4:** Health manpower per 100,000 populations. (*Source: WHO*)

At the community-level, for preventive-promotive and basic curative care, the government has taken a step in the right direction by introducing the Accredited Social Health Activist (ASHA) programme, a community health worker programme, aimed to select, train and place health workers at 1000 population levels. If implemented and sustained appropriately, the ASHA programme, being implemented mainly in the eighteen poorer states of the country, has a great potential to change community health for better.

From the above analysis it clear that India needs to increase the supply of human resources, improve the quality of education and training for different cadres of health functionaries, and optimize in the deployment of human resources. There is a need to think creatively about the human resources in these areas. For instance, India's health system presently is heavily doctor-centric, with other human resource being sidelined to a great extent. There is a need for innovation in this sphere.

### Prescribing Nurses – Legally authorized entities in the US

In 23 U.S. states, Nurse Practitioners (NP) work autonomously, and may choose to open their own clinical practices. American NPs, according to the American College of Nurse Practitioners, are required in 28 states to practice in collaboration with and under the supervision of a physician, though they may prescribe medications in 49 U.S. states, commonwealths, districts, and territories; and carry a DEA number in most states.

Nurse Practitioners treat both acute and chronic conditions through comprehensive history taking, physical exams, prescribing medications, physical therapy, ordering tests and therapies for patients, within their scope of practice. Many NPs have a DEA registration number that allows them to write prescriptions for federally-defined "controlled medications". Nurse Practitioners may also bill Medicare, Medicaid, and private insurance for services performed. An NP can serve as a patient's "point of entry" health care provider,

and see patients of all ages depending on their designated scope of practice. The core philosophy of the field is individualized care. Nurse Practitioners focus on patients' conditions as well as the effects of illness on the lives of the patients and their families. Informing patients about their health care and encouraging them to participate in decisions are central to the care provided by NPs.

In other countries, nurses play a far wider role than they do in India. There are advanced practice nurses (APNs), who include Clinical Nurse Specialists (CNS), Nurse Practitioners (NP), Nurse Anesthetists, and Midwives. These nurses have many roles, like clinician expert, educator, researcher, consultant, and manager, with clinical judgment and leadership qualities. They are critical pillars of the health system. In the United States, the post of APN has been in existence for more than 20 years and it has been found that the APN can make an early diagnosis so that the patient can receive proper treatment in time, have a shorter length of hospital stay, fewer complications, and satisfaction with the care provided. As part of the health care reform in the US, the production of NPs has increased because of a shortage of doctors in general practice. A similar shortage is faced by India, but here there is a more acute shortage of nurses. Therefore, to make the most of the cadre of nurses at the national level, there is a need to work at both levels: to create infrastructure to train more nurses, and to optimize on the roles they can play. The assumption here are: the nurses can play a much greater role than they do, it is easier to set up infrastructure for nurse training than for doctor training, and it is easier to incentivize nurses to serve in rural areas than the doctors.

## **Management of Health Services**

In India, the management of health services is mainly housed in the public sector and the private for-profit sector. The public sector is mandated to provide services to the entire population, with a special emphasis on those who cannot afford to pay for care. The public health system is organized in multiple tiers, starting from sub-centers at 5000 population levels, Primary Health Centers at 30,000 population, Community Health Centers at 100,000 population level, the multi-specialty district-level hospitals, medical colleges, paramedical training institutions, laboratories and tertiary hospitals. This system has been in place for a long time, with significant differences in the spread and quality among states.

Analysis of the 52nd Round National Sample Survey (NSS) on the utilization of health services showed that during 1986-96, there was a decrease in the utilization of public facilities for outpatient care from 26% to 19%; a decrease in access to free care from 19% to 10% and an increase in the number of persons not seeking care due to financial incapacity. Here also there are significant inter-state variations. The failure to achieve the goals set by various policy documents has brought into focus the quality of the public health system. The public system, which is mandated to provide the services, particularly the public health services, needs to significantly improve its performance in most parts of the country.

The Private sector dominates for outpatient care (82%), represents a slight majority for hospitalization (56%), 46% of institutional deliveries and 40% of antenatal care visits<sup>11</sup>. Given the quantum of resources, financial and human, concentrated in the private sector and the extent to which people depend on this sector for service delivery, there is a need to engage with this sector.

Remote geographies are the most under-served areas in India, both by public systems and formal private sector. There is a major gap in availability and access of services in these areas. A large number of health problems can be solved by preventive measures at the community level, and timely care can prevent many problems from exacerbating. The inadequacy of services provided at the level of the community leads to a situation where several preventable conditions set in and lead to higher costs and more pain for the people. The private sector, being curative-heavy does not do much for preventing the diseases and providing timely care to the people. This part of the system, the last mile of healthcare, needs more innovative approaches than have been tried out in the country. There is a need to bring in organizational innovations that provide people the opportunity to benefit from both public and private sector in an optimal manner.

### **Information Management, Surveillance, and Research**

The importance of collecting, processing, and using data to improve health cannot be stressed enough. A great deal of progress can be made by using knowledge about local health needs, advances in knowledge about diseases and about appropriate, cost-effective responses. Generation and application of information and knowledge, if facilitated and made more systematic, can accelerate progress in improving health. The health system in India is not able to manage the information flow well. The Health Management Information System in the public health system is characterized by extensive data collection processes, poor quality of data, and a failure to use the data for practical purposes such as for effectively allocating resources. There is lack of proper monitoring and tracking of healthcare status of patients. There is also unavailability of health history of patients, leading to poor quality of care. In addition, lack of proper health statistics makes it more difficult to devise better policies for rural India. There is little penetration of technology into rural healthcare, insulating it from the advances being made in the use of IT and other technologies for healthcare.

The project is based on the need for innovation discussed above, and from possibilities studied from various parts of the world. The concept, though rooted in empirical reality, is deeply informed by broad perspectives on health and healthcare, and the theory of healthcare delivery.

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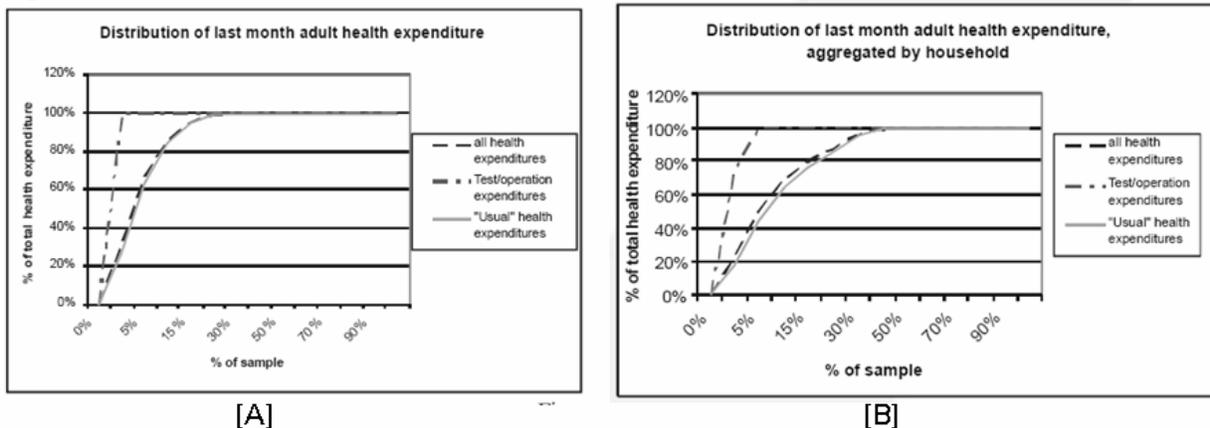
<sup>11</sup> Mahal et al (2001), World Bank

## The Project Proposal

### *Underlying Hypothesis:*

- Preventive-promotive care has a rapid and measurable impact on delivered cost of curative services.
- Insurance is an effective instrument to transform preventive-promotive care from a Public Good to a Private Good.
- Use of low cost diagnostic technologies have the potential to both increase quality of care and reduce cost of care at the village level
- The total cost of effective health care provision can be brought down to Rs 1000/- (\$ 25/-) per year, per family

### Seva Mandir – A Case Study: Health “Shocks” – Nature, Magnitude & Variability<sup>12</sup>



**Figure 5:** [A] Distribution of a month of adult health expenditure as total health expenditure, test/operations expenditure & usual health expenditure. [B] Distribution of a month of adult health expenditure as aggregated by household. (Source: Annie Duflo 2005)

In a study conducted in Udaipur district of Rajasthan assessing health ‘shocks’ and vulnerability of rural populations brought forward a few significant observations. As seen in Fig. 5 [A] less than 30% of individuals accounted for 100% of total health expenditure. 10% of individuals accounted for 80% of total health expenditure. These observations quantify health events as “shocks”: events which happen with small probability but have a high

<sup>12</sup> Annie Duflo (2005)

magnitude. The distribution of health expenditure is even more skewed towards operations and lab-test expenses, with 1.4% of adults accounting for 100% of test and operation expenses.

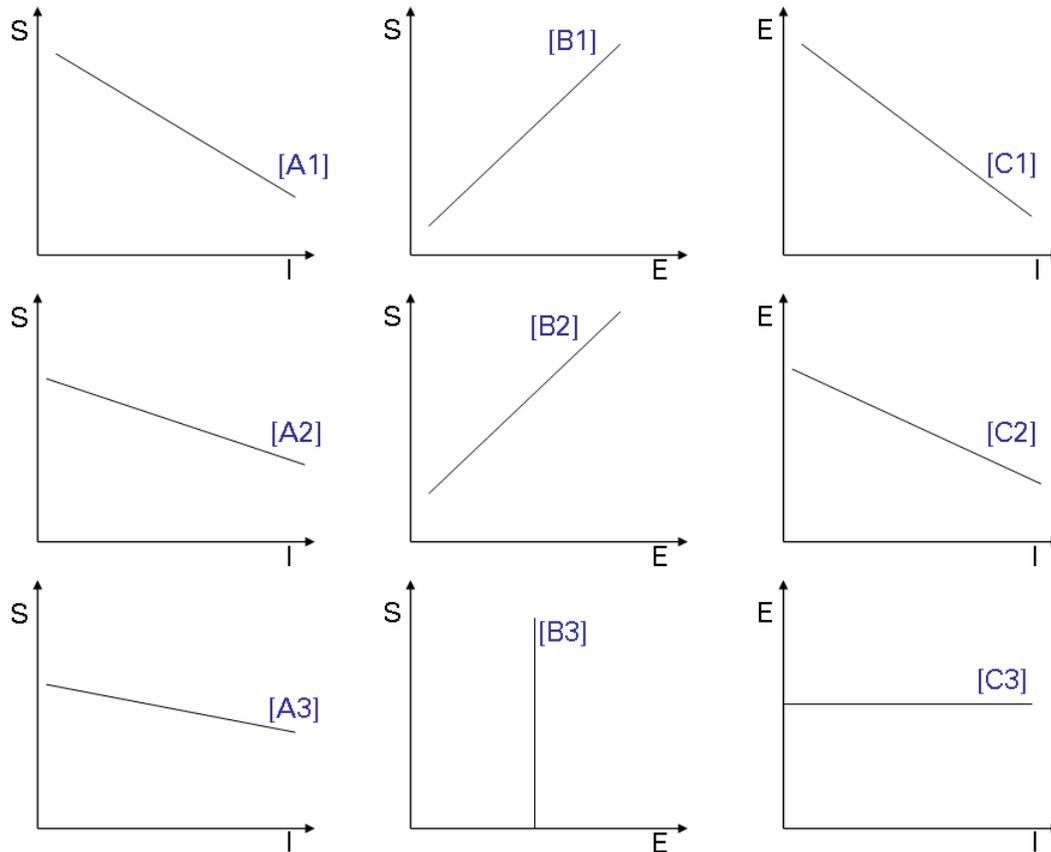
On considering the household expenditure on health rather than the individual *Fig. 5 [B]*, the distribution is less skewed. However, it is still lumpy: 50% of households account for 100% of total health expenditure, and 5% of households account for 100% of operations and lab tests expenditure. Also, a high magnitude associated with health ‘shocks’ is reflected through 14% of adults spending more than Rs 500/- per month on health (including visits, medicines and transportation costs), 8% spending more than Rs 1000/- and almost 2% spent more than Rs 5000/-. The non-institutional medical expenditure was seen to be more elastic to wealth than institutional expenditure, indicating that even poor people can not avoid make some of the “big” health expenses.

The above listed observations reiterate the underlying assumptions of our hypothesis:

- Poor populations are more vulnerable to health ‘shocks’ as compared to the relatively rich, given the poorer health statistics
- Health expenditure is skewed towards both a small subset of the population and strongly towards expenditure associated with hospitalization and lab tests
- Health ‘shocks’ are random in nature and risk pooling at the household level facilitates better risk diversification

The current rural scenario in India, brings forward the immense need to intervene at the community level so as to drive down the cost of health care services delivered at the village level. As seen in *Fig. 6*, a series of two dimensional graphs represent the ‘existing’ scenario as a combination of [A1, B1, C1]. Clearly highlighting the observed inverse correlation between sickness and income [A1], with expenditure and income [C1] also following a similar trend, expressing the vulnerability of ‘poor’ populations towards health ‘shocks’. The direct correlation observed between sickness and expenditure points toward ‘positive-selection’ wherein only the health-care seeking individuals pay for the utilized services, which may or may not correspond to the risk pooling (through savings) at the household level. The proposed hypotheses, supporting community based preventive-promotive interventions assumes to have a direct impact on the observed sickness income correlation, progressing the same towards mutual independence. A similar behavior is also reflected in the expenditure income correlation as seen in [C2]. The eventual goal of the pilot is to amalgamate community based preventive-promotive interventions with risk pooling at the community level, leading to an idealistic behavior as seen in [B3], wherein irrespective of the individual vulnerability towards health-‘shocks’ every household contributes an equivalent premium, cross-subsidizing the ‘sicker’ population for availing health related services. A similar trend is also observed in the expenditure income correlation [C3], wherein the two behave as independent variables as expected in an ideal scenario. Hence, through the envisaged pilot the eventual aim is to promote the derived [A3, B3, C3] correlation through a strategic combination of preventive-promotive interventions, health-

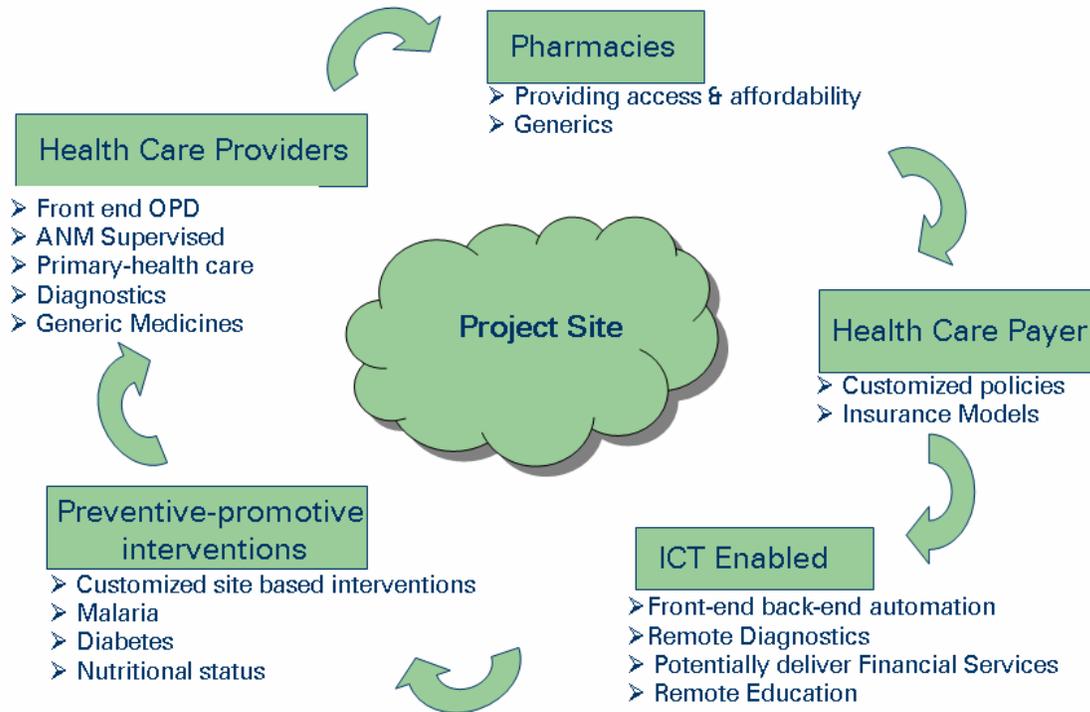
infrastructure facilitated by technological advances in point of care diagnostic technologies and risk pooling at the community level.



**Figure 6:** A series of two dimensional graphs highlighting the observed and derived correlation between sickness [S], expenditure [E] and income [I]. [A1, B1, C1] represents the observed health-care scenario for the rural population. [A2, B2, C2] expected correlation upon introducing community based preventive-promotive activities. [A3, B3, C3] derived correlation upon introduction of both community based preventive-promotive activities and community based risk pooling

### Key features of the Pilot

The effort is conceptualized as an enterprise aiming to build a robust health-care delivery channel at the grass root level. The venture envisions a nurse-led primary health-care facility offering diagnostics and out-patient care. The referral network will provide an access to empanelled private and government, secondary and tertiary health-care providers, building a health-care continuum. Technological innovation i.e. telemedicine, Electronic Health Records (EHR) will add both affordability and accountability through added quality in the network. Innovative health-financing schemes will mitigate the associated volatility in health related expenditures. *Fig. 7* depicts the envisaged Health Ecosystem.



**Figure 7:** The envisaged health care solution

The primary goal of the venture is to devise '**fixed price health-care**' for the community through effective distribution strategies. The assumptions supporting the envisaged target are listed below:

- The health care requirements of a family can be broadly categorized into Preventive-promotive (PP) care + OP cost (Out Patient / primary care) + IP cost (In Patient / secondary & tertiary care), transportation cost and opportunity cost.
- Most insurance schemes in India have a skewed focus towards IP requirements, given the latter being an insurable risk whereas the former being of non-insurable nature.
- An OP event can be categorized into mainly three sections i.e. Consultation, Diagnostics and Generics.
- Research driven epidemiological exercises can effectively govern preventive-promotive strategies introduced at the intervened site.
- The costs incurred for the preventive-promotive (PP) interventions will drive down the cost of delivering 'fixed-price health care'.
- *Thin front-ends* with sufficient technological facilitation can bring down the cost of seeking health-care by addressing the last mile problem as the walk-ins required for the

financial sustainability of these units is proportional to the local demand at the community level.

- The walk-ins are also ensured by facilitating proximity which is inversely correlated to the transportation and opportunity cost involved in-seeking care from the nearest town based health-care provider.
- The current urban/rural demand of health care seeking clients cannot be met alone through doctor-centric models. Hence, exploring alternate, equally competent resources is pertinent for attaining scalability to address the potential rural market of 820 million.
- Insurance schemes in India have either the problem of over-utilization through the aggregators and providers holding a bias towards IP care or underutilization owing to large distances between villages and empanelled health-care providers.
- Accessible health kiosk at the village level provide '*effective gate-keeping*' mechanisms, as the customer seeking hub-&-spoke unit is an independent entity not driven by either the insurance (health-care payer) or hospital (health-care provider) perspective ensuring an Optimum Usage of Empanelled Services.

### **Key Innovations Implemented through the Project:**

The project will operate through the hub-&-spoke model, wherein each unit will comprise of 20 front-end health-clinics/kiosks. The back-end (hub) supervising these kiosks will house doctors - managing both the network of kiosks and the upward referral network for secondary and tertiary care. The doctors will provide continuous assistance to the front end GNM's through telemedicine, videoconferencing and coordinating regular visits of specialist through empanelled providers at the kiosks. Along with the doctors the back-end hub will also house a pharmacy and a diagnostic lab. The back-end pharmacy will house generics, listing over 100 drugs with high utilization for delivering primary health care. The pharmacy will be managed by a full time pharmacist. 3 full time doctors will lead towards establishing a *virtual* doctor-nurse ratio of ~6. The diagnostic lab housed at the hub aims to manage the in-house diagnostic referral demand post the kiosk level.

### **Pilot Site - Pattukottai (block), Thanjavur (district) Tamil Nadu**

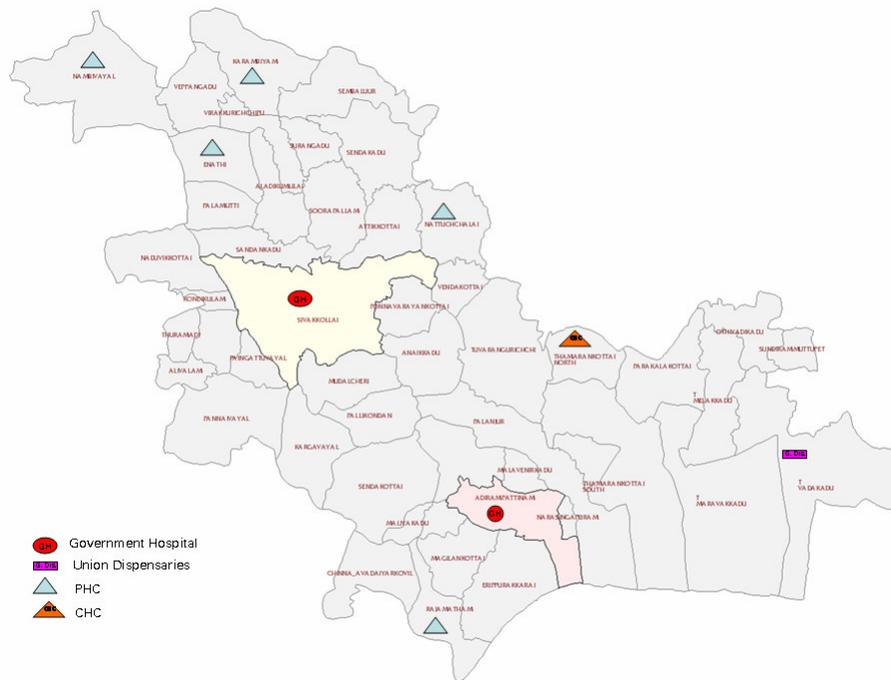
With 81% immunization (urban + rural), IMR at 31 (urban:23, rural: 37) and with an average of 90% institutional deliveries as highlighted in NFHS-III for Tamil Nadu clearly suggests the progressive nature of general health of the population. A fairly decent public health system in the state of Tamil Nadu, along with multiple private health care providers questions the feasibility of the venture in the chosen geography along with simultaneous evaluation of an alternate site.

Being a relatively progressive state, indicates towards the willingness, ability and awareness of the clientele towards seeking healthcare, wherein *quality* is the driving factor. A multitude

of technological innovations offered through our network assure quality, guaranteeing buyin from the local community. Innovative health financing schemes – seeking to implement ‘fixed-price health-care’ offering end-to-end services from curative to preventive-promotive sets aside the pilot as a community organizer, highlighting the long term vested interest of the pilot in community well being.

Thanjavur (block), Tamil Nadu has both the HDI (Human Development Indicators) and GDI (Gender Development Indicators), Per Capita Income and life expectancy at birth ranking amongst the bottom five within the districts in Tamil Nadu. The literacy rate as per 2001 census is between 70 - 80%. Thanjavur shows a moderate poverty ratio range i.e. 30 - 40%. Thanjavur population as per 2001 census was 22,05,375 with a rural population of 14,57,204 i.e. 66% of the district population is rural. Thanjavur District is the Rice Bowl of Tamil Nadu.

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. In the district of Thanjavur a total of 7,211,581 out-patient cases and 3,22,367 in-patient cases were treated in the year 2005-2006. Thanjavur has a total 296 doctors and 485 nurses. Thanjavur has a total of 3 medical stores for Indian medicine and 1430 stores for English medicine.



**Figure 8:** Mapping of the Public Health Systems in the Pattukottai block of Thanjavur district

Pattukottai block has 6 PHC’s placed at Enathy (approx. pop. 16,219), Karambayam (approx. pop. 16, 466), Nambivayal (approx. pop. 24,369), Nattuchalai (approx. pop. 23,635), Rajamadam (approx. pop. 37,363) and Thamarankottai (approx. pop. 24, 154). As shown in

*Fig. 8*, the Health Kiosks will be strategically placed in staggered villages/locations, so as to compliment the existing government health system and provide accessibility to remote areas within the geography.

**Health Kiosk:** Each kiosk will be situated at the Village Panchayat Level with a population ranging from 6,000 – 10,000 people i.e. ~ 2,000 Households. Hence, each unit (20 Kiosks) will have an approximate catchment population of 150, 000 people.



**Figure 9:** Proposed three dimensional design for the “Thin Front End” health kiosk and the hub housing the doctors, pharmacist and a diagnostic lab

**Design of the Health Kiosk:** The health kiosks are envisaged as clinics equipped to cater the primary health-care needs along with being the nodal point for all the preventive-promotive exercises. The envisaged HR innovation of having nurse-centric kiosk, and facilitators like telemedicine and EHR helps towards allocating bare minimum space for the kiosk attaining a space-effective modular design governing the affordability of the unit. The infrastructure at the kiosk provides for a patient bed to facilitate telemedicine measurements specifically ECG. Also, a fridge to store basic generic drugs, rapid diagnostic kits and a small waiting area has been provided for at the health kiosk. Given our underlying hypothesis of preventive care, leads to a strong focus on having print-ads, posters, and hand-outs in the local lingua highlighting the same.

**Human Resource Innovations:** The modular health-kiosks will be managed by a GNM (General Nurse Midwife) ideally with 3 – 4 years of experience in a conventional hospital environment. The added financial sustainability rendered to the system through these innovations provides both a deeper rural penetration, and scalability.

As the current public health system in India is designed with the health sub-centre delivering primarily preventive-promotive care through an ANM (Auxiliary Nurse Midwife). The pilot aims to suggest a transition of the current public health system towards a more efficient model, providing better accessibility at the village level.

Learnings from similar health care delivery models e.g. the Arvind Eye Care wherein the rural people are not only viewed as the potential consumer for the health care facilities offered but also as a meaningful contributor (producer) by training and empowering potential candidates to deliver health-care in a sustainable/profitable manner at the village level. These innovations help in addressing the dearth of trained medical practitioners catering to the health-care requirement of the rural sector.

The pilot aims to adapt the ‘nurse-practitioner’ model to the Indian Rural Sector health-care context with the following role envisaged for the ‘*entrepreneurial nurse*’ led Health-Kiosk:

- Diagnosing, treating, evaluating and managing non-life threatening acute and chronic illness and disease (e.g. diabetes, high blood pressure)
- Obtaining medical histories and conducting physical examinations
- Ordering, performing, and interpreting diagnostic studies (e.g., routine lab tests, bone x-rays, EKGs)
- Prescribing medications
- Prescribing physical therapy and other rehabilitation treatments
- Providing prenatal care and family planning services
- Providing well-child care, including screening and immunizations
- Providing primary and specialty care services, health-maintenance care for adults, including annual physicals
- Providing care for patients in acute and critical care settings
- Collaborating with physicians and other health professionals as needed - providing referrals
- Counseling and educating patients on health behaviors, self-care skills, and treatment options

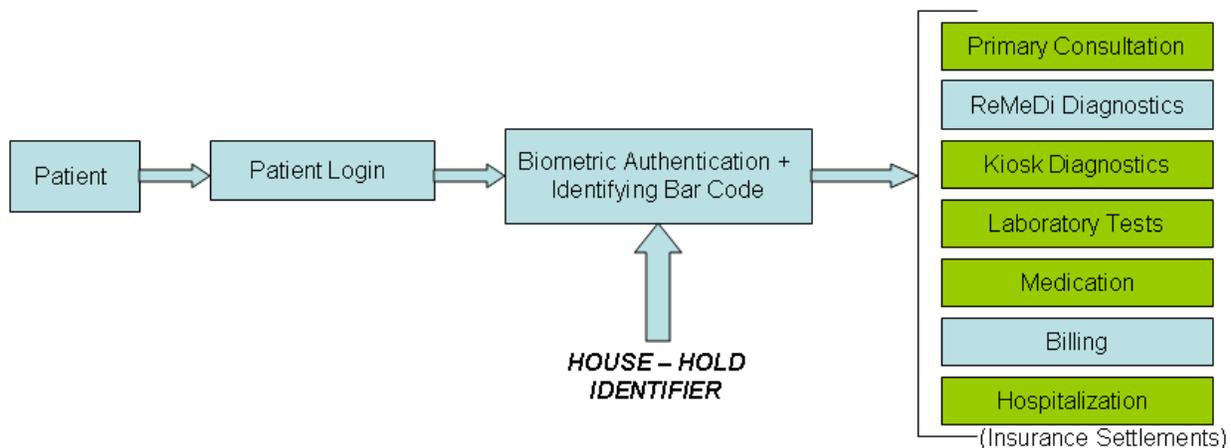
## Collaboration with Centre of Excellence / Advanced Training - Nursing

Training and supporting nurse-practitioners as key health service providers is an essential element in conceptualising the pilot. A Nursing Centre for Excellence renders human resource strategies, including expertise in training, quality of care, retention, incentives, and community participation to the pilot. Strong advocacy efforts are expected to emerge from this initiative, especially in terms of the role of nurses in Indian health systems, henceforth, reiterating the need to prepare a cadre of entrepreneurial nurse practitioners at the rural level, wherein appropriate training modules form the core of their performance. The Nursing Centre for Excellence will provide the listed technical support and assistance:

- Technical inputs and international comparative perspectives in the design and model-building phase
- Support in designing and conducting training programmes and processes for nurse-practitioners, supervisors and other key functionaries
- Research expertise to rigorously evaluate and document the processes and impact of project interventions

### Leveraging on technology:

In the past two decades, the advancement in information and communication technologies has been rapid and has come with a sharp decline in the costs of these technologies. In the health sector also, there have been efforts to develop models that make appropriate use of these technologies to move the system towards a better state. The field is still new and more innovation is required to understand the nature of these technologies better and test their appropriateness in the complex context of the health sector.



**Figure 10:** Out-patient treatment process flow at the thin-front end health kiosk

The array of services provided through the EHR network are highlighted in *Fig. 10*. The technological innovations piloted are categorized as follows:

**Electronic Health Records (EHR):** A collaboration with Yos Technologies, a Bangalore based EHR provider has been established. Working closely with Yos will ensure appropriate customization of the EHR for the pilot site. The data-base aggregated through this partnership will be shared jointly by ICTPH (IKP Centre for Technologies in Public Health) and Yos Technologies for statistical analysis governing the implementable curative as well as preventive-promotive interventions.

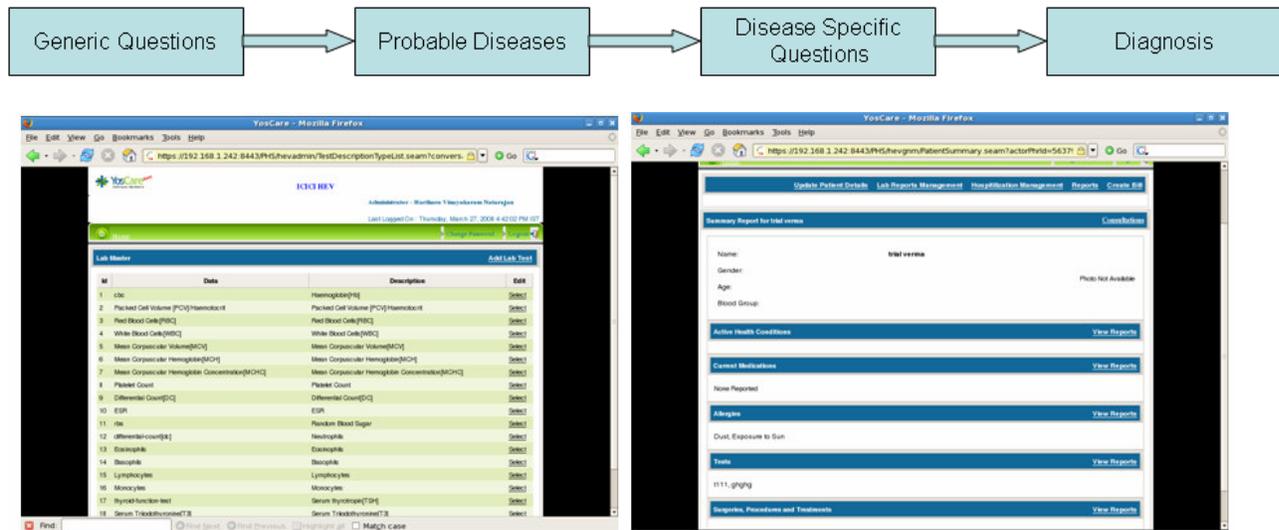
An **electronic health record (EHR)** refers to an individual patient's medical record in digital format. EHR systems increase physician efficiency and reduce costs, as well as promote standardization of care. EHR aims at including patient demographics, medical history, examination, progress reports of health and illnesses, medicine list, allergy lists, immunization status, laboratory test results, radiology images (X-rays, CTs, MRIs, etc.), photographs, from endoscopy / laparoscopy or clinical photographs, medication information, including side-effects and interactions, evidence-based recommendations for specific medical conditions, record of appointments and other reminders, billing records.

Facilitating EHR through the pilot will effectively facilitate the below listed features:

- Accessibility of healthcare services from urban hospitals / doctors: ***Remote Access***
- Continuity of healthcare services to the end user: ***Continuous Care***
- Monitoring and tracking of end user health status and conditions: ***Preventive Care***
- Effective communication channels to the end user to increase awareness of healthcare and healthcare programs: ***Health Education***

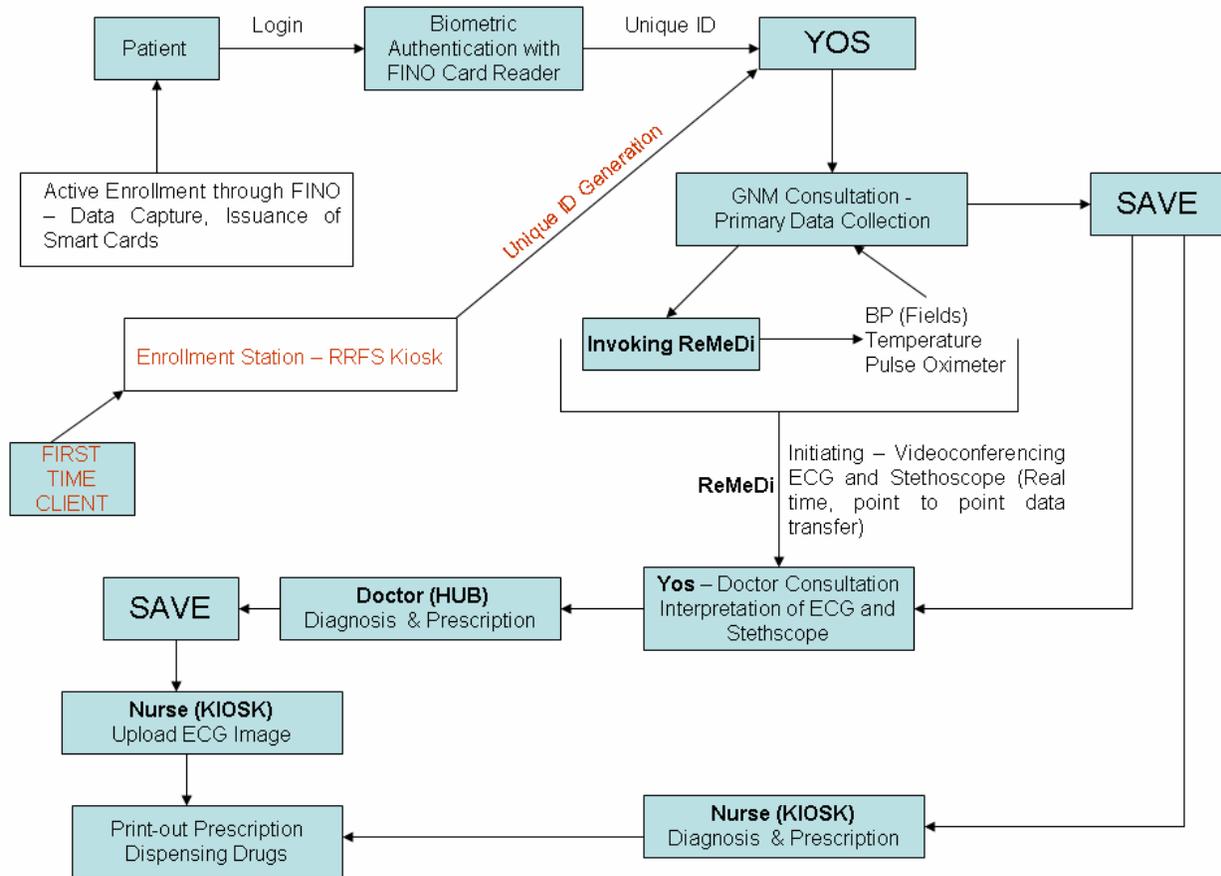
**Telemedicine:** A partnership with Neurosynaptics Communications Pvt Ltd. (<http://www.neurosynaptic.com>) to deploy their telemedicine (ReMeDi – Remote Medical Diagnostics) device at the pilot site as a mode to connect the health kiosk - GNM nurses to the back-end doctors for video-conferencing, consultation and real time diagnostics facilitating real time transfer of a given set of parameters evaluated through ReMeDi has been established. ReMeDi was developed in collaboration with the Indian Institute of Technology, Madras. The kit can be installed at villages and other remote locations, which have Internet connectivity (70Kbps). ReMeDi can measure and transmit basic parameters like: Temperature, Non-invasive Blood Pressure, Pulse Rate, 12 channel ECG , Oxygen Saturation Level and in Blood (Optional), Lung capacity (Optional), Electronic Stethoscope (to capture the respiratory and heart sounds). It comes with software that enables real-time audio/video conferencing at extremely low bandwidths, standalone and store-and-forward mode supported, image capture and storage in patient records, text chat facility, and so on.

The software works with a normal configuration PC with web-camera, speakers and microphones, and is available for Windows 98/ME/XP. There is Interface available with ReMeDi-MDAU for capturing physiological parameters and its storage for future reference.



**Figure 11:** Electronic Health Record, guiding framework. Snapshot of the web-based electronic health record portal

**FINO** (Financial Information Network Organization): A partnership with FINO for handling data/client acquisition and account formation in the EHR system developed in collaboration with Yos Technologies has been established. FINO will issue family-based smart cards to the clients facilitating biometric identification (avoiding fraudulent activities) along with storing primary health information of the customer. This smart-card can be used both at the kiosk level and the secondary network hospital level to link to the EHR of the given patient, avoiding duplication of tests performed, along with an appropriate medical assessment given an access to medical history of the client. *Fig. 12* provides the detailed process flow associated with electronic health records. ***FINO will also act as the primary anchor for developing the technology platform with relevant partners, promoting joint collaboration and managing long term relationships with these partners.***



**Figure 12:** Detailed layout of the electronic health record process flow. Synergizing the web based Yos electronic health record portal with ReMeDi – Neurosynaptic telemedicine devise and FINO – smart card technology

**Diagnostics:** A preliminary analysis of the data obtained from a representative set of PHC's (*Table 1*) in the pilot district hinted at the OP requirements of the targeted population (on an average each PHC observed a daily OP load of 100 – 150 patients). Further, disintegrating the obtained data into utilized diagnostic services guided the Kiosk design towards complimenting the ReMeDi diagnostics with a set of rapid diagnostic kits.

Amongst the stated categories the most common diseases observed at the PHC were respiratory tract infections, pyrexia related problems (viral, malaria, typhoid etc.), dermatological issues (eczema, scabies etc.), worm infestation, anemia, hypertension, diabetes mellitus, acute diarrhoeal diseases, urinary tract infections. The diagnostic tests required to validate the above stated conditions e.g. pregnancy test kit, malaria, tuberculosis, hypertension, typhoid fever, anemia, diabetes mellitus, acute diarrhoeal diseases, urinary tract infections will also be housed at the health kiosks.

**Table 1:** Out patient care seeking patients categorized into various categories based on the representative data gathered from PHC's in Thanjavur

<b>DISEASE CATEGORY</b>	<b>OBSERVED %</b>
<b>Respiratory System</b>	<b>16.6</b>
Cardiovascular System	5.02
<b>Pyrexia Related Diseases</b>	<b>13.39</b>
Connective Tissue Disorder	6.37
Pregnancy Related Disorder	2.36
Skin	9.73
<b>Gastrointestinal System</b>	<b>12.34</b>
Genito Urinary System	4.11
Neurological Disorder	0.69
ENT	7.15
Dental	2.83
Ophthalmic	3.06
Nutritional Disorder	8.83
Endocrine System	2.36
Accidents and Injuries Including Burns	2.73

**Pharmacy:** The hub-&-spoke model as promoted through the pilot facilitates the centralized storage of pharmaceutical drugs which will in turn support the front-end inventories at the health-kiosk managed by GNM. Drugs will be procured through a joint collaboration established with the Biocon Foundation and the Karuna Trust. Given the underlying focus on quality, direct procurement from the generic manufacturer i.e. LOCOST, Baroda – will ensure quality generics being supplied to the health kiosk network.

### **A Unique Management of the PHC through Public-Private Partnerships (PPP)**

The Karuna Trust was handed over the management of Gumballi (Integrated Rural Development Project - Yelandur) PHC in 1996 in a unique and pioneering example of public-private partnership in primary health care. The success of Gumballi PHC and its impact as a 'model PHC' have strengthened the idea of PPP. Now, Karuna Trust runs 30 PHC's in all the districts of the state of Karnataka & 9 primary health centres in Arunachal Pradesh. The PHC's run by Karuna Trust are practicing models of innovative and novel approaches to deliver primary health care.

## Epidemiology – Designing & Implementing Preventive Promotive Strategies

**Epidemiology** is the study of factors affecting the health and illness of populations, and serves as the foundation and logic of interventions made in the interest of public health and preventive medicine. It is considered as a cornerstone methodology of public health research, and is highly regarded in evidence-based medicine for identifying risk factors for disease and determining optimal treatment approaches to clinical practice. The work of communicable and non-communicable disease epidemiologists ranges from outbreak investigation, to study design, data collection and analysis including the development of statistical models to test hypotheses and the 'writing-up' of results for submission to peer reviewed journals. Epidemiological practice and the results of epidemiological analysis make a significant contribution to emerging population-based health management frameworks.

Population-based health management encompasses the ability to:

- Assess the health states and health needs of a target population
- Implement and evaluate interventions that are designed to improve the health of that population
- Efficiently and effectively provide care for members of that population in a way that is consistent with the community's cultural, policy and health resource values

The health and response to environmental stimuli of an individual depends on his/her genetics, nutritional status, immune system, and neuro-hormonal integrity. There has never been a comprehensive study that clearly evaluated the gene expression profile, immune and neuro-hormonal responses to external factors such as nutrients, infection, and other environmental stimuli (like sound, pollution, etc.) in Indians. Such an evaluation is expected to give fundamental understanding as to the physiological, biochemical, and pathological responses of an individual to various external agents and this knowledge, in turn, would give insights as to how human body responds and heals itself when injured.

The deep rural penetration and outreach aims to undertake these investigations along with other research institutes. A strong strategic focus on preventive-promotive research as supported by the underlying principle of disseminating 'fixed-price health-care' inclusive of both the preventive and curative needs of the population. For this model to succeed 'effective community participation' is of utmost importance – ensuring equitable risk pooling, as will be reflected through a direct correlation observed between epidemiological disease incidence and the disease profile of hospitalization claims.

Data will be collected from a sample of population in the selected villages pertaining to their environment, nutrition, anthropometry (height, weight, body mass index, and for children

their birth weight, growth pattern, disease(s) incidence, and immunological profile to various immunizations; and in women data regarding the age of marriage, reproductive health, pregnancy and its associated events including illness); present health status will be recorded, and blood sample will be collected (subject to ethical clearance). This data will be recorded once in a year and computerized. Routine and essential biochemical analysis will be performed (such as Hemoglobin, blood glucose, blood urea and serum creatinine).

Based on the data derived from this survey, *targeted preventive-promotive and curative* measures will be implemented. Based on the careful analysis of the data collected from study subjects as outlined above, it is perfectly possible to develop models that predict accurately physiological, biochemical, and pathological responses to various stimuli such as nutritional factors, infections, etc.

There is sufficient evidence indicating that for many diseases, appropriate preventive measures bring down the need for curative care to a significantly lower level. Taking this understanding into account, implementing appropriate preventive-promotive measures will bring down the incidence of most prevalent diseases in the intervened geography.

As curative expenditure holds a majority influence on health-pricing, a significant influence is expected on 'pricing' health-care as the saving on curative expenditure will outlay the expenditure on preventive-promotive exercises.

### **Collaboration with Research Organization:**

**ICTPH** (IKP Centre for Technologies in Public Health): ICTPH along with serving the role of coordinating and implementing the entire program will also utilize its in-house expertise in epidemiology - guiding the design of survey, partnering with survey organization for field implementation, data-analysis driving the preventive-promotive strategies from their design, implementation to success evaluation. ICTPH will also conduct lateral comparison with similar programs in different geographies henceforth, refining the scale-up strategies. These assignments will guide ICTPH in innovating, delivering and implementing reasonable solutions facilitating development of newer diagnostic and therapeutic solutions.

**ICCHN** (ICICI Centre for Child Health and Nutrition): ICCHN is a funding and research centre focused on the health and nutrition of vulnerable women, infants and young children. The Centre carries with it almost a decade of experience of working in the area of health, with special expertise in the preventive and promotive care. ICCHN will guide the preventive and promotive interventions of the Venture, along with providing support for research in the Venture.

**Innovative Financing:**

The rural scenario has a number of players managing health-insurance schemes mostly skewed towards IP care, with no attention to OP and PP requirements, along with no or little consideration to the transportation costs and opportunity costs involved in utilizing the nearest available health-care facilities within the insurers network. This has led to a limited success of these schemes both in terms of outreach, continuity (renewal rates) and growth (new enrollments) through rural populations.

As per the IRDA regulations health insurance needs to provide a minimal coverage period of one year, inculcating the traditional short-term approach of most health insurance providers. As the insured cannot be assured continuity of their coverage beyond a year, and in particular when they could become 'bad risks', dramatically reduces the incentive to insure when people perceive themselves as 'good risks', as the value proposition of insurance to such clients is the long-term protection of their assets. Innovative health-financing schemes **investing in multiple-year/long term coverage** of the insured attracts genuine demand, as generated through insurance education and promotional efforts.

In a drive to bring down the premiums as a strategy to promote universal acceptance, the cover is often reduced to the bare minimum, along with introducing a cap on surgical/hospitalization events (IRDA requires a must cover ('cap') no less than Rs 5,000 (per individual) or Rs 10,000 (per household)). Given the average surgical expenditure incurred by the household for these high-cost events is considerably high as compared to the coverage provided through insurance, still leads to a significant out-of-pocket expenditure questioning the sole criteria of 'insuring' against health associated financial 'volatility'. Hence, a clearer **evaluation of the local demand for medical procedures along with negotiating costs with health care providers will ensure optimal delivery of services and customer satisfaction.**

A lump sum **payout on diagnosis of a critical illness** irrespective of hospital stay/bill provides the much needed financial cushion to the household to deal with a catastrophic health event

**No claim discounts** on renewal premiums incentivizes the client towards realizing the long term association benefit

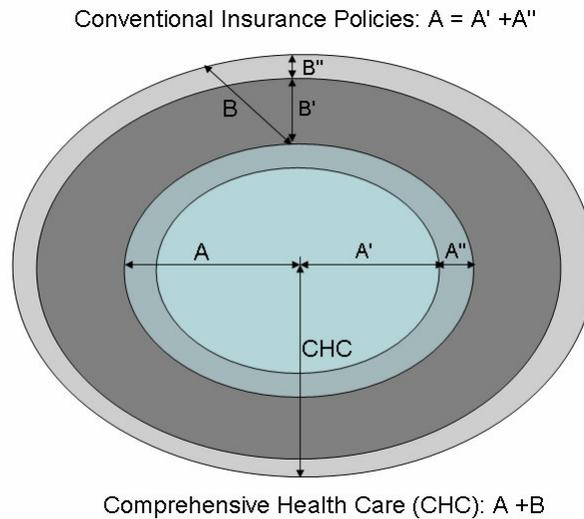
Appropriately **incentivizing** the 'gate-keeping' staff (doctors and nurses) ensures a healthy OP – IP balance maintained within an ecosystem

Exploring **partnerships with emergency care providers e.g. EMRI** (*Emergency Research Management Institute, Hyderabad is working closely with multiple state governments to promote and manage the '1-0-8' toll free number across the states coordinating emergency care*), will ensure accessibility of paramedical care along with transportation to the nearest hospital providing a true 'connect' between primary health care providers and networked secondary/tertiary healthcare providers catering to the hospitalization and catastrophic needs.

The imbedded aim to innovatively ‘price’ end-to-end delivery of health care, poses the challenge of accounting for the various events preceding and following a ‘care-seeking’ episode for a household.

One can broadly categorize the health-care expenditure of a house-hold into:

Preventive-promotive (PP) + primary health care (OP) + hospitalization (IP) + Transport + opportunity cost



**Figure 13:** Defining Comprehensive HealthCare (CHC) – conventional IP insurance cover (A) complimented with OP care (B)

As shown in *Fig. 13*, (A) highlights the conventional health insurance cover provided by insurers mainly insuring in-patient care (IP). (B) provides for out-patient care. A comprehensive ‘Curative’ health-care package will be priced as:

$$CHC = A + B$$

But with PP (preventive-promotive) and technological facilitation will hopefully be:

$$CHC (PP) = A' + B'$$

$$\text{Cost of delivering (PP)} \leq A'' + B''$$

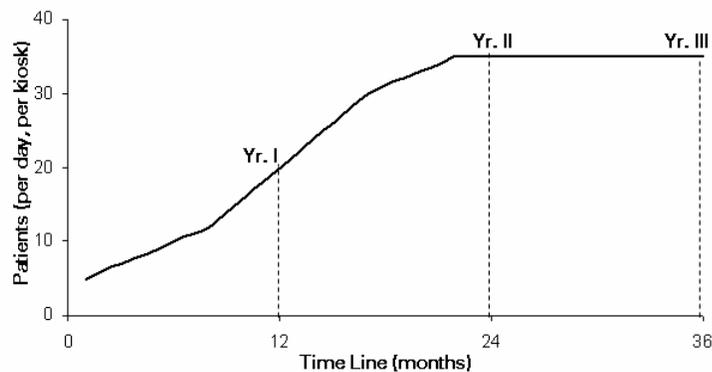
$$CHC \gg CHC (PP) + \text{Cost d (PP)}$$

As the strategic focus of the pilot on PP, was dealt with in the epidemiology section, clearly reflecting upon the ‘price’ reduction for delivering health. Implementing community based schemes wherein the price for delivering preventive-promotive services is also included as an integral part of the premium, translates the Public Good nature of PP to that of a Private Good.

### Pricing OP (Out-patient Care)

- **OP** will be provided through the Kiosk network, the OP activities can be broadly categorized into Consultation, Diagnostics (ReMeDi and Rapid Diagnostic Tests) and Generics.
- The **consultation will be priced at Rs 20/- per visit** - which includes telemedicine video-conferencing session with the doctor housed at the hub – if required. (A field survey of the pilot site suggested that the local practitioners are charging a fee ranging from Rs 30/- to Rs 100/-, for a range of consultations from MBBS doctors to specialists).
- A **margin of 25%** is assumed on the **generics dispensed** through the Health Kiosks. With an average spending of Rs 10/- per person, per visit
- A margin of **20%** is assumed on the **delivered diagnostic tests** at the health-kiosk. With an average cost of each diagnostic test at Rs 25/-
- 100% walk-ins would require consultation at the Kiosk
- 50% walk-ins would require an additional test at the kiosk, to facilitate diagnosis (with an average of one diagnostic test per person)
- Number of consultation days per month 25

A conservative estimate of the patient walks-ins, building up at a steady rate is highlighted in Fig 14:



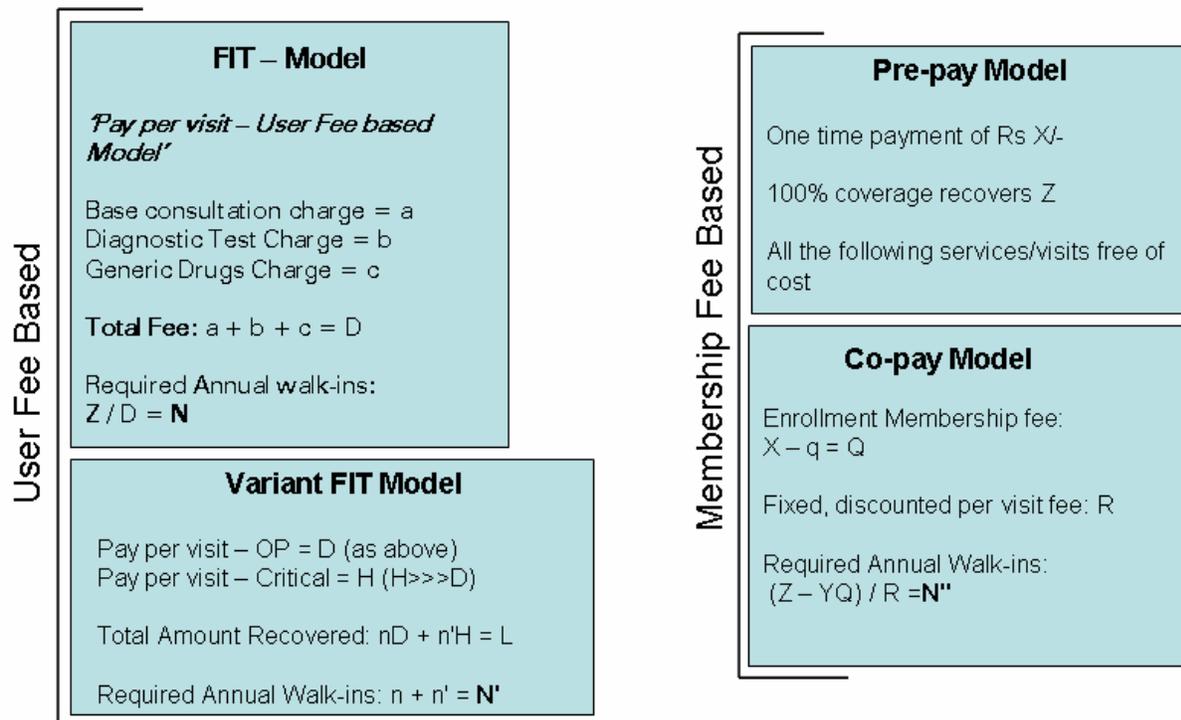
**Figure 14:** Yearly build-up of number of walk-ins per kiosk, per day achieving an equilibrium stage at the end of second year with a daily client load of 35 walk-ins per day, per kiosk

Further validation of these assumptions will be achieved through the epidemiological health survey that will precede the launch of health Kiosks. These surveys will serve a dual purpose of health 'need assessment' along with analyzing the services provided through the existing health care providers - both private and public, the willingness and ability of local population to pay for these services. An estimate of the size of OP rural market (average no. of OP visits

per year per house hold) will assist towards evaluating a speculative market share for the pilot.

### Pricing 'Fixed Price Health Care' – (OP + IP)

As discussed earlier the price for out patient care as evaluated in the previous section needs consolidation with the IP pricing (conventionally charged by the insurance providers) and also account for implemented facilitative PP interventions in the given geography. At the community level there are multiple options that can be explored as a mode to implement the *comprehensive cover* provided.



**Figure 15:** The proposed health financing models – User-fee & membership fee based. A close evaluation of the required walk-in for all the proposed schemes brings forward the expected correlation i.e.  $N \gg N' \gg N''$ . As the former aims to promote positive selection, hence only charging the 'actual' health-client, whereas the membership fee based models intrinsically aim to pool the risk at the community level, henceforth reducing and capping the household contribution [Number of households in the intervened population – Y; Cost of delivering comprehensive health care at the household level – X; Total cost to be recovered from the community to financially sustain the implemented scheme –  $X*Y = Z$ ]

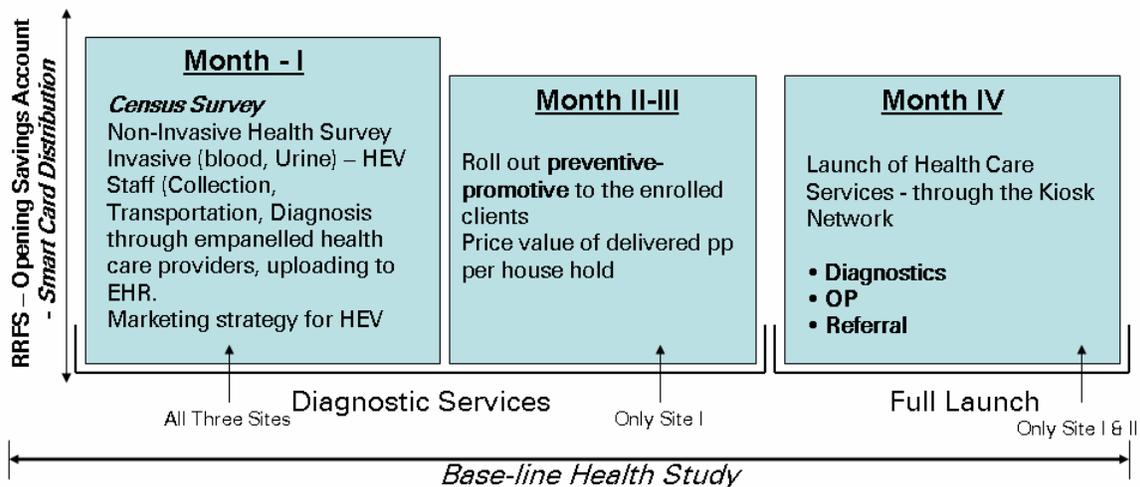
The options could range from the FIT (free individual travel) model, wherein just a 'fixed' user fee is charged upon utilization of services. Implying a fixed price is paid both for a visit seeking primary care and/or a catastrophic health event, revoking the observed correlation

between health ‘shock’ and health expenditure at the household level by providing the risk buffer at the community level. The proposed FIT option is only applicable in a geography where the health care provider has 100% coverage and the numbers of walk-ins for primary care are substantially high to pool for low probability high-cost health events. Through such an intervention a clear promotion of positive selection is observed, wherein the health-care seeking population pays more as compared to the healthy population. Another variant of the FIT model correlates the severness of health event to the price charged i.e. primary care visits are priced relatively lower as compared to the charge for a hospitalization event.

An orthogonal alternative to the FIT model are the membership-fee based models. Within the membership fee based strategies a pre-pay model with one time premium payment entitling members for free visits to seek all levels of care are feasible options but meet with criticism of misuse of provided services. Capping the number of free visits at the primary level works towards avoiding misuse of the services provided. An alternate option is to introduce co-pay at the primary level ensuring optimal usage of the facility, avoiding overcrowding of both out-patient and referral services.

## Research and Deployment Strategy

As proposed, the strategy for the pilot aims to innovate in a number of areas i.e. human resources, technology, health-financing, pricing preventive-promotive care. Hence, it is envisaged that an intensive research phase as shown in *Fig. 16* will precede deployment phase.



**Figure 16:** Intensive research roll-out strategy for SV-RHCS

**Site Selection:** Three villages will be selected in the short-listed geography of Pattukottai district of Thanjavur. A pre-defined set of parameters will govern the homogeneity in site selection e.g. population of village, proximity to a public health care service, proximity to a

town. One of the three sites will be the control with only a baseline – end line study conducted for comparison.

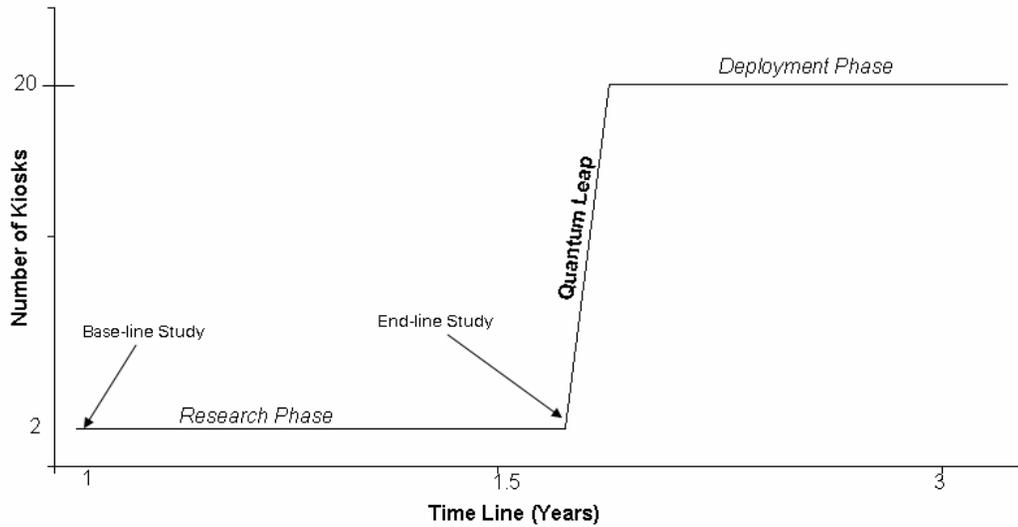
**Epidemiological Survey:** A detailed census house hold survey will be conducted in all the three selected sites. The survey aims to evaluate the base-line parameters for health also evaluating invasive health parameters. The survey will bring forward the constitution of health expenditure, willingness to pay, quality evaluation of private and public health-care providers, health problems (communicable, life-style, occupational and/or environmental).

**Site-specific Targeted Interventions:** The epidemiological survey will help evaluating the core drivers of health expenditure of the surveyed populations. The underlying hypothesis highlights the feasibility of segregating a set of ‘principal’ healthcare events from the observed health expenditure profile of a population.

Evaluating the main causalities of health-expenditure at community level, will govern the design of targeted interventions. These interventions will be implemented in only *one of the three sites*, so as to clearly evaluate if the cost incurred at the community level in realizing these interventions will have an impact on the incurred cost for delivering curative services. Also, ideally the intervention implemented at the community level will have a short life-time but high impact.

**Launch of Services:** The Health Kiosk aims to provide three services, Diagnostic, OP and Referral. The diagnostic services will be launched along with the epidemiological survey so as to facilitate the market-entry of a new player in the intervened geography. Through the deployment phase of the targeted interventions only the diagnostic services will be available at the village health kiosk. Only upon completion of desired preventive-promotive interventions a comprehensive launch of the services will be accomplished.

**Impact Assessment:** With an in-depth analysis of the geography, along with targeted preventive promotive interventions, with a comprehensive health-care plan rolled out through the health kiosk providing diagnostics services, OP care and referral, we aim to capture the total health expenditure for serving the targeted population. This will in turn help the pricing of a comprehensive health care package with due weightage to preventive-promotive activities. Also as only one of the three chosen sites will experience a roll-out of the community interventions, a comparison with geographies wherein no intervention was delivered but a pre-defined list of services were provided through the health kiosk to the control site, where neither an intervention nor the launch of the health kiosk was observed will help in detailed impact analysis.



**Figure 17:** Scale-up strategy regarding the simultaneous launch of health kiosks in different geographies within a district

### Scale-up strategy of Health Kiosks:

After the research and development phase wherein a detailed impact assessment study will help in refining the 'fixed price health-care' financing strategy, as shown in *Fig. 17*, a synchronized launch of 20 Health Kiosks will be observed. The health kiosks will provide the core services – Diagnostics, OP and Referral, completing the envisaged hub-&-spoke unit. These health kiosks will be launched in 20 different villages with a population of ~ 10,000 people. It is expected that the entire hub-&-spoke ecosystem of 20 health kiosks and a hub housing doctors, pharmacist and a diagnostic lab will break-even in approximately three years.