KARNATAKA'S ROADMAP TO IMPROVED HEALTH

Cost effective solutions to address priority diseases, reduce poverty and increase economic growth

cghr
CENTRE FOR GLOBAL HEALTH RESEARCH

Azim Premji University

CDDEP THE CENTER FOR Disease Dynamics, Economics & Policy
WASHINGTON DC • NEW DELHI

KARNATAKA'S ROADMAP TO IMPROVED HEALTH

Cost effective solutions to address priority diseases, reduce poverty and increase economic growth

Authors:
S. Rao Seshadri[a*], P. Jha[b], P. Sati[b], C. Gauvreau[b], U. Ram[b], R. Laxminarayan[c]

Affiliations:
[a]Azim Premji University, Bangalore, India; [b] Centre for Global Health Research, University of Toronto, Canada; [c] Public Health Foundation of India, New Delhi, India

** S. Rao Seshadri. Email: Shreelata.seshadri@apu.edu.in*

EXECUTIVE SUMMARY

This Report is based on research and analysis undertaken by the Centre for Global Health Research (CGHR) in collaboration with the Registrar General of India (RGI) and the Center for Disease Dynamics, Economics & Policy (CDDEP), applying cost-effectiveness methodologies developed in the context of the Disease Control Priorities Project – 2 (http://www.dcp-3) to data on causes of death in Karnataka. New data indicates that several hundred thousand people in Karnataka are dying prematurely from easily preventable causes. Using verbal autopsy methodology to rigorously follow up on and establish cause of death for deaths reported through the Sample Registration System, the main causes of death for people below the age of 70 in Karnataka from 2001-03 have been estimated as follows:

- Of the approximately 48,044 children under the age of 5 in Karnataka who died in 2012, approximately 11,618 newborns died of prematurity & intra-uterine growth retardation, 4,860 died of neonatal infections, and 5,698 died of birth asphyxia & birth trauma before one month old. Approximately 3,749 children died of pneumonia and 3,628 died of diarrhoeal diseases.
- In 2010, about 8,000 children between the ages 5-14 died of avertable causes. For both genders, about a quarter of the deaths were due to communicable diseases: primarily diarrheal disease and meningitis/encephalitis for boys, and primarily diarrheal disease and measles for girls. Evidently, infectious disease interventions (such as routine immunization) usually reserved for <5 years olds, might also benefit older children. Other significant causes of all deaths in this age group are accidents: for boys, drowning (14%), venomous snakes and animal attacks (9%) and falls (6%); for girls, drowning (9%) and transport accidents (9%).
- An estimated 35,000 young adults aged 15-29 years died prematurely in 2010; the leading killer by far for both men and women was suicide – 20% of all deaths for men and 21% for women. Other leading causes among young men involved high risk behaviours, such as transport accidents, HIV/AIDS, and liver and alcohol related diseases.

- Mothers most often died for reasons that can be addressed by ensuring institutional delivery in good quality institutions, accompanied by emergency obstetric care: haemorrhage, sepsis, eclampsia and complications from abortion or miscarriage.
- The five leading causes of death in Karnataka among both adult men and women (30-69 years) are heart disease, stroke, chronic lung disease, cancer, and tuberculosis. These five diseases accounted for 57% of all deaths among men and 55% among women.

  Based on this analysis of the leading causes of death, we suggest an Entitlement Package of cost-effective, scalable interventions that can avert over 130,000 premature deaths in the state at the cost of about Rs. 650 (US$11) per person per year. Currently the bulk of health expenditures are paid for out-of-pocket, causing a heavy financial burden on individuals and households, especially the poor. In order to reduce regressive and inefficient private out-of-pocket expenditures, total government investment in health must increase substantially. This is very much in line with the recommendation of the High Level Expert Group on Universal Health Coverage, which advocates that the government should implement a health entitlement card which assures every citizen access to a national health package of essential primary, secondary and tertiary care, both inpatient and outpatient (Sen, 2012).

The Government of Karnataka (GOK) can take several steps to achieve good health at reasonable cost: (i) increase health budgets sufficiently to substantially crowd out private spending for the most cost-effective services; (ii) re-allocate currently available funds so as to provide comprehensive coverage for the Entitlement Package; and (iii) put in place a universal health program with a combination of direct government provision through a network of public health facilities at the primary, secondary and tertiary levels; and contracted, well-regulated private provision of selected essential services, paid for by either the government or through social insurance.

Keywords: The Million Death Study; Karnataka; Cost Effectiveness Analysis; universal health coverage

TABLE OF CONTENTS

INTRODUCTION

Government of India's 12th. Plan document clearly lays out the priorities for the next five years: (i) a focus on strengthening public health systems; (ii) enhancing the availability and quality of human resources in health; (iii) making essential drugs and diagnostics available free of cost; and (iv) strengthening support systems such as inter alia accreditation, health information, training and capacity building to ensure quality, accountability and good governance. It is in this context, analysing available data and introducing fresh evidence, that we look at Karnataka and make recommendations regarding how health outcomes in the state can be substantially enhanced through the systematic application of widely available and cost-effective interventions.

Why focus on Karnataka?

Karnataka can do much better

Karnataka has made great strides in health status in the past few decades; for example, life expectancy at birth has increased from 55 years in the early 1970s for both genders to 65 years for males and 70 years for females in 2006-10. While the state generally performs better than the national average on several key indicators (Table 1), there is room for improvement in many areas, such as the use of full ante-natal care (ANC) services (which includes 3 ANC visits, TT injections and 100+ IFA tablets), the early initiation of breastfeeding and the full immunization of children aged 12-23 months [UNICEF Coverage Evaluation Survey (CES), 2009].

Table 1. State-level Comparison of Key Indicators

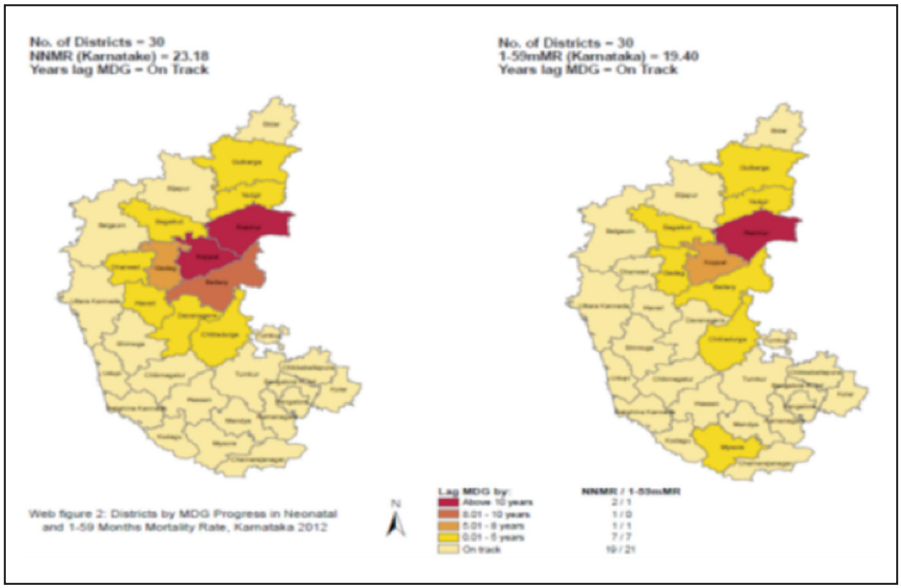
State	Infant Mortality Rate*	Maternal Mortality Ratio**	Full Ante-natal Care %[1]	Full Immunization %[1]	Initiation of Breastfeeding %***
All India	42	178	26.5	61	33.5
Karnataka	32	144	49	77.6	38.2
Kerala	12	66	76.1	82.5	66

State	Infant Mortality Rate*	Maternal Mortality Ratio**	Full Ante-natal Care %[1]	Full Immunization %[1]	Initiation of Breastfeeding %***
Tamil Nadu	21	90	42	56.2	39.1
Maharashtra	25	87	40.9	66.2	51.3
Uttar Pradesh	53	292	13	52.7	15.6
Bihar	43	219	7.8	69.9	16.5

*Source: * SRS Bulletin, Vol. 48, No. 2; September 2013; ** Census of India, Special Bulletin of Maternal Mortality; 2010-12;1 Data for Karnataka, Kerala, Tamil Nadu and Maharashtra taken from DLHS-4 factsheets and for Uttar Pradesh and Bihar taken from Annual Health Survey 2012-13 factsheets; ***UNICEF Coverage Evaluation Survey (2009).*

Overall health outcomes in Karnataka still lag behind neighbouring states like Kerala and Tamil Nadu: for example, the Maternal Mortality Ratio (MMR) reported by the Sample Registration Survey (2010-12) for Karnataka is 144 per 100,000 live births. Although this represents close to a 20% reduction in 2 years, it continues to be the highest among the four southern states. Similarly, Karnataka has achieved the India-specific Millennium Development Goal 4 (MDG4) target of an Infant Mortality Rate (IMR) of <38 per 1,000 live births, but its IMR, which stands at 35 per 1,000 live births is higher than rates in Kerala and Tamil Nadu at 12 and 22 respectively. Figure 1 below shows that the state is on track to meeting MDG4, but 11 districts lagged in achieving the goal in the area of neonatal mortality in 2012, with two lagging by a period >10 years. Measuring 1-59 month mortality, 9 districts lagged behind the MDG goal, with one lagging by a period >10 years (Million Death Study Collaborators, 2010).

Figure 1. Child mortality in Karnataka – Million Death Study Collaborators (2010)



NNMR=Neonatal Mortality Rate

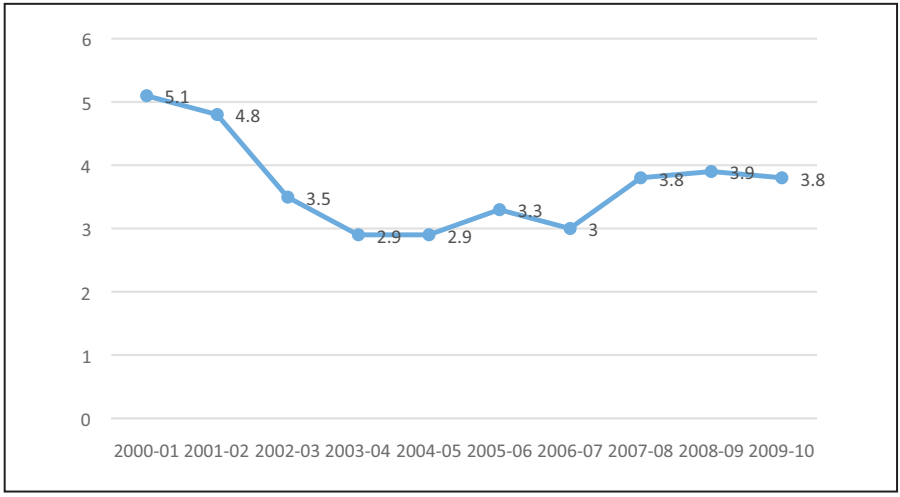
A MDS 2010 study showed substantial geographic and gender disparities in child deaths: of all under 5 deaths in Karnataka in 2005, approximately 82% of deaths occurred in rural areas, and children who live in rural areas were 1.5 times more likely to die than those in urban areas. Furthermore, the state mortality rate for girls aged 1-59 months (49.5 deaths per 1,000 live births) is higher than for boys in the same age group (35.0 per 1,000 live births). Girls under 5 years old are 1.4 times more likely to die of any cause compared to boys (MDS Collaborators, 2010). Child health outcomes are a bellwether for general and future health outcomes for the general population, and in the case of Karnataka, there are significant rural-urban gaps as well as gender gaps in child survival that should be addressed as a priority.

Karnataka Can Afford Better Healthcare

Karnataka is one of the better performing states in the country. In recent decades, the state has emerged as a major economic engine in terms of industrial growth.

Karnataka has strengths in telecommunications, electronics, information technology, and biotechnology, and is a leader in knowledge-based, technology-driven industries. Karnataka invests substantially in infrastructure, and is highly investor-friendly due to the government's encouragement of Public-Private Partnerships (PPPs) (Government of Karnataka, 2010; Karnataka Portal, 2010). The real Gross State Domestic Product (GSDP) grew substantially between 2004-05 and 2011-12 (current prices) at the rate of 14.7% per year (Centre for Monitoring the Indian Economy, 2013). Per capita GSDP (current prices) in 2011-12 was estimated at US$1,624.40. This represents an annualized growth rate of 13.4% between 2004-05 and 2010-11. State tax revenue was estimated to have grown at 17% in the first nine months of FY2012-13. With this surge of public funds, Karnataka can afford to direct more resources toward public healthcare and universal health coverage.

Figure 2. Karnataka Health Budget as a Proportion of Total Budget (2000-2010)



Public expenditures on health remain low at 0.87% of Gross State Domestic Product. Per capita, public expenditure is low, at Rs. 233; in comparison, Kerala invests almost 25% more on health per capita. Tellingly, private expenditures on health are more than twice as high as public expenditures, indicating a disproportionately high and undesirable burden carried by individuals for financing their health care needs.

Table 2. Public and Private Expenditures on Health (selected States) 2004-05 (latest)

	Expenditure (in Rs. million)			Expenditure (in Rs.)		In %	
State	Public Exp.	Private Exp.	Total Exp.	Per Capita Public	Per Capita Private	Public Exp. As share of GSDP	Public Exp. As share of State Exp.
All India	263132.13	1044135.9	1307268.1	242	959	NA	NA
Karnataka	12901.25	33041.5	45742.75	233	597	0.87	3.77
Kerala	9431.01	87545.01	96976.02	287	2663	0.88	4.65
Tamil Nadu	14334.23	66562.1	80896.32	223	1033	0.71	3.43
Maharashtra	20900.91	103402.99	124303.9	204	1008	0.55	2.88
UP	22805.12	151006.06	173811.18	128	846	0.92	3.86
Bihar	8264.17	37256.45	45520.62	93	420	1.12	4.12

Note: State-wise data do not include family planning services, health expenditure by local governments, firms and NGOs.

Source: Table No. 1.3 of National Health Accounts Report 2004-05 of Ministry of Health and Family Welfare, Government of India (latest).

Better Health Boosts the Economy

In the report of The Lancet Commission on Investing in Health (2013), Jamison and others summarize growing evidence that investing in health boosts both personal and national income, as well as 'full' income, a concept that attempts to account for the welfare benefits of improved life expectancy. This powerfully reiterates the arguments made by Jeffery Sachs in The End of Poverty (2004) and recently reaffirmed by Professor Amartya Sen in an interview about his book An Uncertain Glory: India and its Contradictions (The Hindu, June 24, 2013). Furthermore, the improved health of children helps increase their overall learning capacity and future productivity in the workforce as adults. David Bloom refers

[1]*http://www.thehindubusinessline.com/economy/despite-slowdown-karnataka-tax-revenues-clock-17-growth/article4309638.ece*

specifically to the 'demographic dividend', and to measures that are necessary to ensure that this is maximized. High among the priorities are ensuring access to both education and quality health care: "People cannot lead full lives, students cannot learn as well as possible, and workers cannot be fully productive unless they are in good health." (Bloom, 2010). Deogangkar et al (2012), in a systematic review of studies on the impact of immunization on productivity, found that despite substantial variation in the methods of measurement and outcomes used, explicitly including variables of broader economic impacts was found to improve the attractiveness of vaccination.

Who are we?

The Centre for Global Health Research (CGHR), St. Michael's Hospital and University of Toronto, is a non-profit, non-partisan organization that conducts high quality research to advance global health. In an ongoing nationwide study led by India's Registrar General of India (RGI) and CGHR, researchers will administer questionnaires to over one million Indian households where deaths will have occurred in the period 1998-2014. By documenting the circumstances surrounding the deaths, trained physicians can determine the most probable causes of death. This method is called **'verbal autopsy'**, and has already provided invaluable information about premature deaths in India and in Karnataka that can be used to help save thousands of lives.

The Center for Disease Dynamics, Economics & Policy (CDDEP) produces independent, multidisciplinary research to advance the health and wellbeing of human populations in the United States and around the world. CDDEP provided analytical assistance in determining the cost-effectiveness of interventions aimed at neonates, children, and adults to propose a comprehensive entitlement package to the state government of Karnataka. Interventions spanned diarrheal disease, neonatal and maternal health, surgery, acute respiratory infections, acute myocardial infarctions, diabetes, and malnutrition. Interventions also look at scaling up current vaccine and immunization efforts and emergency medical services.

The Azim Premji University aims to create outstanding and effective programmes of learning, research and advocacy in education, development and allied fields like health, nutrition, and livelihoods. The Health and Nutrition Program of

the University particularly focuses on the overarching developmental themes of public health, which are access, equity and efficiency. The Initiative seeks to engage with the major actors in the public health domain with the objective of influencing health priorities, resource allocations, policies, goals and plans. It also seeks to address the challenges of the health system, both public and private, which is responsible for implementing programs and producing desired outcomes.

What is the Purpose of this Report?

Improved health is both a desirable outcome for Karnataka as well as an important input into economic growth. A healthier workforce is a productive workforce and more likely to attract investment and jobs to the state. The purpose of this report is to provide the Government of Karnataka (GOK) with a comprehensive roadmap to achieving significantly improved health. This report describes the leading causes of premature deaths and disability in Karnataka using new research findings, the most cost-effective interventions to address these causes of disease burden and outlines specific steps that can be taken to improve overall health in the state.

Until recently, the causes of premature deaths in India have been relatively unknown because most Indians die at home in rural areas without any medical attention and are not documented.. The MDS has implemented a standardized, validated verbal autopsy system to collect cause-of-death data nation-wide from 2001 onwards. MDS research has shown that several lakh people in Karnataka are dying prematurely from easily preventable causes. By implementing the interventions suggested in this report, over 130,000 premature deaths can be prevented at the cost of Rs. 534 per person per year: about half the price of a monthly bus pass in Bengaluru.

Throughout the report, the following questions will be addressed:

- What are the most common causes of premature death in Karnataka?
- What are the major health system constraints?
- Which interventions would be most cost-effective and what can be done to improve the related health system issues?
- How can the government pay for better healthcare?

LEADING CAUSES OF DEATH IN KARNATAKA

There are an estimated 346,500 avoidable deaths in Karnataka every year (MDS Collaborators, 2010). Here we describe causes of preventable, premature deaths in Karnataka under the age of 70. To target potential initiatives for specific populations, we will address the causes of death in each of the following categories:

- **Neonates** (infants less than 1 month old) and children (between 1 month and 59 months old);
- **Mothers** (15-49 years old);
- **Older children** (5-14 years old) and **young adults** (15-29 years old); and
- **Adults** (30-69 years old).

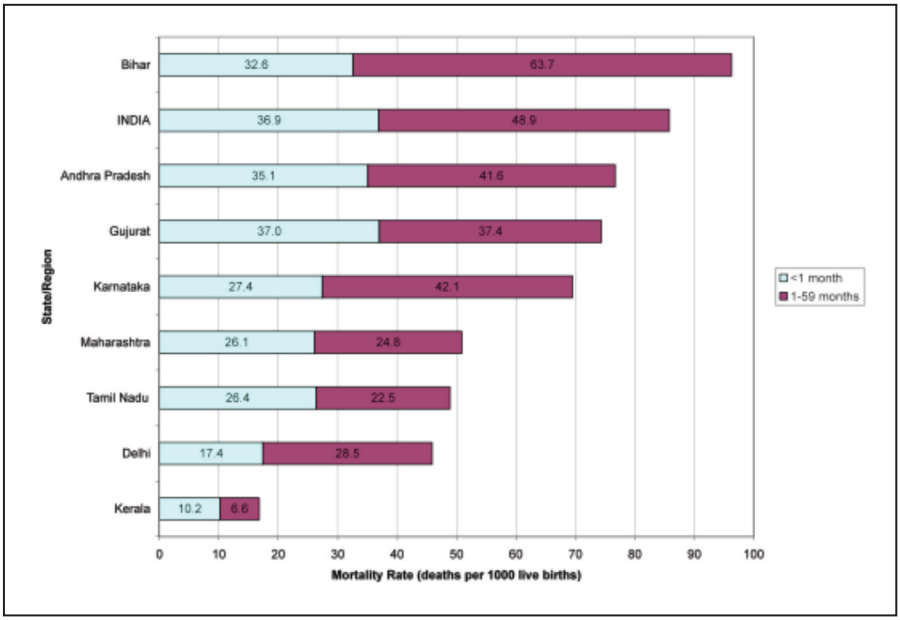
Neonatal and Child Mortality (24% of all deaths under 70)

According to the District Level Household Survey (2012-13), institutional deliveries accounted for about 89% of all births in Karnataka. Delivery in an institution where providers are trained and proper equipment is available is a recognized intervention to reduce neonatal and infant mortality. MDS data indicates that in 2005, approximately 84,000 children (33,000 neonates under one month old and 51,000 children aged 1-59 months) died in Karnataka. Our analysis shows that the majority of these deaths could have been prevented with relatively simple interventions.

Neonatal and Child Mortality Rates

The neonatal mortality rate is the number of deaths of children under 28 days (1 month) per 1,000 live births of the same population per year. The child mortality rate is the number of deaths under the age of 5 years (59 months) per 1,000 live births of the same population per year. The following two figures compares state mortality rates for neonates and children between 1-59 months for selected states of India (Figure 3) (MDS Collaborators, webappendix; 2010).

Figure 3. Comparison of Child Mortality Rates (2005)

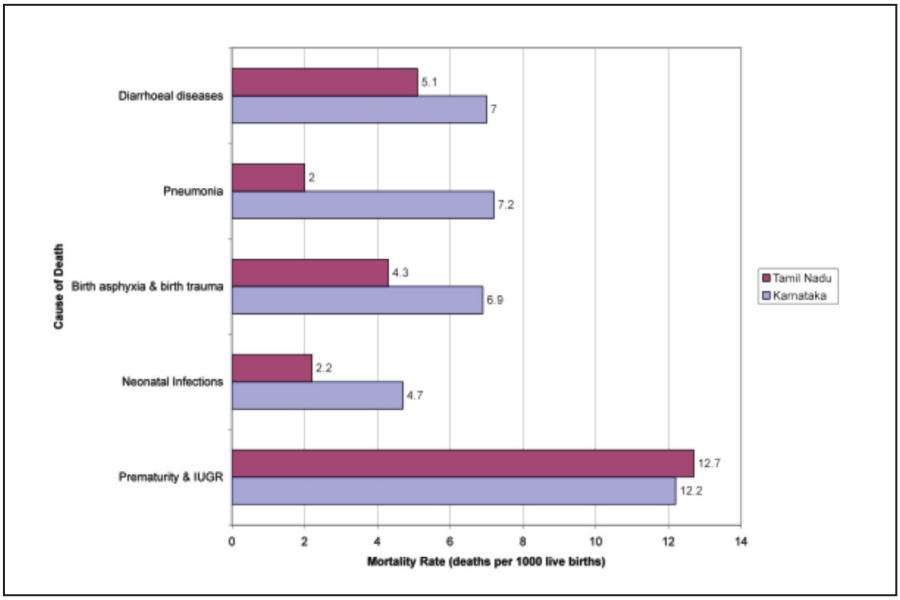


(Source: Million Death Study Collaborators 2010)

In these comparisons, the states neighbouring Karnataka, Maharashtra, Tamil Nadu and Kerala, all have consistently lower mortality rates. Furthermore, the mortality rate for children under five in Karnataka was higher than that for Gujarat and Andhra Pradesh.

Karnataka is often compared to Tamil Nadu as they are neighbouring states with similar economies and demographics. The mortality rates for each of the five leading causes of child deaths under 5 years old are compared for Karnataka and Tamil Nadu (Figure 4).[1]

Figure 4. Child Mortality Rates, Karnataka and Tamil Nadu (2005)



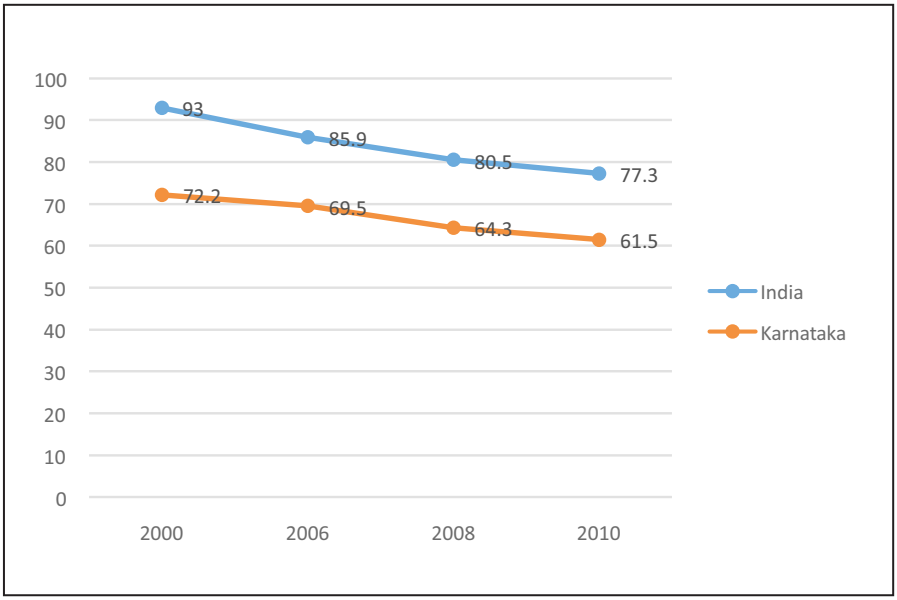
Source: MDS Collaborators 2010
Note: IUGR = Interuterine growth restriction

Tamil Nadu had significantly lower mortality rates compared to Karnataka for four of the five leading causes of death in children under age 5.

Child Mortality Trends

Over the last ten years, mortality rates of children under 5 years have been steadily declining (Figure 5).

Figure 5. Child Mortality Rates for Karnataka and India (2000-2010)



Source: Million Death Collaborators, 2010

While the overall child mortality rates for the state are lower than those for the entire country, the rate of decline between 2000 to 2010 in Karnataka (15%) is slower than the national rate (17%) (CGHR, 2011).

What is Killing Children in Karnataka?

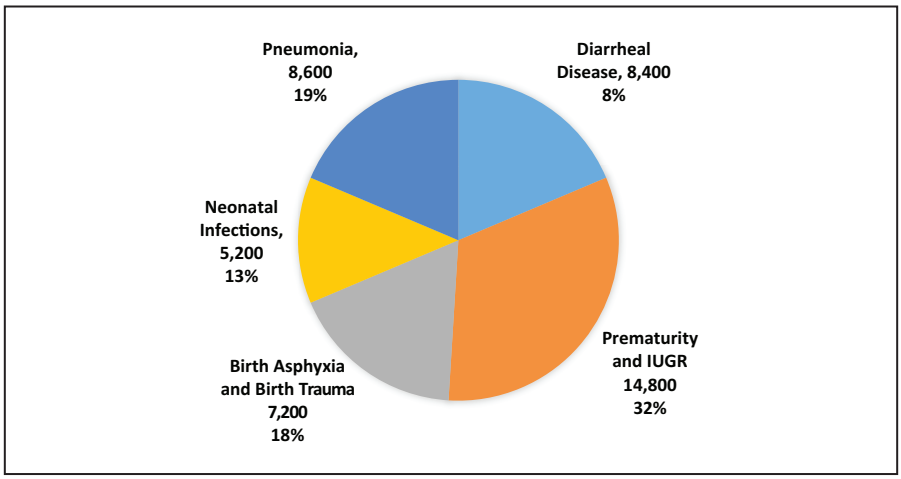
There are five leading causes of neonatal and child deaths under 5 years old in Karnataka:

- **prematurity & intrauterine growth restriction (IUGR);**
- **birth asphyxia & birth trauma;**
- neonatal infections;
- pneumonia; and
- diarrhoeal diseases.

Of the approximate 84,000 children under 5 years old who died in 2005, approximately 15,000 neonates died of prematurity & IUGR, 6,000 died of neonatal infections, and 7,000 died of birth asphyxia & birth trauma before one

month of age. In children between 1-59 months, approximately 9,000 died of pneumonia and 8,000 died of diarrhoeal diseases. Neonatal deaths account for 62% of the top five leading causes of deaths under 5 years old (Figure 6).

Figure 6. Five Leading Causes of Neonatal and Child Deaths in Karnataka (2005)



Source: Million Death Study Collaborators 2010

Maternal Mortality (1% of all deaths under 70)

Maternal mortality is defined as the death of a woman during pregnancy or within 42 days after the termination of pregnancy, but most maternal deaths occur around the labour, delivery, and period immediately following the delivery of a child.[23] Consequently, maternal mortality is closely linked to neonatal mortality.

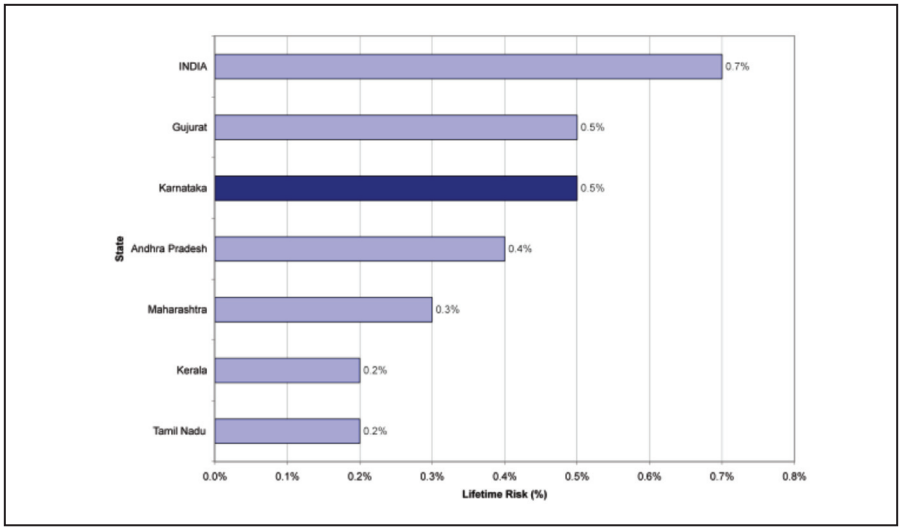
It is estimated that over 2,500 maternal deaths occur each year in Karnataka alone.[13;24] However, maternal mortality levels can vary greatly within Karnataka, depending on access to emergency obstetrical care, the woman's education level, and other factors.[25]

Maternal Risk

Maternal deaths are often presented in the form of the **maternal mortality**

ratio (MMR), which is the number of maternal deaths in women between 15-49 years old per 100,000 live births in a given year.[25] This is the indicator used in this report. **Lifetime risk** of maternal death is the probability that a 15-year-old female will die eventually from a maternal cause assuming that current levels of fertility and mortality (including maternal mortality) do not change in the future, taking into account competing causes of death.[2] Though lower than the national average, the lifetime risk for maternal death in Karnataka between 2007-2009 is relatively high, with Tamil Nadu, Kerala, Andhra Pradesh, and Maharashtra showing much lower risk (Figure 7) RGI Special Report 2007-09).

Figure 7. Lifetime Risk of Maternal Mortality (2007-2009)



Source: Registrar General of India 2011

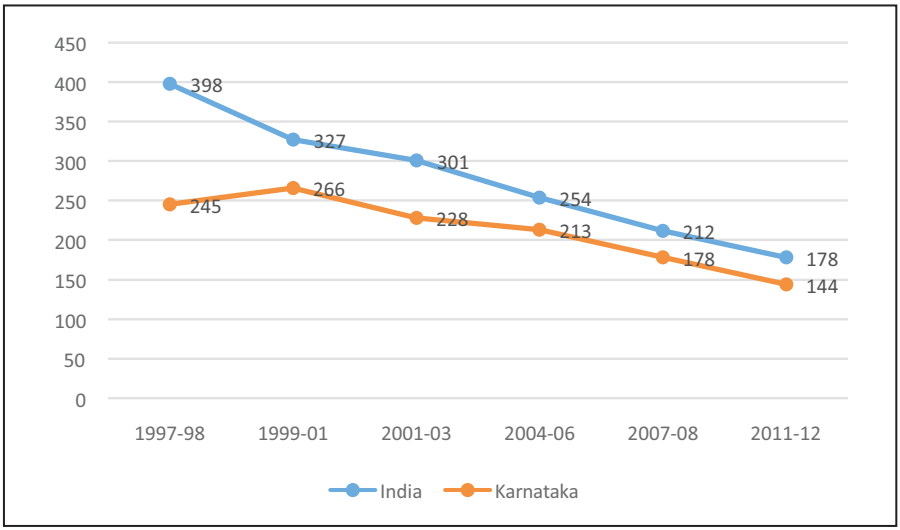
Maternal Mortality Trends

MMRs are declining for both Karnataka and India. But while Karnataka has lower MMRs compared to national averages, the decline for Karnataka (13%) is lower than the trend for all of India (nearly 50%).

---

[2] *WHO, UNICEF, UNFPA, The World Bank, and the United Nations Population Division. Trends in Maternal Mortality: 1990 to 2013. Geneva, World Health Organization, 2014.*

Figure 8. Trends in Maternal Mortality Karnataka and India (1997-2012)

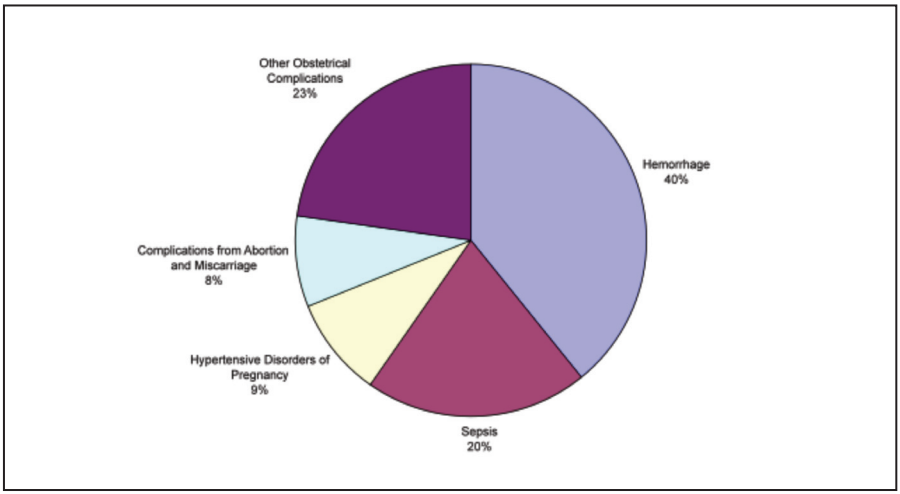


Source: Registrar General of India (1997-2012).

What is Killing Mothers in Karnataka?

In Karnataka, particularly between 2001-2003, the leading causes of maternal death include haemorrhage, sepsis (infection), eclampsia (hypertensive disorders), and complications from abortion and miscarriage, most of them highly preventable (Figure 9) (CGHR, 2011).

Figure 9. Direct Causes of Maternal Deaths among Non-EAGA[3] States (2001-2003)



Source: Centre for Global Health Research 2011

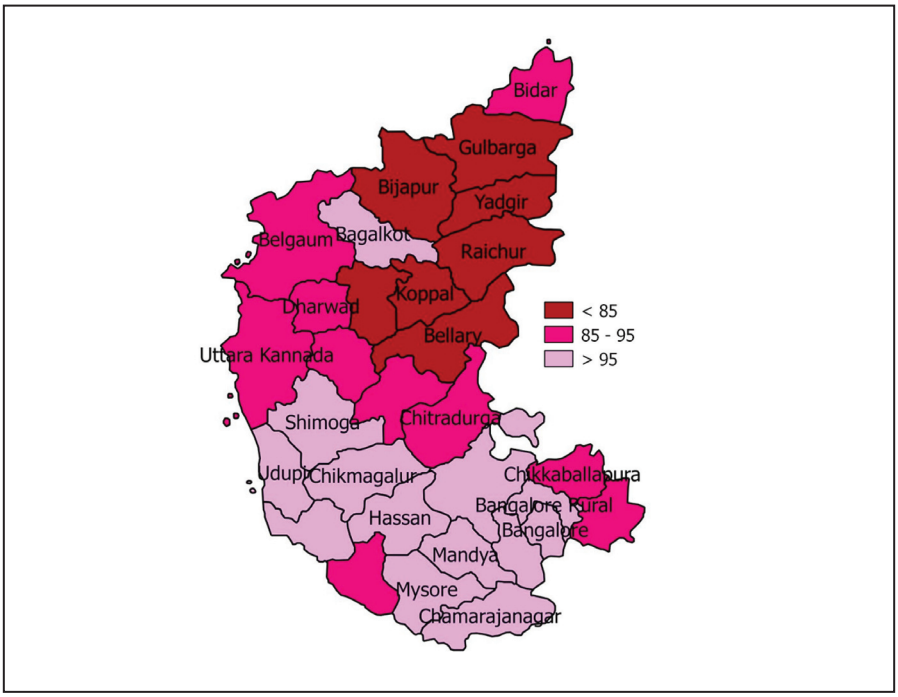
Approximately 70% of maternal deaths from three of the leading causes of maternal mortality (haemorrhage, sepsis, and hypertensive disorders), can be addressed with the emergency medical obstetric care available at health care facilities. Furthermore, institutional deliveries can help reduce complications and deaths from all of the neonatal causes of death listed earlier (prematurity & IUGR, infections, and birth asphyxia and birth trauma). Institutional deliveries for pregnant women, therefore, have been encouraged as the most effective way to reduce both maternal and neonatal deaths. A study conducted in 2011-12 indicated that of 149 First Referral Units (FRUs) across the state that had upgraded infrastructure, only 139 had the necessary facilities to conduct Caesarean sections; and in two study districts, of 14 designated FRUs, only 8 had the facilities to conduct C-sections, and those facilities were not available round-the-clock (IPH Policy Brief, 2012).

---

[3]The Empowered Action Group states plus Assam (EAGA) are nine Indian states identified as being at risk for having the worst health indicators and poorest health system capacity. Karnataka is categorized as a "non-EAGA state". Data for all non-EAGA states were shown here instead of for Karnataka alone because the larger number of deaths from multiple states provided a more reliable profile for causes of maternal deaths.

While Karnataka has similar institutional delivery rates compared to Andhra Pradesh, Maharashtra and Gujarat, it trails behind the rates for Tamil Nadu and Kerala.[11]Regional disparities in institutional delivery rates within the state are also significant, with the southern and central districts performing substantially better than the northern districts. Approximately one quarter of the state districts have an institutional delivery rate of less than 85% (Figure 10).

Figure 10. Percentage of Births Delivered in a Facility, 2012-13



Source: District Level Household Survey 4 (2012-13)

Older Child and Young Adult Mortality

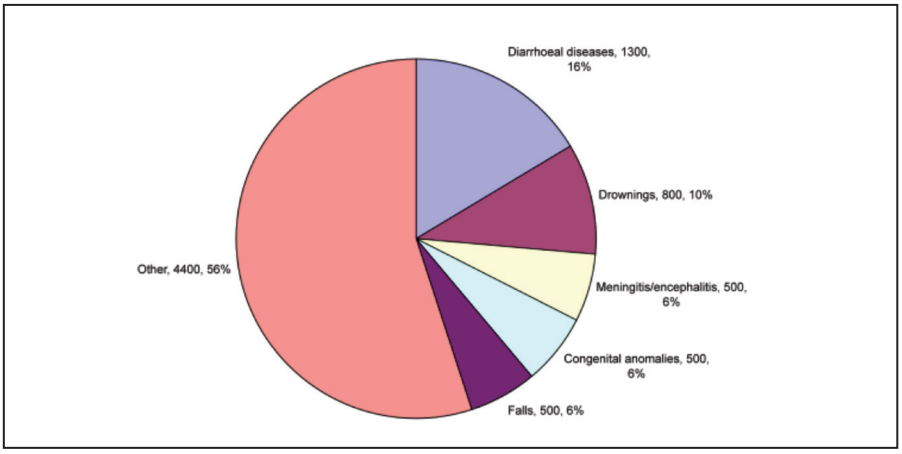
Note: the numbers of deaths at these age groups were relatively low as reported in the MDS and other national surveys, and therefore the causes of death may not be as accurate as those for the other age categories. Nonetheless, it is useful to review the results, as they may reveal certain risk patterns that can be addressed with simple interventions.

Older Child Mortality (5-14 years)
(2% of all deaths under 70)

In 2005, 8,000 children between the ages of 5 and 14 years died prematurely in Karnataka. The five leading causes of death account for about half of the total causes of death among males and females in this age group (Figure 11) (CGHR, 2011).

It is important to recognise that infectious diseases (diarrhoeal disease, meningitis/encephalitis) comprise a significant proportion of these deaths, which suggests that infectious disease interventions usually intended for children under 5 years old might also benefit older children.

Figure 11. Causes of Death Among 5-14 year old Males in Karnataka (2005)



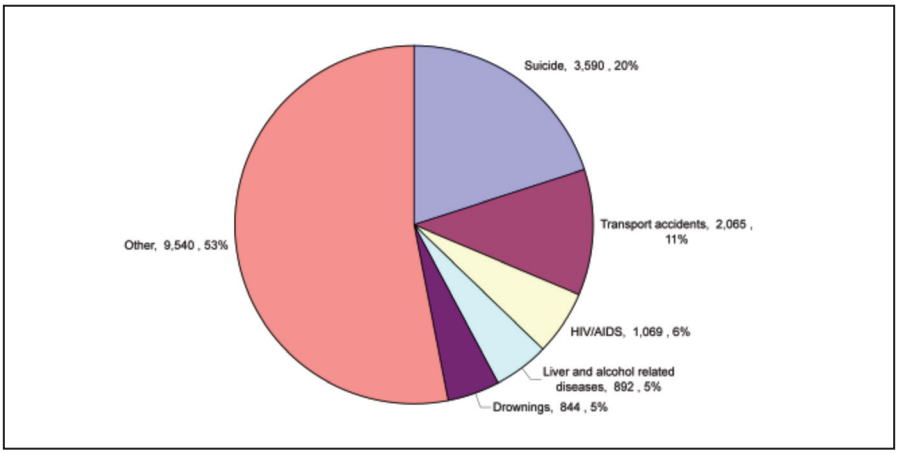
Source: Centre for Global Health Research 2011

Young Adult Morality (15-29 years)
(10% of all deaths under 70)

In 2005, 35,000 young adults between 15-29 years old died prematurely in Karnataka.[28] Although most leading causes vary between males and females, the leading killer for both males and females in this age group, by far, is suicide. Other leading causes of death among young adult males include those that often involve high-risk behaviours, such as transport accidents, HIV/AIDS, and liver and alcohol-related diseases. Following suicide, the leading causes of death

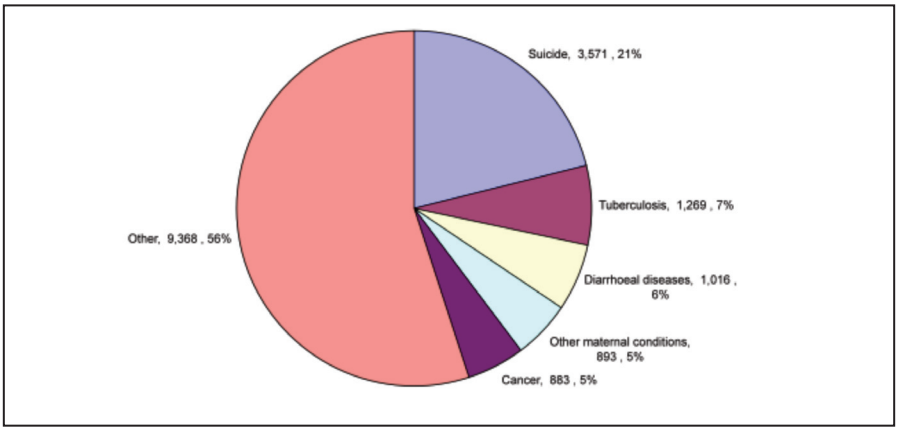
for young adult females include infectious diseases, such as tuberculosis and diarrhoeal diseases, as well as a significant proportion from maternal conditions (Figures 12a and 12b).

Figure 12a. Causes of Death Among 15-29 year old Males in Karnataka (2005)



Source: Centre for Global Health Research 2011

Figure 12b. Causes of Death Among 15-29 year old Females in Karnataka (2005)



Source: Centre for Global Health Research 2011

Adult Mortality
(63% of all deaths under 70)

It is estimated that 217,000 adults between the ages of 30 and 69 years died prematurely in Karnataka in 2005 (Million Death Study, 2010). The deaths were the result of a variety of different diseases, conditions, and injuries.

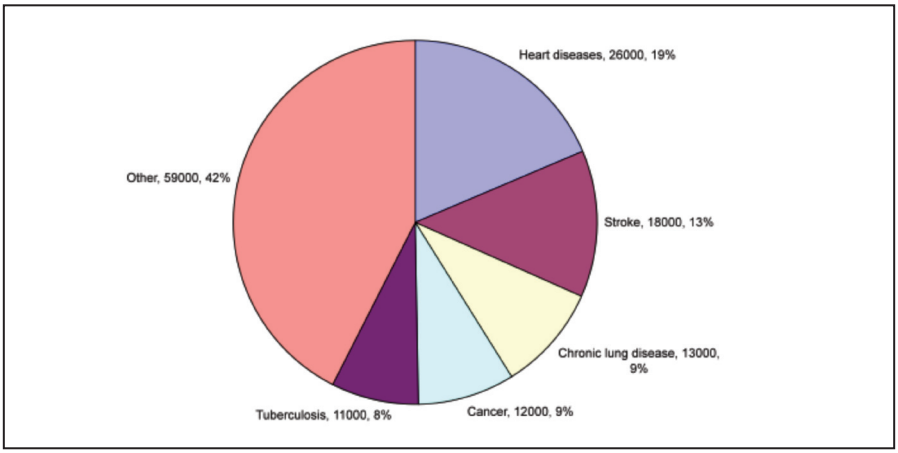
Adult Mortality Rates

Mortality rate is the number of deaths per 1,000 population. The mortality rate for adults aged 30-69 in Karnataka averaged 9.6 deaths per 1,000 population (12.1 deaths per 1,000 population in males and 7.1 deaths per 1,000 population in females). This is higher than the average mortality rate for non-EAGA states of 8.7 deaths per 1,000 population (10.7 deaths per 1,000 in males and 6.7 deaths per 1,000 in females) (CGHR, 2011).

What is Killing Adults in Karnataka?

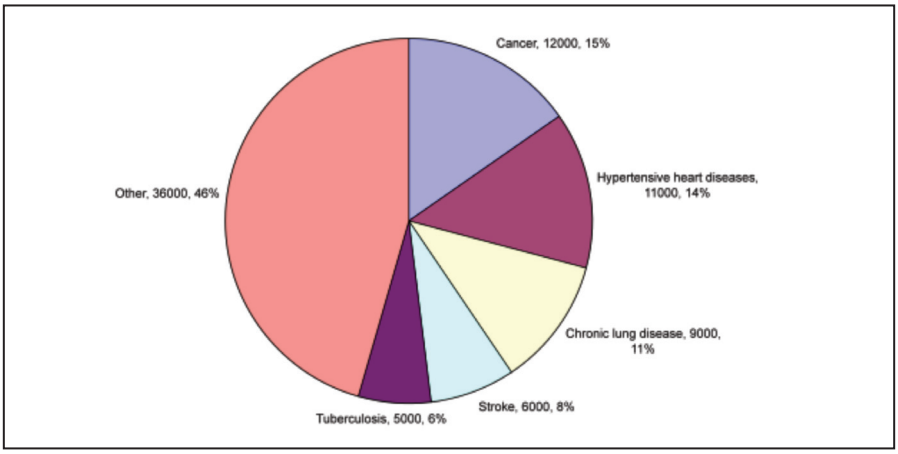
Between 30-69 years old, adults in Karnataka most often die from chronic diseases, although infectious diseases and suicide remain strongly important causes. The proportional breakdown of the leading causes of deaths (as a total of all deaths) for males and females are shown in Figures 13 and 14.

Figure 13. Causes of Death Among 30-69 year old Males in Karnataka (2005)



Source: Centre for Global Health Research 2011

Figure 14. Causes of Death Among 30-69 year old Females in Karnataka (2005)



Source: Centre for Global Health Research 2011

Although the order varies slightly between males and females in this age group, the leading five causes of death are exactly the same for both genders: heart diseases, cancer, chronic lung disease, stroke and tuberculosis. These five diseases account for 57% of the all causes of death in males and 55% of all causes of death in females (Million Death Study, 2010).

The adults in this age group who die from heart disease, chronic lung disease, tuberculosis, and stroke are most often male. Premature deaths from all types of cancer, however, appear to occur equally in both males and females.

Risks of Tobacco Use

Tobacco smoking of bidis and cigarettes currently causes about 1 million deaths a year in India, or about 10% of all deaths at all ages (Jha et al, 2008). Tobacco use poses a major health risk, and contributes extensively to the four leading causes of adult death: heart disease, stroke, chronic lung disease, and cancer.

Despite this fact, there has been an increase in the number of smokers by about 23% in Karnataka over the past decade (3,916,000 smokers in 1998 compared to 4,821,000 smokers in 2010). Furthermore, cigarettes are more hazardous to health, but are slowly replacing bidis as the preferred tobacco product throughout India – especially among young men. A study by Joseph et al (2011) on smoking

patterns across the country showed that the absolute number of cigarette smokers in the age group 15-29 had increased from 2.7 million to 13.2 million between 1998 and 2010 – an almost 5-fold increase! Increase in bidi smoking in the same age group over the same period was far less: from 9 million to 11.5 million. A similar pattern was observed across all age groups, with dramatic increases in the number of cigarette smokers, while the number of bidi smokers remained stable or even reduced.

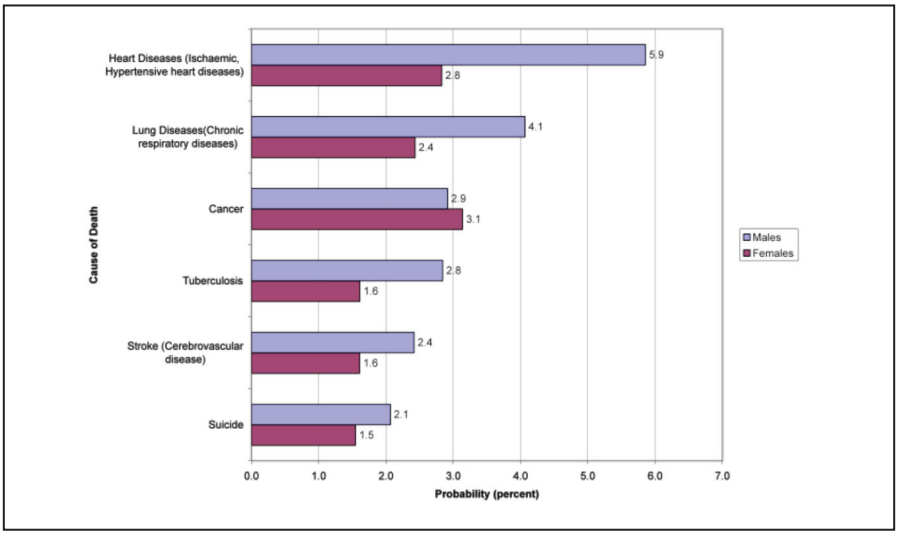
Male bidi smokers are estimated to lose roughly six years of life, while female bidi smokers lose about eight years. The more hazardous cigarettes, on the other hand, cause male smokers lose about 10 years of life (Joseph et al, 2011). A 30-69 year old male smoker in southern India has nearly twice the chance of dying when compared to a male non-smoker of the same age. In addition, 30-69 year old females in southern India are 20% more likely to die than their non-smoking peers (CGHR, 2011).

What are the chances of dying of preventable diseases?

Sometimes the magnitude of this information can be lost in the statistics. To put these data into perspective, one can consider the future parents, workers and leaders of Karnataka. What are the chances that the current generation of youth in Karnataka will lead a healthy and productive life into old age? Conversely, what are the chances that, at current standards, young adults in Karnataka will die prematurely from preventable causes?

In the hypothetical absence of other causes of death, the relative probability of this hypothetical 15-year old dying before age 70 from some of the leading causes of adult death are presented in Figure 15.

Figure 15. Probability of a 15 year old in Karnataka dying prematurely from select causes



Source: Centre for Global Health Research 2011

Some figures are quite dramatic – for example, a 15-year old boy would have a 1 in less than 17 chance of dying specifically from heart disease and a 1 in 24 chance of dying from lung disease. Considering all causes of death, this hypothetical 15-year old has a 30% chance of dying prematurely from any cause before he or she reaches his or her 70th birthday. In comparison, a 15-year old in the United States is only 14% likely to die prematurely before the age of 70 years.

While these figures are sobering, it is heartening to consider that many of these major killers are related, and therefore only a small number of interventions can simultaneously help prevent multiple causes of death. Never smoking or quitting alone would have a major impact in improving the chances that Karnataka youth can become healthy, productive members of the state and die of old age rather than disease.

NECESSARY PRIORITY ACTIONS

Now that the causes of premature death in the state are clear, it is important to also review the health system constraints in Karnataka and India.

Karnataka is uniquely positioned to be a leading state in the reform of India's health care system and implementation of UHC. Major steps will be required to surmount current health system constraints, but these challenges can be overcome. State-level policymakers have the power to save thousands of lives within the borders of their own state, and motivate the rest of India to do the same. But how should the Government of Karnataka begin?

It may be useful to study the progress of successful health reform initiatives in Mexico.

Case Study: Health System Reform in Mexico

A decade ago, Mexico faced similar health issues as India does today: the country was confronted with concurrent epidemics of infectious and chronic diseases; it had wide income inequalities; the system was fragmented and out-of-pocket health care costs were high. In 2003, the policymakers in Mexico implemented a social insurance package – the **Seguro Popular** - that would progressively entitle nearly 5 crore (50 million) people to priority health interventions similar to the package suggested in this report.

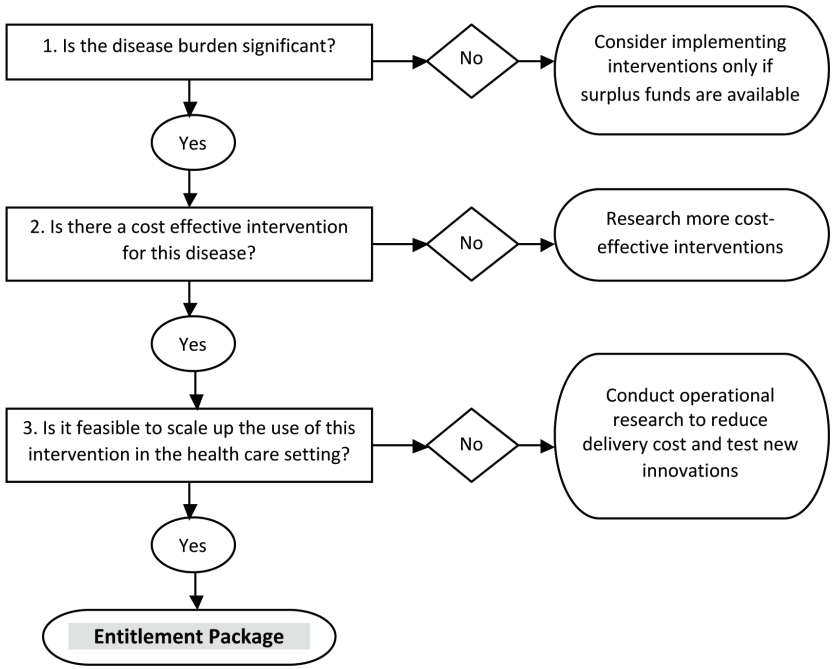
The program was built on two main pillars: the first was to piggyback on and strengthen an existing conditional cash transfer program – ***Opportunidades***; and the second was to continually collect and evaluate evidence on effective interventions and keep the system nimble in terms of responding to on-going changes in the nation's health (Vance, 2012).

There are three reasons why the Mexican reform experience is relevant to Karnataka. First, Karnataka too faces the same situation with regard to out-of-pocket spending, inequality in the distribution of health contributions, and catastrophic and impoverishing household expenditures on health.

The reorganization of financing undertaken by Mexico attempts to respond to these issues. Second, the Mexican reform has been designed and implemented in a resource-constrained setting, where limited health budgets make it necessary to ensure accountability for funds being spent, efficiency in the use of available resources and consumer satisfaction with the quality of care being provided. All these are also relevant and important for Karnataka. The state needs to improve health systems functioning within the available envelope of resources. Third, Mexico's example demonstrates the role played by health in the process of economic transition; and how it is central to economic development. This is a powerful argument for investing in health care, and one that needs to be underlined for policy-makers who decide the allocation of scarce resources. Given that health allocations in Karnataka have been on the decline, this is a timely juncture at which to make this argument as forcefully as possible (Knaul and Frenk, 2005). We argue that this approach is the key to accelerated health progress (Jha and Laxminarayan, 2009).

We propose that the GOK implement an essential Entitlement Package (defined further in this section), a group of specially selected interventions chosen based on their cost-effectiveness and impact on health in Karnataka. The following three-step system was used to determine which interventions should be included in the package (Figure 16).

Figure 16. Flowchart for Prioritizing Health Interventions



Only interventions that met all three criteria were included in the Entitlement Package.

The Lancet Commission on Investing in Health (2013) suggests that a 'grand convergence' in health is possible by 2035, by using available technologies and financing that reduce infectious, child and maternal mortality rates in low income countries to the levels now prevalent in the best performing middle income countries; and this would mean adopting a package of the most cost-effective interventions as well as ensuring their effective implementation with investments in health systems strengthening. Using this framework, the published literature, and the Cost Effectiveness Analysis (CEA) methodology used in the DCPP-2 (www.dcp2.org), the most cost-effective interventions against major causes of death and disability have been identified and presented in the following table. This analysis compares the cost incurred to achieve one unit of health benefit for various interventions. A frequently used measure of 'health benefit' is Disability

Adjusted Life Years (DALYs) averted. The DALY is expressed as the number of years lost to disability, ill-health and death. The total cost for each intervention is arrived at after considering various factors such as cost per incident from local estimates and incidence rates from published literature. Cost Effectiveness Ratio or CER is the ratio of total cost to DALYs averted. Interventions which yield maximum benefit for lowest cost (or low CER) are the most cost-effective. The data use 2005 deaths as a reference point, but very similar results are seen using the more contemporary rates.

The interventions also take into consideration those that can be feasibly scaled up for wider use across the state. The selected interventions are presented as an Entitlement Package (Table 3) that all citizens of the state should have access to as a basic right, through the public healthcare network or, where necessary, using government financing to purchase services from regulated private providers.

Table 3. The Entitlement Package

Intervention	**Cost per person (Rs.)**	**Estimated deaths per year**	**Estimated deaths averted per year**	**Cost per DALY averted (Rs.)**
Neonatal & Maternal Care Package	39.0	34500	20772	13952-16656
Vaccine Program (Measles, Hep. B, Hib, Rotavirus, Pneumococcus)	35.0	32756	17843	31153-58866
Acute Respiratory Infections	29.1	7019	3356	3443.85
Diarrhea (Breastfeeding promotion & ORT)	3.3	6535	5548	3531
Nutrition (Vitamin supplementation & salt iodization)	0.7	872	648	535-652

Intervention	Cost per person (Rs.)	Estimated deaths per year	Estimated deaths averted per year	Cost per DALY averted (Rs.)
Cardiovascular Diseases (Hospital monitoring, cardiac catheterization and angioplasty, Polypill)	177.4	32976	23715	4354-38577
Diabetes (Metformin)	1.7	8483		3729-4295
Breast and Cervical Cancer (Screenings & HPV Vaccination)	25.9	2909	2182	160852-244016
TB (DOTS)	10.1	22674	21340	776-3051
Suicide (Pesticide control)	0.2	3492	1746	204
Basic Surgical Package	45.7	31970	23978	2737
Emergency Care & Ambulance Program	88.7	129274	24331	13935-16420
Total	456.8	313460	145459	

WHAT WILL IT COST?

With public financing, the comprehensive set of interventions suggested in the Entitlement Package would prevent over 145,000 deaths and only cost about Rs. 460 per person per year [Center for Disease Dynamics Economics & Policy, 2012]. Over 20,000 mothers and new-borns can be saved by implementing 100% institutional delivery throughout the state for less than Rs. 40 per person per year. For approximately the same cost, nearly 18,000 children can be saved by immunizing them with essential vaccines. The most inexpensive interventions address diarrheal diseases and undernutrition, with each therapy costing less than Rs. 2 per person, each year, yet saving over 5,000 lives. Among adults with acute myocardial infarctions, over 23,000 lives can be saved with a series of easily available medications, such as aspirin or streptokinase [CDDEP, 2012]. Making basic surgeries and emergency care available to all can save over 48,000 additional lives by simply making the care available to those in need [CDDEP, 2012].

On top of this, the state would need to spend approximately Rs. 200 per capita to fund the reforms and institutional strengthening that need to be put in place in order to make the health system deliver the desired health benefits (author's estimates). This includes investments in information systems, required reporting by public and private hospitals, strict enforcement using National Health Standards on hospital norms, and reform of the drug procurement and human resource management systems. A start has already been made by GOK on many of these fronts; but much more investment in hardware, software and human resources is required to enhance their quality and effectiveness.

This would bring the total to about Rs. 650 per capita (about US$ 13) ***additional*** investment per year that Karnataka would need to make to fully implement the recommended Entitlement Package.

The state has a sufficiently robust physical infrastructure in place to implement the interventions described in the package. Many of the interventions included in the Entitlement Package are already receiving some coverage under the on-

going government programs. For example, with the implementation of the highly effective EMRI 108 Ambulance Service, the GOK already provides one of the recommended items included in the Entitlement Package; should it continue doing so, that would mean that ~Rs. 90 of the total cost of Rs. 450 entailed by the Package is already covered. Other programs, such as the enhanced maternal and child health package, are also being supported under the National Rural Health Mission (NRHM); the Entitlement Package supports additional and further expansion of neonatal care interventions, an area where Karnataka needs to improve performance.

Can Karnataka Afford to Implement the Entitlement Package?

Per capita public expenditure on health has risen from about Rs. 170 in 2001 to Rs. 325 in 2010; but at the same time, the health budget as a proportion of the total budget has shown an overall decline, from 5.1% to 3.8% between 2000 and 2010 (Government of Karnataka, Budget Highlights 2010-2011). In short, public spending on health is lagging behind spending on other sectors as the overall economy state grows. Meanwhile, World Bank data (2011) indicates that out-of-pocket expenditure comprises 86% of private health expenditure. It is time for the state to seriously consider a publicly financed healthcare system that would reduce costs that are normally paid out-of-pocket by individuals and families in the private sector, thereby reducing barriers to seeking appropriate healthcare.

The GOK currently spends about Rs. 325 per capita each year in health; raising this by Rs. 650 would mean tripling the current level of public spending. With higher state growth rates, this may not be challenging. Even at current levels of spending, NRHM documents show under-spending of both Plan and Non-Plan budgets in the years following the implementation of the NRHM: the total budget was underspent by about 35% in 2006-07, about 20% between 2007-09, and by more than 50% in 2009-10. ***Therefore the additional investment required to provide the comprehensive package appears to be well within the government's reach.*** The main issue is to direct both the currently available resources, as well as any additional resources, to: (i) more efficient interventions that save the most lives; (ii) strengthen implementation of programs particularly to correct regional disparities; and (iii) stringently monitoring results. This will ensure that the Entitlement Package is fully implemented and effectively reduces

avertable morbidity and mortality, especially among the poor. Importantly, thus far, programs have been targeted at specific populations – for example, RCH and JSY are largely for the benefit of mothers and children. The Entitlement Package argues for a major investment in people of all ages, both genders and in all regions. It promises a political commitment to providing everyone the opportunity to achieve good health as a political right. Amartya Sen has long argued that such entitlements are central to modern market-based economies (Sen, 1986).

ENSURING UNIVERSAL ACCESS TO HEALTH CARE

Families in Karnataka face a high burden of out of pocket expenditures on health. In a national study, the 2003 World Health Survey found that 7% of households faced catastrophic health payments, defined as out-of-pocket payments exceeding 40% of a household's capacity to pay. Of total out-of-pocket expenditure in 2004-2005, 65.17% was spent on medicine, 16.06% on ambulatory care, 14.98% on inpatient treatment, and 3.79% on other services [National Sample Survey Organization, 2006]. In 2004-2005, households paid 70.4% of per capita expenditure on health while public sources covered only 23.2% [Planning Commission of India, 2005]. Prinja et al found that, of those who opted not to seek medical care, 20% of urban households and 28% of rural households, cited financial constraints as the main reason.

Total health expenditures will have to increase substantially if private out-of-pocket expenditures are to be reduced. In the current fiscal scenario, GOK has several options for doing this: (i) increase health budgets sufficiently so as to substantially crowd out private spending for the critical services suggested in the Entitlement Package, an entirely reasonable recommendation given the current low levels of spending; (ii) re-allocate funds being already spent so as to provide comprehensive coverage for the services covered by the Entitlement Package; and (iii) put in place a universal health program with a combination of direct government provision through a network of public health facilities at the primary, secondary and tertiary levels and/or contracted private provision of services, paid for by either the government or through insurance, to provide comprehensive coverage of health services. We discuss the context for implementing last option below.

In order to reduce the burden of out-of-pocket payments and their negative impact on healthcare access, GOK has been a pioneer in providing financial risk protection options for poor households. In 2003, Karnataka launched Yeshasvini, a health insurance program covering 2.2 million farmers in state cooperatives for an annual Rs. 60 premium. Outpatient services are covered for free and diagnostic tests are provided at concessionary rates in hospitals within

the program's network. The plan also covers hospitalizations up to Rs. 1 lakh and multiple surgeries up to Rs. 2 lakh. Benefits of the scheme were available to spouses and children for an additional Rs. 60 per person per year [Kuruvilla and Liu, 2007]. The scheme essentially covers high cost low-frequency events, with about 1,600 different surgical interventions covered [Radermacher, Wig, van Putten-Rademaker, Muller and Dror, 2005]. An impact evaluation published in 2010 found that the scheme increased the utilization of services while reducing out-of-pocket expenditures; it also demonstrated a workable model of community health insurance in a resource-poor setting, with an emphasis on accountability and local management [Aggarwal, 2010]. In many ways, this scheme (along with similar efforts in Andhra Pradesh) was a precursor to the Rashtriya Swasthya Bima Yojana (RSBY), which became operational in Karnataka in 2008.

Initiated and jointly funded by the central and state governments, RSBY currently covers about 35 million families living below the poverty line (BPL) nationally for a Rs. 30 registration fee. Upon enrolment, each RSBY beneficiary receives a biometric enabled smart card that is accepted at any RSBY hospital across India. RSBY beneficiaries receive inpatient coverage for most diseases requiring secondary care up to Rs. 30,000 per year without co-payment. The program pays for pre-existing conditions upon enrolment and has no age limit. RSBY beneficiaries retain freedom of choice between public and private providers, and hospitals are reimbursed for each patient according to fixed package rates. In coming years the government plans to expand the program by making it available to individuals above the poverty line, increasing the amount of insurance coverage, and extending coverage to outpatient services and drugs (http://www.rsby.gov.in/).

In an effort to provide high quality care to BPL families at super specialty hospitals, GOK has launched the Vajpayee Arogyasri Yojana, a health insurance scheme to cover catastrophic illness for these families. The program, which is limited to five people per family, covers household medical expenses up to Rs. 1.5 lakh, or 5 lakh in exceptional cases, at no expense to the family [The Hindu, 2011]. Currently the scheme is being implemented in North Karnataka, with plans for expansion to the rest of the state.

There is some indication that these public health insurance schemes have helped. From 1993-1994 to 2004-2005 the percentage of people impoverished due to

out-of-pocket health payments declined from 4.29% to 3.86% [10]. In 2005-2006 nearly 10.5% of households reported having at least one member covered by some form of health insurance [National Family Health Survey, 2005-06]. Nevertheless, certain gaps still exist. Table 4 compares the coverage of these schemes to that of the proposed Entitlement Package.

Table 4. Comparison of KN Entitlement Package with Vajpayee Arogyashree and Yeshasvini Scheme

KN Entitlement Package	**Vajpayee Arogyashree**	**Yeshasvini Health Care Scheme**
A. Mothers and Neonates (<1 month) **A1. Maternal Care**		
A1.1. Maternal care package, including institutional delivery	No maternal care package	Maternal care package covered
A2. Neonatal Care		
A2.2. Neonatal care package, including institutional delivery	No neonatal care package	Neonatal care package covered
B. Children (1-59 months) **B1. Vaccine-Preventable Diseases**		
B1.1. Expanding vaccination coverage to 100%, with the addition of: - 2nd dose measles - hepatitis B - Hib - streptococcus pneumoniae (pneumococcus) - rotavirus	No vaccination coverage	No vaccination coverage

KN Entitlement Package	Vajpayee Arogyashree	Yeshasvini Health Care Scheme
Additional coverage of EPI: - TB - diphtheria-pertussis-tetanus - polio - measles		
B2. Acute Pneumonia		
B2.1. Improved pneumonia case management	No pneumonia case management	Pneumonia case management only for children
B3. Diarrhoeal Diseases		
B3.1. Breastfeeding promotion B3.2. Oral rehydration therapy (ORT) B3.3. Zinc supplementation	No diarrhoeal management	No diarrhoeal management
B4. Undernutrition		
B4.1. Vitamin A supplementation B4.2. Salt iodisation	No undernutrition management	No undernutrition management
C. Other Diseases, Conditions, and Interventions (>5 years) **C1. Medical Management of Heart Attack**		
C1.1. Primary treatment of aspirin and streptokinase with secondary polypill treatment	No medical management of heart attack	No medical management of heart attack

C2. Diabetes		
C2.1. Metformin drug therapy	No diabetes management	No diabetes management
C3. Tobacco Control		
C3.1. 33% increase in tobacco prices; warning labels; clean air laws; mass information on risks	No tobacco control management	No tobacco control management
C4. Breast and Cervical Cancers		
C3.1. Breast cancer screenings C3.2. Cervical cancer screenings C3.3. HPV vaccinations (to prevent cervical cancer)*	No screening and vaccinations (Surgeries covered)	No screening and vaccinations (Surgeries covered)
C5. Tuberculosis		
C4.1. DOTS program	No coverage of DOTS program	No coverage of DOTS program
C6. Suicide		
C5.1. Pesticide control control program	No pesticide control program	No pesticide control program
C7. Basic Surgical Package		
C6.1. Basic surgical package	Surgical Package primarily for obstetrics, trauma and injury – Covered	Surgical Package primarily for obstetrics, trauma and injury (It covers more surgeries) – Covered

C8. Emergency Care		
C7.1. First-aid training for lay-people	No first-aid training for lay people	No first-aid training for lay people
C7.2. Ambulance program	No ambulance program	No ambulance program
Additional Interventions in DCP2, but not in KN Report		
HIV/AIDS: - Voluntary counselling and testing - Peer-based programs targeting at-risk groups (e.g, commercial sex workers) to disseminate information and teach specific skills - School-based interventions that disseminate information to students - Prevention of mother -to-child-transmission with antiretroviral therapy	No program (or) Intervention for HIV/AIDS	No program (or) Intervention for HIV/AIDS

These different schemes should be folded into one more comprehensive UHC Entitlement Package that covers theå entire population of Karnataka. Indeed, economies of scale to achieve good health at low cost require pooling of various schemes, an emphasis on enrolling all eligible persons, and to rigorously monitor outcomes.

Second, what is apparent from reviewing these programs is that they are mostly targeted to populations below the poverty line (BPL). **While it is important to offer support for those most disadvantaged, the key strategy for the**

most effective health interventions is to provide access to everyone, independent of income. Eventually, it is important – as in Mexico – to extend coverage to the entire population of the state. Apart from the uncertainties associated with ensuring that all genuine BPL households receive services, there is the issue that the BPL focus may be too narrow because many middle-income households also face catastrophic health costs, often from chronic or prolonged illnesses.

Third, the current focus of health insurance in the state on secondary and tertiary level surgical interventions needs to change. While the insurance schemes do attempt to address the fact that treatment of these conditions could entail catastrophic health expenditures, they are not based on the available evidence on the major causes of death and disability. **Current insurance schemes are not addressing the largest causes of death; instead it is the diseases that are responsible for relatively low disease burden – albeit involving catastrophic expenditures - that are being covered.**

It is essential that the state use its available funding more effectively. What is required is a substantial change from business as usual, and a substantial increase in the scale of what is offered. In line with the recommendations of the High Level Expert Group, we recognize that there are some specific things the state can do. First, it should allocate adequate funds for enhanced availability of drugs – a crucial factor accounting for significant out-of-pocket expenditures even in government hospitals. Second, it could provide higher salaries to doctors, attracting them to serve in public sector hospitals. This would improve the availability and quality of services within government hospitals, reducing the need for patients to seek care in the private sector at prohibitive cost or (worse) go without any care at all. Third, the GOK could put in place a mechanism whereby private providers are registered, qualified and monitored so as to participate in provision of public health interventions (example, JSY Chiranjeevi), and make them eligible to be reimbursed. Finally, the state should reduce crippling out-of-pocket expenditures for all types of care by shifting resources to a comprehensive health insurance program that would ensure greater access to and equity in health care provision.

A comprehensive health insurance program that integrates the various other schemes, and which explicitly focuses on social insurance (but prevents private

indemnity insurance), is required. Such a scheme that would offer services through both government and private institutions and would cover all households (BPL and non-BPL) with the full range of cost-effective health services (primary, secondary and tertiary) would not only address the stigma associated with publicly funded health programs for the poor, but also many of the endemic problems facing the system today:

(i) Put in place a quality control system regulating the quality of care provided by service providers since all participating hospitals/institutions would need to meet certain minimum standards in order to participate in the insurance program (this would effectively create a state-wide database to monitor outcomes and catch fraudsters);

(ii) Establish and implement standard operating procedures (SOP) for the treatment of various medical conditions, using the Indian Public Health Standards. This would ensure that patients received the appropriate surgical and medical interventions for their condition, since deviations from the SOP would not be reimbursed;

(iii) Enforce the existing Essential Drug List by requiring clinicians to prescribe only those drugs that have been included in this list using standard protocols;

(iv) Prescribe Continuing Medical Education and re-certification for clinicians to ensure that they update their clinical skills and maintain the highest standards of quality.

There are also some risks associated with implementing a universal health insurance scheme that need to be taken into account:

First, there is the issue of supplier-induced demand. Since tertiary hospitals stand to profit from inpatient health insurance, the government should tighten its regulatory infrastructure to ensure that unnecessary care is not being provided to patients. Setting caps on spending on tertiary care so that balance is maintained with other forms of health spending is an urgent priority. A related issue is of moral hazard. If patients know that tertiary care will be provided, there is some concern that they will be less prompt in seeking early care for conditions like cardiovascular disease and diabetes, thereby resulting in expensive hospitalization.

Also, there is the issue of providing outpatient care. On the one hand, in any given year, fewer than 2% of families are likely to face hospitalization and the bulk of healthcare expenditure is in an outpatient setting, particularly on pharmaceuticals. This places a large burden on household finances and argues for inclusion of outpatient care in any insurance scheme. On the other hand, however, coverage for outpatient care presents clear risks: (i) there are challenges in ensuring that only legitimate health care providers are empanelled; and (ii) with a large number of outpatient care providers, there is significant potential for fraud, which in turn can drive up premiums.

To address these issues and therefore improve health outcomes we propose some solutions below:

Table 5. Challenges and Solutions

Challenge	**Possible solution**
1. Moral hazard particularly in absence of deductibles/ copayments: a. Tendency to overuse medical services, since there is no fear of financial shock and out of pocket expenditure (insurance coverage and cashless transactions) b. Tendency to neglect the preventive, promotive health care focusing on rational lifestyles	• Intensive IEC campaign to inform beneficiaries of (i) legitimate benefits and entitlements under the insurance scheme; (ii) the hazards of misusing the system; and (iii) the importance of primary prevention of disease.
2. Supplier-induced demand: Tertiary care institutions providing unnecessary care to patients due to in-patient health insurance	• Setting up a strong regulatory mechanism that checks that unnecessary care is not being provided.

Challenge	Possible solution
	• Setting caps on spending for tertiary care
3. Attempts.o game the system: a) Political elites influencing the enrolment process to favor particular individuals/groups b) Political elites influencing the choice of provider/or hospital empanelment process	• Opening up membership to all, irrespective of BPL/APL status. • Using a transparent mechanism such as Universal ID scheme to ensure that data on individual members is accurate and unbiased. • Using a transparent on-line mechanism, with well publicized objective (measurable) criteria, for qualification for service providers under the scheme. • Creating a directory of empanelled private service providers and making it available on-line.
4. Ensuring that management of the scheme – including claim settlement, empanelment, Social Audit, quality of care etc. – is smooth and efficient	• A single nodal agency – such as The Suvarna Aarogya Suraksha Trust – should be established and made responsible for the entire program. • A comprehensive benefits package should be established and then made widely available through various media channels. • The administration of the insurance scheme has to be powered by IT solutions that will ensure that transparent

Challenge	Possible solution
	mechanisms are in place for on-line application and e-authorization of treatments, live updates of information and intensive data analysis. • Stringent monitoring should be instituted for scrutiny of claims, denial of claims, delays in payouts, cross-referrals and quality of care.

Valuable lessons can be drawn from the commitment to health care reform of other countries, such as the United States (US) and China. The US is currently attempting to revamp its inefficient and inequitable health care system, largely private, because it is clear that it is not delivering health outcomes commensurate with the amount being spent. The US spends 16% of its GDP on health – more than any other country in the world – and yet millions are suffering without proper care.

Similarly, China suffered for decades under a market-driven health delivery approach in a fee-for-service medical field that heavily relied on profitable drug treatments. Out-of-pocket spending as a percentage of total health spending grew from about 20% in 1978 to almost 60% in 2001(Yip and Hsiao, 2008). It has since declined dramatically to about 35% in 2010, as a result of a series of reform measures, including a dramatic increase in social health insurance since about 2002 [6]. As part of the overall health sector reform efforts, the government is investing in more supplies and infrastructure to accommodate this increased coverage. Furthermore, with the impressive growth in GDP and the accompanying growth of health expenditure as a share of GDP, health spending in China has exploded and is perhaps the fastest in world history [Eggleston, 2012].

CHALLENGES

When addressing health issues in Karnataka, it is important not only to understand the medical concerns of the population, but also to identify failures in the functioning of the health system. Extensive discussions of the health system issues in India and Karnataka have been published in a number of reports by various groups and organizations (see, for instance, the report of the Karnataka Knowledge Commission).

This Report now turns to examining systemic constraints to achieving the desired health outcomes. The following section is based on extensive consultations by the study team with officials of the Government of Karnataka, members of civil society, academicians and service providers.

Poor Quality of Essential Health Services

Poor quality of care is a critical problem in health service delivery in Karnataka. A study in one of the most backward districts of the state, Koppal, found that weak information systems, discontinuity in care, unsupported health workers, haphazard referral systems and distorted accountability mechanisms contribute significantly to maternal deaths (George, 2007). The study goes on to recommend that further increases in funding be made contingent on fixing these quality of care problems, since otherwise it only means a waste of resources.

Another important quality failure is in the availability of life saving drugs at health facilities. A study conducted in Tumkur District showed that only about 25% of facilities reported no shortage of drugs, while almost 40% of facilities reported that a fifth of essential drugs were unavailable to patients seeking care at the health facility (Karuna Trust, 2010).

Table 6. Availability of Drugs according to GOK norms at Public Facilities

Extent of reported drug shortage	Total facilities (N=11)	
	Frequency	%
No shortage	3	27.3
Less than 5% shortage	1	9
16-20% shortage	3	27.3
More than 20% shortage	4	36.4
All essential drugs available	6	54.5

Source: Transparency Study, Center for Global Health Research, 2010

Management and Organizational Failures

- Lack of adequate human resources: There are substantial shortages in all cadres of staff, including specialists (particularly obstetricians, paediatricians and anaesthetists). Department of Health and Family Welfare (GOK) data from 2013 indicate that while the vacancy in general duty Medical Officers was at around 10%, the vacancy of specialists was close to 50% of the required number. This means, for example, that the government's objective of providing emergency obstetric and neo-natal services (EMONC) cannot be achieved; unless the state is able to provide such services, the decrease in maternal and neo-natal mortality will plateau.

- Low staff morale and motivation: Poor staff morale and motivation are a major cause for doctor absentee-ism and poor quality of care. Findings from a recent study indicate the following key reasons for low staff morale and motivation:[22]
  - Excessive amount of time spent on administrative "firefighting" (with superiors or community members demanding better service that may not be possible) and therefore less time available to concentrate on technical work
  - Low morale resulting from lack of clarity in job expectations
  - Lack of support from superiors in their day-to-day functioning
  - Absence of a structured period of orientation to their professional duties through, for example, induction training

Lack of Transparency and Accountability

A recent study on transparency, accountability and corruption in the health sector found that there are important areas in which the health system is failing patients (results in Table 7) (Karuna Trust, 2010). About 35% of survey respondents had been asked by the Medical Officer/doctor to purchase drugs from a private pharmacy, even though drugs are made available free at government facilities; 13% had been referred to a private clinic; and 11% had paid hospital staff for services. Nursing staff received 47% of these unofficial payments, while 36% went to the consulting doctor. The majority of such payments (64%) were requested for providing medical services that should have been free at government facilities.[32]

Table 7. Corruption in Service Delivery (Exit Interview findings)

Issue	Total Respondents (N=159)	
	Frequency	%
Asked to buy medicines from outside	56	35
Asked to conduct tests outside	22	14
Not provided free medicines from hospital	8	5
Asked to go to private clinic	21	13
Made a payment to doctor, nurse or other staff	17	11

Source: Transparency Study, Karuna Trust

Poor Health Knowledge

Poor knowledge of simple and widely accessible interventions among rural and marginalized households leads to unnecessary deaths, as data from the Coverage Evaluation Survey (CES) conducted by the UNICEF show. Of those who did not deliver in an institution, a large proportion was still ignorant of the benefits of institutional delivery, and opted not to avail of it despite services being available. Similarly, almost 85% of parents who chose not to have their children fully immunized did so because they did not think immunization was necessary. Awareness and utilization of the Janani Suraksha Yojana – a conditional cash transfer scheme to promote institutional deliver – also needs to be strengthened in order to promote safe delivery.

Table 8: Poor Healthcare Seeking Behavior

Reasons for not delivering in an institution:	
No time to go	47.6%
Not necessary	7.3%
Better care at home	12.8%
Lack of Knowledge	4.8%

Reasons for partial or no immunization of children 12-23 months:	
Did not feel the need	83.6%
Did not know about vaccines	5.6%
Did not know where to go	6.3%
Awareness of the Janani Suraksha Yojana (JSY)	77%
Received assistance under JSY	45%

Source: Source: Karnataka Fact Sheet, CES 2009

Resistance to accessing modern health care still persists, especially among tribal communities and some other ethnic groups. Traditional practices, such as a special diet for pregnant women and isolating women during menstruation, are still practiced. It is encouraging to note that younger generations appears to be moving away from such traditions, possibly as a result of better education and awareness.[4]

[4]*Personal communication, staff of the Department of Health and Family Welfare, GOK.*

CONCLUSIONS AND RECOMMENDATIONS

We have shown in this report that key health outcomes in Karnataka are inadequate given its economic prosperity. Like China, Karnataka has the necessary economic growth and resources to fund the suggested health care reform. The concerns raised in the previous section also point to the need for a significant upgrade of institutional quality and governance structures. Without such a change, increased spending on health in the public sector could result in few health and economic gains to show for increased public health spending.

We recommend that Karnataka take a step wise approach in deploying its resources for improved health care. Putting in place the Entitlement Package is step 1, to fill the gaps for less than 100% coverage of current basic interventions. Table 9 outlines these gaps. In the next iteration of health care planning, an updated Entitlement Package would move beyond these basic conditions and would include more expensive/specialized conditions based on the disease burden of the time.

Table 9. Current Coverage of Interventions Recommended in the Entitlement Package

Entitlement Package Recommendations	**Current Coverage**
A. Mothers and Neonates (<1 month)	
A1. Maternal Care	
A1.1. Maternal care package, including institutional delivery	Mothers receiving any ante-natal check-up: 94.5% Institutional delivery: 89.1% Home delivery by skilled personnel: 3.2%
A2. Neonatal Care	
A2.2. Neonatal care package,	Mothers receiving post-natal check-

Entitlement Package Recommendations	Current Coverage
including institutional delivery	up within 2 weeks of delivery: 87.8%
B. Children (1-59 months)	
B1. Vaccine-Preventable Diseases	
B1.1. Expanding vaccination coverage to 100%, with the addition of: - 2nd dose measles - hepatitis B - Hib - streptococcus pneumoniae (pneumococcus) - rotavirus	Children 12-23 months fully immunized: 77.6% Children 12-23 months who have received one dose of measles vaccine: 89.6% Children 12-23 months who have received Hep-B3: 76.1% Other vaccines coverage: 0% through public system
B2. Acute Pneumonia	
B2.1. Improved pneumonia case management	Children with acute ARI in the last 2 weeks who received treatment: 90.7%
B3. Diarrhoeal Diseases	
B3.1. Breastfeeding promotion	Children 0-5 months exclusively breastfed: 73.9%
B3.2. Oral rehydration therapy (ORT)	
B3.3. Zinc supplementation	Children with diarrhoea in the last weeks who received ORT: 56% Children with diarrhoea in the last 2 weeks who received treatment: 77%
B4. Undernutrition	
B4.1. Vitamin A supplementation	Children 9 months and above who have received at least one dose of Vit A supplementation: 80.5% Salt iodisation coverage: 46.1
B4.2. Salt iodisation	

Entitlement Package Recommendations	Current Coverage
C. Other Diseases, Conditions, and Interventions (>5 years)	
C1. Medical Management of Heart Attack	
C1.1. Primary treatment of aspirin and streptokinase with secondary polypill treatment	No coverage through the public system
C2. Diabetes	
C2.1. Metformin drug therapy	No coverage through the public system
C3. Tobacco Control	
C3.1. 33% increase in tobacco prices; warning labels; clean air laws; mass information on risks	There is coverage through various policy measures and the enforcement of COTPA.
C4. Breast and Cervical Cancers	
C3.1. Breast cancer screenings	Public sector program currently being piloted.
C3.2. Cervical cancer screenings	
C3.3. HPV vaccinations (to prevent cervical cancer)*	
C5. Tuberculosis	
C4.1. DOTS program	Case detection rate (new smear positive): 68% DOTS treatment success rate: 83% (RNTCP Report, 2011)
C6. Suicide	
C5.1. Pesticide control program	No Coverage
C7. Basic Surgical Package	
C6.1. Basic surgical package	Basic surgery available as follows: (i)

Entitlement Package Recommendations	Current Coverage
	for obstetrics at Community Health Center (FRU; Taluk Hospital) and above; (ii) for obs/gyn, pediatrics, orthopedics, ENT, ophthalmology and dental at District Hospital and above; (iii) specialist tertiary surgery facilities for cardiology, cancer, brain and spine, orthopedics.
C8. Emergency Care	
C7.1. First-aid training for lay-people	No Coverage
C7.2. Ambulance program	517 ambulances (approximately 1 per 100,000 population) in EMRI Arogya Kavacha program; additional ambulances available in both public and private sector not accounted for.

Source: All the data is from DLHS-4 Karnataka State Fact Sheet (2012-13)

In addition to extending the coverage of essential services and increasing access to the Entitlement Package, the state needs to address the health systems constraints being faced as well. Currently, several initiatives are being implemented to ease some of the key constraints identified above; however, there is more that the state can and should do if it wants to catch up with neighboring states on health systems outcomes.

Table 10. Recommended Priority Health Sector Reforms

Constraint 1: ***Inadequate Public Funding***

- ***Increase public health funding*** (possibly through income tax or other social prepayment system (e.g., tobacco tax).

Constraint 2: ***Disparities in Service Coverage***

- ***Combine all existing schemes into one, all-encompassing program*** that will deliver the Entitlement Package to all citizens of the state.
- ***Enhance availability of key human resources*** by (i) instituting 1-2 year compulsory rural service in rural areas for new doctors, and a guarantee to stay in the state for a defined period; (ii) providing short-term re-training for doctors in anaesthesia and emergency ob-gyn to increase availability of crucial RCH services; (iii) decentralizing staff recruitment to the district-level and requiring staff to remain in their district for a minimum period.

Constraint 3: ***Management/Organizational Failures***

- ***Establish a public health cadre*** under the Director of Public Health.[2]
- ***Establish annual report cards*** on key health indicators, along with district rankings.
- ***Create a focus on results by providing financial or non-monetary rewards/incentives*** for district reductions in mortality (e.g., annual awards for good performance).
- ***Support Management Capacity Building Programs*** at the district level and below, where management challenges are the most acute after decentralization/devolution of programs to the lower levels.

Constraint 4: ***Lack of Transparency and Accountability in the Health System***

- Enforce the ***Private Health Care Establishment Act*** to regulate standards for public and private health services, and conduct independent audits of health care providers.
- Adopt ***e-Human Resources Management*** software package for administering all transfers, ensuring posts are filled with appropriately qualified personnel,[2]

- Establish a ***Public Health Care Intervention Package*** (e.g., the Entitlement Package) that all citizens have a right to expect from public hospitals and publicize this widely.
- ***Engage*** Panchayati ***Raj Institutions (PRI)*** to act as advocates for citizens' rights to basic health services.

Constraint 5: ***Poor health knowledge/social and economic constraints among individuals in the community***

- ***Target female community leaders*** through PRIs and self-help groups to educate and empower other women/mothers in their community about hygiene, infection care, the importance of breastfeeding and ORT, nutrition, and general health knowledge.
- ***Regularly gather feedback/opinions*** from stakeholders.[2]

Finally, the issue is not one of economic affordability, but political will – policy makers need to be determined to eliminate the high toll currently being taken by avertable mortality, and invest in simple cost-effective interventions that will make the crucial difference. There are good examples of this already in place – the TB control program is an example of a successful government implemented program which is cost-effective and delivered through the public system. Based on data made available by the Revised National Tuberculosis Control Program (**http://www.tbcindia.nic.in/perfor.html**), over 10 million people have been initiated on the internationally accepted DOTS (directly observed therapy short course) since the inception of the program in 1997, thus saving an estimated 1.8 million lives; and TB death rates have been cut dramatically from 29% to 4%. The HIV/AIDS control program is another example of this as well, using internationally established best practice strategies to prevent a generalized epidemic and contain prevalence at 0.36%.

It therefore makes sense for Karnataka to now focus resources and efforts to provide the most comprehensive cover for the widest range of beneficiaries. This would mean:

- Bringing together **robust evidence** in an accessible format; and disseminating available information meaningfully to all actors – government at all levels,

communities and their representatives, civil society organizations, media, researchers and academics.

- Strengthening capacity of the government's own health care network with adequate staffing and infrastructure; as well as innovative purchasing of health services from selected **qualified** private providers.
- Ensuring **financial** commitment to ensuring universal access to care; this is not likely to be prohibitive given Karnataka's economy.
- Establishing adequate **safeguards for quality and reliability** of service delivery in both public and private institutions.
- **Changing the organization and administration** of the health sector in the state, with (i) establishment of a separate public health cadre as has been done successfully in a few other states, to ensure delivery of essential basic health care; (ii) capacity building at the district level, with a focus on health systems management, to support decentralized decision-making; (iii) strengthened systems for monitoring and supervision, emphasizing transparency and accountability.

The time is now right for Karnataka to tackle the constraints to reducing avertable morbidity and mortality. It will take a focused strategy that (i) uses the available information on causes of death and cost-effective interventions; (ii) puts in place the recommended Entitlement Package of services; and (iii) ensures that they are universally accessible and of the highest quality.

Ultimately, Karnataka needs to ensure **political commitment** at all levels to universal coverage of the Entitlement Package. This means sensitizing government at the highest levels on the importance of supporting the health sector. Over time, reports such this one, as well as other serious efforts by both government and non-government sources, should result in an enhanced responsiveness on the part of policy makers to the legitimate needs and expectations of an increasingly well informed and vocal citizenry.

Acknowledgements:

The authors gratefully acknowledge the partial support of Disease Control Priorities (3rd Edition) and the Bill & Melinda Gates Foundation.

APPENDIX A – INTERVENTION DESCRIPTIONS

A. Mothers and Neonates

A1.1. Maternal Care Package

The maternal care package is intended to prevent complications and deaths due to a lack of proper care for mothers during pregnancy, labour, and in the period following delivery. This intervention would include the case management of the principal causes of maternal deaths in India (haemorrhage, sepsis, hypertensive disorders or eclampsia, obstructed labour and unsafe or septic abortions), as well as institutional deliveries with available emergency obstetric care for all mothers at a community health centre or a local maternity centre.[9]

A2.1. Neonatal Care Package

The neonatal care package in intended to prevent deaths due to poor neonatal care. Interventions for neonatal care would include:[9]

1. **Essential birth care** – including immediate drying, warmth, early breastfeeding, hygiene maintenance, and infection prevention;
2. **Postnatal visits** – to promote healthy home care practices, including exclusive breastfeeding, warmth protection, clean cord care, and seeking care in emergencies;
3. **Neonatal resuscitation** – using skilled attendants to provide stimulation for newborns who do not breathe spontaneously;
4. **Extra care for small newborns** – to provide extra support for low birth weight and premature newborns, including warmth, feeding, and illness identification and management; and
5. **Emergency care** – for the management of ill infants, with particular attention to those with neonatal infections requiring antibiotics.

B. Children (1-59 months)

B1.1. Vaccination Package

This suggested immunisation intervention includes expanding coverage of the

childhood vaccines commonly provided in India's Universal Immunisation Program (UIP) to 100% coverage of all children in Karnataka.[9] The following immunisations should also be added to the vaccination package:

- a second dose of measles
- Hepatitis B (HepB)
- Haemophilus influenzae type B (Hib)
- Streptococcus pneumoniae (pneumococcus)
- Rotavirus

B2.1. Pneumonia Case Management

This intervention for pneumonia case management recommends treatment for all cases of pneumonia. Non-severe cases can be treated at the community or facility level, including care from health workers, and possible medications (such as antibiotics). More serious or severe cases of pneumonia might require extended in-patient hospital stays, x-rays, and oxygen.[1]

B3.1. Breastfeeding Promotion

Breastfeeding promotion promotes exclusive breastfeeding of infants until the age of six months, and continued breastfeeding for the child's first year of life.[9]

Breastfeeding promotion strategies can include:[38]

- hospital policies and actions that encourage breastfeeding over bottle feeding
- counselling and education by peers or health workers
- mass media and community education
- mothers' support groups

B3.2. Oral Rehydration Therapy (ORT)

Oral rehydration therapy (ORT) is intended to prevent death by replacing lost fluids caused by diarrhoea. WHO recommends therapy with oral rehydration solution containing 75 milliequivalents of sodium and 75 millimoles of glucose per litre. [38]

B3.3. Zinc Supplementation

Zinc supplementation is intended to treat dehydration from diarrhoeal disease. Zinc supplements could be provided during an episode of acute diarrhoea to

reduce the severity of the event and to help prevent deaths.[38]

B4.1. Vitamin A Supplementation

Vitamin A supplementation to address undernutrition could be administered as semi-annual doses of 200,000IU to children aged one to four years old.[9]

B4.2. Salt Iodisation

While the iodisation of salt does not necessarily reduce deaths, it is a highly cost-effective way to prevent avoidable complications in children and adults as a result of undernutrition, such as goiter, neurological impairment, spastic motor disorders and cretinism from iodine deficiency.[9]

C. Adults (30-60 years)

C1.1. Medical Management of Heart Attack

The suggested intervention for medical management of heart attack involves two parts:[1]

1. Treating acute heart attack patients (within 12 hours of the start of the heart attack) with aspirin and an injection of streptokinase, a thrombolytic drug used to dissolve blot clots that cause both heart attacks and strokes.[39]
2. Secondary prevention with ongoing polypill treatment. Polypills are combination drugs that prevent heart attacks and contain: aspirin, a statin, a beta-blocker, an angiotensin-converting enzyme inhibitor, and a thiazide.

C2.1. Metformin Drug Therapy

Diabetes is a major risk factor for other health problems, including cardiovascular disease. As such, pharmacological management of the disease with metformin is recommended to help prevent further complications from heart disease.[9]

C3.1. Tobacco Control

Tobacco control would involve several policy changes, including a 33% increase in tobacco prices, warning labels on tobacco products, the implementation of clean air laws, and mass public education programs on the risks of tobacco use.

C4.1. Breast Cancer Screenings

This intervention suggests breast cancer screenings (clinical breast exam or

mammography) at least once every two years for women between 40 to 70 years old. This will help detect early cases of breast cancer to improve the chances of successful cancer treatment.

C4.2. Cervical Cancer Screenings

Screenings for cervical cancer are recommended to start for women at age 35 years, with follow-up screenings performed every five years thereafter. Cervical cancer screenings could include visual screening with ascetic acid, DNA tests for human papillomavirus (HPV) and cytological screening. Treatment with cryosurgery would be provided for cancer positive patients. Both screening and treatment of cervical cancer would be performed at a primary health centre.[9]

C4.3. HPV Vaccinations

Approximately 70% of cervical cancer is caused by two types of Human papillomavirus (HPV) infections. HPV vaccinations are therefore recommended for a single annual cohort of girls between 5-15 years old to prevent the later onset of cervical cancer.[9]

C5.1. DOTS Program

The DOTS program is intended to prevent deaths due to tuberculosis. DOTS is a multi-component strategy that has been promoted by WHO for the past decade and has five key elements:[9]

1. Political commitment by national governments;
2. Diagnosis, primarily by sputum-smear microscopy;
3. Short-course chemotherapy using first-line drugs;
4. A regular drug supply; and
5. Systematic monitoring to evaluate the outcomes of every patient.

C6.1. Pesticide Control Program

A system of pesticide control is intended to prevent deaths due to suicide as a result of pesticide consumption. Pesticide control priorities could include regulating the distribution, packaging and sale, of poisonous substances.

C7.1. Basic Surgical Package

A basic surgical package is intended to prevent complications and deaths from acute health problems that can be corrected with basic surgery. The suggested

basic surgical package include the following:[38]

- initial treatment for injuries
- obstetric complications (e.g., haemorrhage and obstructed labour)
- life-threatening abdominal and extra-abdominal conditions
- simple elective surgeries for common conditions (e.g., hernias, clubfoot, cataract, hydroceles, and otitis media)

C8.1. Emergency Care

This intervention is intended to prevent complications and deaths due to delayed emergency care. Emergency first response encompasses three main points of care:

- prehospital care
- transportation
- hospital care

This intervention focuses on the first two points, suggesting 1) first-aid training for lay-persons, and 2) an improved ambulance transportation program. Efficient transportation from the scene of the event to the health care facility is crucial to minimising the potential health damage of the patient.[38]

GLOSSARY, ACRONYMS & EQUIVALENCIES

Glossary

Adult	Defined in this report as a person between 30-69 years old.
Birth asphyxia	The deprivation of an adequate supply of oxygen to the unborn baby.[42]
Birth trauma	The physical trauma of child birth.[42]
Child	Defined in this report as a person less than 5 years old.
Child mortality rate	The number of deaths of children (<5 years) in a population per 1,000 live births.
Demographic dividend	Increased economic growth due to a rising share of working-aged people in the population.
Intrauterine growth restriction*	An unborn baby that is below the 10th weight percentile for his or her age (in weeks).42
Lifetime risk	The probability that at least one woman of reproductive age (15-49 years) will die due to child birth or within six week following child birth.[26]
Maternal mortality ratio*	The number of maternal deaths in women between 15-49 years old per 100,000 live births in a given year.
Mortality rate	The number of deaths per 1,000 of the population per year.[42]
Mother	A woman between 15-49 years old who has borne at leas one child.
Neonate	An infant less than 1 month old.
Older Children	Defined in this report as a person between 5-14 years old.
Prematurity	Baby born before 37 weeks of gestation.
Verbal autopsy	A research method that helps determine the most probable cause of death for people who have died with no medically documented cause of death.
Young Adult	Defined in this report as a person between 15-29 years old.

**terms appear in both Glossary and Acronyms*

Acronyms

ANM	Auxiliary Nurse Midwife
BPL	Below Poverty Line
CGHR	Centre for Global Health Research
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
IUGR	Intrauterine Growth Restriction*
JSY	Janani Suraksha Yojana
MMR	Maternal Mortality Ratio*
NRHM	National Rural Health Mission
PPP	Public-Private Partnership
SRS	Sample Registration Survey

**terms appear in both Glossary and Acronyms*

Equivalencies

60 rupees (Rs)	= 1 U.S. dollar (US$) *[at May 2014 rates]*
1 lakh	= 100,000
10 lakh	= 1 million
1 crore	= 100 lakh = 10 million
100 crore	= 1 billion = 1,000 million

REFERENCES

1. Aarogya Card Scheme Launched. The Hindu, June 12, 2011.
2. Aggarwal, A. *Impact Evaluation of India's 'Yeshasvini' community-based health insurance programme.* Health Economics Special Issue: Evaluating innovative health programs; Vol 19, Issue Supplement 1, pages 5-35; September 2010.
3. Bloom, DE. The Economics of Demography. The Aspen Institute; **https://www.aspeninstitute.it/.../028-037-Bloom%2055-56%20ingl.pdf**
4. Center for Disease Dynamics Economics and Policy, Washington DC (2012). *Summary: Cost Effectiveness Analysis conducted for select interventions in Karnataka.*
5. Centre for Monitoring the Indian Economy (CMIE). Annual Report; 2013.
6. Chow J, Darley S, Laxminarayan R. Discussion Paper: Cost-effectiveness of Disease Interventions in India. Resources for the Future; 2007.
7. Deogaonkar R[1], Hutubessy R, van der Putten I, Evers S, Jit M. *Systematic review of studies evaluating the broader economic impact of vaccination in low and middle income countries.* BMC Public Health. 2012 Oct 16;12:878. doi: 10.1186/1471-2458-12-878.
8. Deolalikar AB, Jamison DT, Jha P, Laxminarayan R. *Financing Health Improvements in India.* Health Affairs, 2008; 27:978-990.
9. Economic Research Foundation. Government Health Expenditure in India: a benchmark study. New Delhi, Mac Arthur Foundation; 2006.
10. Eggleston, K. *Health Care for 1.3 Billion: An Overview of China's Health System.* Working paper series on health and demographic change in the Asia-Pacific #28, Walter H. Shorenstein Asia-Pacific Research Center, Asia health policy program, Stanford; 2012.
11. Fan, V. **http://uhcforward.org/blog/2012/jan/11/does-efficiency-matter-getting-universal-health-coverage.**
12. George A. *Persistence of high maternal mortality in Koppal District, Karnataka, India: observed service delivery constraints.* Reproductive Health Matters; November 2007.
13. Government of India, Census of India; 2011.
14. Government of India, Central Bureau of Health Intelligence. Mortality Statistics in India, 2006.
15. Government of Karnataka. Budget Highlights; 2011-12.
16. Government of Karnataka, Department of Industries and Commerce. *Why Karnataka?* 2010.
17. Government of Karnataka, Directorate of Economics and Statistics. *Table 1: Gross State Domestic Product (at factor cost by industry of origin, at current prices)*; January 2010.
18. Government of Karnataka, Directorate of Health and Family Welfare. General service statistics. 2011.

19. International Institute for Population Sciences (IIPS), Mumbai. *District Level Household and Facility Survey (DLHS-3) 2007-08, Karnataka*; 2010.
20. International Institute for Population Sciences (IIPS) and Macro International, Mumbai.
i. *National Family Health Survey (NFHS-3) 2005-06*, Vol. I; 2007.
21. Jamison DT, Breman JG, Measham AR et al. *Disease Control Priorities in Developing Countries.* 2nd ed. 2006.
22. Jha P and R Laxminarayan. *Choosing Health: an Entitlement for All Indians.* Center for Global Health Research; 2009.
23. Jha P, Jacob B, Gajalakshmi V. *A nationally representative case control study of smoking and death in India.* New England Journal of Medicine, 2008; 358:1137-1147.
24. Joseph R, Gupta PC, Jagdish K. *Smoking in India: Trend analysis from 1998-2010.* September 2011.
25. Karnataka Knowledge Commission. *Status Report by the Study Group on Delivery of Health Services; 2010.*
26. Karnataka Portal (2010). *Advantage Karnataka.* Available: http://www.karnataka.com. Last accessed January 2010.
27. Karuna Trust. *Review of organizational structure, development programs/schemes and implementation mechanisms of Health and Family Welfare, Indian Systems of Medicine and Drugs Control Department*; 2008.
28. Karuna Trust. *Study of transparency, accountability and corruption in health care and health system in Tumkur district, Karnataka.* Karuna Trust, 2010.
29. Kazmin A. India: *Labor to Unlock.* Financial Times, October 4, 2010.
30. Knaul FM and J Frenk. *Health Insurance in Mexico: Achieving universal coverage through structural reform.* Health Affairs; November 2005 vol. 24 no. 6 1467-1476.
31. Kuruvilla S LMaPJ. The Karnataka Yeshasvini Health Insurance Scheme for Rural Farmers and Peasants: Towards Comprehensive Health Insurance Coverage for Karnataka? 2005. Social Science and Development Conference.
32. Kuruvilla, S and M. Liu. *Health security for the rural poor? A case study of health insurance scheme for rural farmers and peasants in India.* http:/digitalcommons.ilr.cornell.edu/articles; 2007.
33. National Rural Health Mission. *Rapid Appraisal of NRHM: 2008-09.* Ministry of Health and Family Welfare, New Delhi.
34. National Sample Survey Organisation. *Morbidity, Health Care and the Condition of the Aged NSS 60th Round (January-June 2004).* Ministry of Statistics and Programme Implementation, Government of India; 2006.
35. Office of the Registrar General of India. *Maternal and Child Mortality and Total Fertility Rates: Sample Registration System*; 2011.
36. Office of the Registrar General of India. *Special Bulletin on Maternal Mortality in India*; 2004-2006; 2007-2009; 2011-12.

37. Office of the Registrar General of India. Sample Registration System Statistical Report. 1-12-2009.
38. PBS Newshour with Jeffery Brown. China struggles with healthcare reform among growing demand. September 20, 2011.
39. Planning Commission of India. High Level Expert Group Report on Universal Health Coverage for India; 2011.
40. Planning Commission of India. *Karnataka Human Development Report: Investing in Human Development*; 2005.
41. Prinja S, Bahuguna P, Pinto AD, Bharaj G, Kumar V, Tripathy JP, Kaur M, Kumar R. The Cost of Universal Health Care in India: A Model Based Estimate. PLOS One; January 2012.
42. Radermacher R, Wig N, van Putten-Rademaker O, Muller, V and DM Dror. CGAP Working Group on Microinsurance Good and Bad Practices. *Case Study No. 20: Karnataka, India: Yeshasvini Trust*; 2005.
43. Ronsman C, Graham WJ. Maternal mortality: who, when, where and why. The Lancet, 2006; 368:1189-1200.
44. Sen A. *Food, Economics and Entitlements.* World Institute for Development Economics Research, United Nations University; 1986.
45. Sen, G. Universal Health Coverage in India: A long and winding road, *Economic and Political Weekly*, Vol. XLVII (8): 45-52; 2012.
46. The Hindu. (2011). *Aarogya Card Scheme launched.* Available: http://www.thehindu.com/todays-paper/tp-national/tp-karnataka/arogya-card-scheme-launched/article2098243.ece. Last accessed 12th June 2011.
47. The Million Death Study Collaborators. (2010). *Causes of neonatal and child mortality in India: a nationally representative mortality survey.* The Lancet, Volume 376, Issue 9755, Pages 1853 – 1860.
48. UNICEF. *Coverage Evaluation Report 2009.* Ministry of Health & Family Welfare, Government of India; 2010.
49. van Doorslaer E, O'Donnell O, Rannan-Eliya RP et al. Effect of payments for health care on poverty estimates in 11 countries in Aisa: an analysis of household survey data. *The Lancet* 2004;368:1357-1364.
50. Vance E. *Mexico chalks up successes in health care reforms: near-universal coverage results from science-informed changes.* Nature; August 2012.
51. World Bank. *Project appraisal document on a proposed credit in the amount of SDR 96.5 million to the Government of India for improving health outcomes through the Karnataka Health System Development and Reform Project, Report No. 31142-IN.* Human Development Sector Country Management Unit, South Asia Region, India; 2006.
52. Yip W, Hsiao C. The Chinese health system at a crossroads. *Health Affairs* 2008;27:460-468.

NOTES


Azim Premji
University