Building the Infrastructure to Reach and Care for the Poor:

Trends, Obstacles and Strategies to overcome them

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Abstract

Infrastructure forms a critical part of health service delivery in any country. Availability, Accessibility, Affordability, Equity, Efficiency and Quality of MNH services highly depend on the distribution, functionality and quality of infrastructure. Most developing countries have invested substantially in developing health infrastructure in rural areas which provides a base for extending MNH services to the poor. Still, there is clear evidence that in many countries there are gaps and inadequacies in health infrastructure. The functionality and utilization of health infrastructure has been sub-optimal or poor due to a variety of reasons. This paper reviews available literature and assesses the coverage and gaps in infrastructure for MNH. It also identifies critical issues in management of infrastructure and analysis their causes and impact on services delivery to the poor. The paper also reviews impacts of reforms on infrastructure and provides some recommendations for improvement of infrastructure management so as to ensure better services to the poor.

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1. Introduction

A health system is composed of various elements such as infrastructure, human resources, data system and financial systems. Adequate infrastructure which includes buildings, equipment, supplies and communication equipment forms a crucial part for the health services. (Kleczkowski et al, 1984). Poor infrastructure generally leads to poor quality of service, which in turn not only wastes resources but is positively dangerous to the health and welfare of the patients and the community at large. The poor suffer more if government services are not functional or are of poor quality as they do not have any other choice.

Over the years, governments, communities, philanthropists and religious organizations have all been active in building health facilities, so as to respond to their social obligations in the health sector. The concept of primary health care led to a rapid expansion of outpatient service facilities in the form of Primary Health Centres (PHC), Dispensaries and Sub Centres (SC), with a view to take healthcare to the community. Developments in medical technology have led to more and better inpatient care facilities at nursing homes and hospitals that include super-specialty care and sophisticated equipment for diagnosis and treatment. Worldwide, the number of hospital beds has increased from 5 million in 1960 to 17 million by 1980, which has more than doubled the per capita supply (World Bank, 1993). Our overall observations indicate that delivery of Maternal and Neonatal Health (MNH) services are also improving to address the needs of women and children. Many countries have set up women's hospitals, maternity homes, and children's hospitals with specialized neo-natal care facilities. Even though in some urban areas there are specialized hospitals for children and maternal care, MNH services in rural areas have still remained within PHC and general hospitals[1].

A preliminary analysis of rural health infrastructure in India brings out several important observations. For example, Table 1 depicts the growth of PHCs and other rural health infrastructure in India since 1950s. Between 1950 and 2000 the rural health infrastructure (SC/PHC/ Community Health Centre (CHC)) has gone up from 725 facilities to more than

[1] The term hospitals is used to cover general and specialty children's or women's hospitals. The paper does not focus on super specialty high tech hospitals.

163,000. The number of hospitals and dispensaries increased from 9,200 to 43,000 and the number of beds in public and private hospitals from 117,000 to 870,000. As a result, the availability of health facilities has improved significantly. Also, affordability concerns are addressed to some extent as government facilities provide free services or highly subsidized services.

Table 1: Expansion of rural health infrastructure in India

	1951	1981	% increase 1951-1981	1995-2000	% increase 1981-2000
SC/PHC/CHC	725	57,363	7912.1	163,181	284.5
Dispensaries & Hospitals (all)	9,209	23,555	255.8	43,322	183.9
Beds (Private & Public)	117,198	569,495	485.9	870,161	152.8

Source: Government of India, Planning Commission, 10th five year plan document, 2002-07

However, access to health facilities and delivery of quality services in the rural areas deserve considerable attention from planners. Infrastructure planning (location, layout, and maintenance of health facilities) is mainly left to engineers for whom health facilities are no different from any other buildings. The distance to health facilities limits people's willingness and ability to seek care, particularly when transport is limited. There is a heavy urban bias in the distribution of health facilities. Lack of recognition of the role of engineers in health departments has resulted in poor maintenance of health infrastructure and consequently the services they provide suffer. Inadequate priorities for health infrastructure by the health managers and politicians, as well as insufficient funds from the government, are the main causes for the poor state of health infrastructure in many developing countries. Deteriorated health buildings are not only unattractive to the staff and patients but also could become positively dangerous; critical areas such as Operation Theatres (OTs) and labour rooms could cause life-threatening infections if not maintained properly.

Efficiency losses from poor selection and maintenance of medical equipment are also very high. WHO estimates that less than half of all medical equipment in developing countries is usable (WHO, 1986). If medical equipment in government facilities is not working, poor patients are forced to go to higher levels which are far off or seek medical help from the private sector by paying very high user fee, which contradicts the very purpose of setting up government health facilities.

Lack of proper infrastructure for purchase, storage, and distribution of essential drugs and medicines is another major concern in the delivery of health services in rural areas. Information and Communication Technology (ICT) infrastructure can support an efficient and effective logistics planning minimising the "stock out" of drugs and medicines.

ICT infrastructure can also support data collection, compilation, and analysis of community health needs at SC/PHC/CHCs, and thus support data-based planning for delivery of cost effective and quality health services. Government heath infrastructure has been mostly centrally planned and supplies driven and not demand driven, to meet the community health needs. This is one of the reasons for the low utilization of government health facilities in rural areas.

The World Development Report of 1993, titled "Investing in Health", highlighted several points on the importance of infrastructure and the poor state of infrastructure in many developing countries. In some countries the under-funding of lower level facilities has been exacerbated by the creation of multiple levels of outpatient facilities, none of which functions well. At the same time, tertiary care hospitals are crowded with patients who could be treated in less costly and more accessible district hospitals or health centers if these were functioning well. A study in Chad, for example, revealed that 71 percent of all central hospital consultations were for problems that could have been treated at lower-level facilities. Excess public facilities in urban areas are a problem in many countries. Health facilities of various ownership (government, private, NGO, parastatal) tend to cluster exist in urban areas which can result in excess capacity and hence lower utilization (World Bank, 1993).

Inadequate and poorly maintained health infrastructure is a major barrier for use of health services in rural areas which primarily focus on maternal and child health services for the poor. Poor infrastructure will therefore be a major obstacle in achieving the millennium development goals.

2. Purpose of the paper

This paper is one of the series of papers commissioned by WHO to understand the linkages between the Maternal and Neonatal health and Poverty. This paper focuses on the relationship of infrastructure for health services to MNH and poverty. The areas covered in

the paper follow the terms of reference given by WHO. This paper attempts to assess the current levels of coverage of MNH services - especially EOC services, the level of investment in infrastructure for MNH and the issues related to infrastructure and its impact on MNH - especially for the poor. The paper also addresses what impact health reforms and international aid have had on MNH infrastructure. We conclude this paper with a few practical suggestions to improve the infrastructure for better service delivery to the poor, and with the identification of areas for further research in MNH.

3. Methodology

This review paper is based on published and unpublished documents, as well as field observations of the authors and discussions of the key stakeholders regarding health infrastructure and its relationship to MNH and poverty. As the time available for the study was limited, our literature survey was confined to articles in English language only. There is limited literature on health infrastructure in developing countries. Our literature search includes medical journals, internet websites of international agencies like the World Bank, materials available at WHO Geneva office through their library and databases, journals in architecture, planning, civil engineering and management, project reports, workshop reports, survey reports and other unpublished materials related to the topic of health infrastructure. Most of the literature on the subject does not differentiate access to all potential users from access to the poor. Our review of literature is also supported by qualitative field observations of the authors during their work as public health management experts in various projects over the last 15 years. The paper also derives insights from interactions with key managers at various levels in several countries, but mainly in India.

Even though more commonly used term is Emergency Obstetric Care (EmOC), in this review paper we are using the term EOC (which stands for Essential Obstetric Care) as it is preferred by WHO. EOC includes EmOC and other parts of obstetric care which are non emergency such as ante natal and post natal care, abortion services. The EmOC includes Basic EmOC (6 signal functions[2]) and Comprehensive EmOC functions (8 signal functions[3]). WHO also prefers the term Comprehensive EOC which is synonyms with Comprehensive EmOC and

[2] 6 Signal functions of BEmOC: 1. Administer Parenteral antibiotics, 2. Administer parental Oxytocics drugs, 3. Administer parental anticonvulsants for pre-eclampsia and eclampsia, 4. Perform manual removal of placenta, 6. Perform manual removal of retained products, 6. Perform assisted vaginal delivery

Basic EOC which is synonyms with Basic EmOC, and hence in this paper we have used the term EOC instead of EmOC at most places except when specific programmes have focussed only on emergency obstetric services.

4. What is included in Health Infrastructure?

Health infrastructure includes land and buildings, medical equipment, medical and general furniture, communication instruments such as telephones and wireless (radio call systems), logistics for medical supplies, ambulances etc. Infrastructure can be classified based on its functions in health system [see box 1]. The focus of the paper is on infrastructure for MNH services, especially for the poor. Hence, very high-tech tertiary care infrastructure is not included in this review paper. Secondly, the infrastructural issues from developing countries are emphasised as these are the areas where major MNH problems are located and where resource constraint are a major problem.

Box 1: Classification of infrastructure

- Physical infrastructure
  - Buildings for clinics, hospitals and primary health care
  - Buildings for staff housing
  - Buildings for drugs and vaccine storage etc
- Medical Equipment and other furniture
  - Medical Equipment
  - Furniture for administration and hospitals
- Transportation
  - Ambulance and other vehicles
- Drug and other consumable supplies
  - Drug and medicines
  - Sutures, dressing materials, linen and rubber materials
- Information and Communication Technology
  - Telephone, fax, wireless…
  - Computers, internet.

The basic parameters of infrastructure that are explored in this paper include:

- Location of infrastructure in relation to population and geography
- Availability of infrastructure in relation to the norms or needs
- Investments in infrastructure & their growth
- Management of the infrastructure – systems of management for planning and monitoring, systems of repair and maintenance.

[3] 8 signal functions of CEmOC include: all of those included in BEmOC plus 7. Perform surgery (C-section), 8. Perform blood transfusion

- Utilisation of the infrastructure and benefit to the poor.
- Effect of reforms on infrastructure

For each of the above parameters the paper discusses what is the situation, what are the barriers and problems related to it, how they have been solved in some situation and finally a few strategies to improve infrastructure for MNH services are discussed.

5. Assessment of coverage of Health Infrastructure

Coverage is usually measured in terms of availability and distribution of infrastructure compared to the population. There are some norms for infrastructure globally. For example UNICEF, WHO and UNFPA suggest a minimum of one Comprehensive Essential Obstetric Care (CEOC) and 4 Basic Essential Obstetric Care (BEOC) centres per 500,000 population. (UNICEF/WHO/UNFPA, 1997)

Paxton et al (2004) have recently done a comprehensive review of the coverage of EmOC in the world. We provide data from this paper on availability of Comprehensive and Basic EmOC facilities per 500,000 populations in table 2, given below.

Table 2: Coverage of EmOC in selected countries and MMR

Maternal Mortality Ratio	Country and Period of Time	Area	Facilities surveyed	Availability of EmOC			# Facilities with <6 signal function (% of facilities surveyed)
				Comp (1/500K pop)	Basic (4/500K pop)	Comp + Basic (5/500K pop)	
17	United States 2000*	National	3084	533%	0%	107%	81 (3%)
92	Sri Lanka 1999	16 out of 25 Districts	115	114%	20%	38%	59 (51%)
110	Honduras 2003	National	27	169%	0%	34%	5 (19%)
150	El Salvador 2003	National	33	215%	0%	43%	5 (15%)
220	Morocco 2000	National	510	105%	59%	69%	312 (61%)
230	Nicaragua 1999-2000*	10 out of 17 SILAIS	126	250%	53%	90%	107 (85%)
380	Bangladesh 1999*	National	710	105%	18%	35%	364 (51%)

410	Peru 1999-2000*	Six Northern Provinces in the Dept. of Ayacucho	31	200%	0%	50%	29 (94%)
420	Bhutan 2002*	National	31	400%	80%	122%	23 (74%)
420	Bolivia 2003	National	85	194%	11%	48%	45 (53%)
500	Pakistan 1999	3 Districts of the Province of Sindh	70	100%	31%	45%	41 (59%)
540	India 2000	7 out of 31 Districts in Rajasthan State	82	31%	38%	36%	35 (43%)
690	Senegal 2000*	National	172	165%	6%	39%	134 (78%)
730	Cameroon 2000	5 out of 10 provinces	487	133%	3%	29%	465 (95%)
740	Nepal 1999-2000*	45 Districts of the Eastern, Western and Mid-western Regions	157	69%	5%	18%	134 (85%)
850	Benin 2002*	National	282	186%	35%	66%	237 (84%)
880	Uganda 2002*	19 out of 56 districts	197	121%	24%	43%	156 (79%)
1000	Mauritania 2000*	National	67	140%	5%	32%	59 (88%)
1000	Mozambique 1999	Sofala Province	27	133%	8%	33%	22 (81%)
1100	Chad 2002*	38 out of 55 health districts	40	150%	11%	39%	9 (23%)
1200	Mali 2002*	8 Regions and district administrative de Bamako	153	118%	17%	38%	112 (73%)
1400	Rwanda 2003	Four Districts	27	600%	0%	86%	21 (78%)
1600	Niger 2000*	National	85	100%	61%	69%	9 (11%)
1800	Malawi 2000	Southern Region; 12 out of 27 districts	193	173%	2%	36%	173 (90%)

* Public and private facilities included
Source: Paxton, Bailey, Lobis 2004

The above table shows that in many countries, at the aggregate level, availability of EOC facilities is much below the norm indicating lack of access to EOC services. When the facilities are segregated by CEOC and BEOC an interesting trend emerges. The availability of CEOC in many countries (study areas) is much above the minimum norm of one per 500,000 populations suggested by UN agencies. But the BEOC services are much below the norm. The data in the table also show that many potential facilities have some of the 6 BEmOC functions and hence do not qualify as BEmOC facility. Even in counties where overall number of facilities is adequate in most countries, there are regions or areas at sub-

national level which have less number of facilities than the norm. Thus, the location of facilities is also very important to ensure equitable access to all in rural areas. The authors suggest that one more indicator for maternal health should be added to the two MDG indicators for maternal health (1) MMR and (2) proportion of births attended by skilled birth attendance - this is access to EmOC services, which also indicates the availability of functional infrastructure. There is no comparable data source showing coverage of Neonatal Care services in the world.

Increase in coverage

It is not clear whether the EOC facilities have increased globally or not as there is not much comparable data from the past. However in some countries there has been some increase in coverage of EmOC in recent years. In Bangladesh there have been two surveys on the availability of EmOC. In this country, the coverage of EmOC has improved between 1994 and 1999 - even though marginally (see table 3). This could be partly due to the government efforts and some projects such as - one with UNFPA support to set up CEmOC services in Maternal and Child Welfare Centres (MCWC) (Gill, 2004).

Table 3: Increase of EmOC coverage in Bangladesh between 1994 and 1999

Year	Comprehensive EmOC per 500,000 population	Basic EmOC per 500,000 population
1994	0.14 (14% of the target)	0.41(10 % of the target)
1999	0.27 (27% of the target)	0.60 (15% of the target)

Source: Bangladesh Maternal Health Services and Maternal Mortality Survey, 2001

After 1999, an important project has been implemented- Women's Right to Live and Health (WRLH) Project supported by UNICEF and Averting Maternal Deaths and Disability (AMDD) program at Columbia University to improve CEmOC in all district and selected sub-district hospitals in Bangladesh. This project included supply of equipment, training, monitoring and some infrastructural improvement. As a result, there has been further improvement in availability of comprehensive EmOC (see table 4).

Table 4: Increase in Comprehensive EmOC facilities in Bangladesh between 2000 and 2003 among facilities covered by WRLH project.

Type of facility	Total facilities selected	No EmOC		Basic EmOC		Comp EmOC	
		Baseline	2003	Baseline	2003	Baseline	2003
District Hospital	59	8	4	9	7	42	48
UH complex	64	33	15	28	26	3	23
Total	123	41	19	37	33	45	71

Source: Naree 2003, Occasional Publication, DGHS, Government of Bangladesh.
(Note: UH – Sub district Hospitals)

There has also been good progress in countries such as Bhutan where more basic and comprehensive EmOC services are functional with support from AMDD program. The number of BEmOC facilities increased from 4 to 14, and CEmOC facilities increased from 4 to 6 between 2000 and 2002. The geographical distribution of the facilities also improved the access to people living in more remote areas of Bhutan (see map in annex 1). Even in countries like Nepal the health infrastructure has improved over the past few years (See annex 2).

But in many countries such as India, there is no statistical information showing increase in the availability of EmOC in the country as a whole, even though there were some major externally assisted projects such as the World Bank assisted projects: Child Survival and Safe Motherhood project (CSSM) (1992-96); Reproductive and Child Health project (1997-2004); State Health Systems Projects (World Bank 1991, World Bank 1997) totalling to expenditure of about 1.5-2 billion US dollars. In these projects, no mechanism was set up to monitor the availability and functioning of EmOC infrastructure (World Bank, 1997), nor do the Government of India's publications gives details of how many First Referral Units (FRUs - CEmOC facilities) are functional (GOI, 2000-01). This is in spite of the fact that most of these projects had a major component of strengthening FRUs, PHCs and district and sub-district hospitals with an objective to reduce maternal mortality.

In some southern states of India- such as Tamil Nadu, Andhra Pradesh and Kerala - there has been some progress in making PHCs provide 24-hour delivery services and making sub-district hospitals fully functional as FRUs for obstetric and neonatal emergencies. Tamil Nadu and Kerala made efforts to operationalise all the FRUs and developed a program of

certification of FRUs with help from UNICEF. Unfortunately there is no published paper documenting these efforts (Padmanaban, 2004).

Over the last three years in India, with financial and technical support from AMDD program, UNFPA has helped the state government of Rajasthan to improve EmOC services in seven districts. Under this project, CEmOC facilities increased from 17 to 23 and BEmOC facilities increased from 26 to 53 between 2000 and 2002 (Caro, 2004). Evaluation of the AMDD programme shows that coverage and utilization of EmOC services improved in many countries where the project is active (see table in annex 3).

Private sector health infrastructure is rapidly increasing in India. Unfortunately there is no regulation or registration of private hospitals or health centres / dispensaries, and hence there are no reliable data on this. But there is a rapid increase in use of private sector for delivery care. For example, the NFHS surveys show that between 1992-99, the number of institutional deliveries in the private sector increased from 11% to 17 %. Even Caesarean Section (CS) increased from 2.5% to 7.1%, mostly in the private sector (IIPS 1992-93, IIPS 1998-99). See table 5.

Table 5: Proportion of Deliveries in Public and Private Institutions and C-sections in Urban and Rural India for years (1992-93 & 1998-99)

	Public institutions	Private Institutions	Own Home	Others / Don't Know	NGOs or Trust Hospital/ clinic	C-Section		
						Urban	Rural	Total
NFHS I	15%	11%	74%	1%	-	5.7	1.6	2.5
NFHS II	16%	17%	65%	1%	1%	14.7	4.9	7.1

Source: IIPS 1992-93 National Family Health Survey I,
IIPS 1998-99 National Family Health Survey II

In countries like Sri Lanka and Malaysia, which have registered improvements in MMR and IMR, the availability of health infrastructure care substantially improved in the early part of 20th century (Pathmanathan, 2003 et. al, Senavirathne, 2000). See the table 6.

Table 6: Hospital Beds per 1000 population in Sri Lanka and Malaysia.

	Sri Lanka						Malaysia					
Year	1940	1950	1960	1970	1980	1990	1940	1950	1960	1970	1980	1990
Beds per 1000 Population	1.82	2.6	3.01	3.02	2.87	2.48	-	2.46	2.04	-	1.71	1.49

Source: Investing in Maternal health, Pathmanathan et al., 2003

The comparison of hospitals and hospital beds per 100,000 populations in Sri Lanka and India over the last fifty years shows very clearly that Sri Lanka has historically made substantially more investment in creating hospitals and hospital beds than India. In the year 2000, India had 92 hospital beds per 100,000 populations, whereas Sri Lanka had 290 hospital beds per 100,000 populations. In the year 1995, India had 1.7 hospitals 100,000 population compared to 2.4 hospitals for Sri Lanka (See annexes 4 and 5 respectively).

Even though there is no reliable data on the increase of coverage of MNH services, our observations in several countries indicate that many countries are in the process of building new infrastructure or improving the existing infrastructure through repairs, renovation, remodelling or expansion to the existing infrastructure. Thus the infrastructure for MNH seems to be increasing in developing countries.

There are some countries in Eastern Europe and former USSR where there has been major economic downturn as a result the infrastructure has substantially deteriorated. For example in Tajikistan, the infrastructure for health services has deteriorated due to civil war and lack of repairs and maintenance as a result of severe economic problems after separation from the Soviet Union. In such places there has been an increase in home deliveries and may have led to increase in maternal and neonatal mortality (Veenema, 2000). Other war ravaged countries like Afghanistan has also reported heavy losses of health infrastructure leading to decreased access to maternal health services and very high MMR. (Bartlett et al 2002)

Even though there are no data, anecdotal evidence clearly points to the possibility of decline in access to services due to un-necessarily sophisticated and un-realistic infrastructure requirements. For example due to scare of HIV / AIDS, Government of India introduced new blood banking regulations about 7 years ago which mandated that each blood bank should have 7 rooms and 3 air-conditioners in order to get a licence. Such un-realistic infrastructure standards led to closure of many rural blood banks and blood transfusion services. Thus decreasing access to blood transfusion which is a life saving measure. (Mavalankar, 1999a)

Investment in Infrastructure and shortfall

There are no data on global investment in infrastructure for health, but in most countries, even in rural areas there is substantial infrastructure, in terms of hospitals, health centres,

equipment, vehicles etc. The health expenditures as part of GDP for countries that contribute to most maternal deaths are given in the table 7. But it is not possible to separate this in terms of expenditure for infrastructure.

Table 7: Maternal deaths, MMR, skilled attendance and health expenditure in top 13 countries contributing maximally to global maternal mortality.

Country	Number of maternal deaths	MMR 2000 (Maternal deaths per 100,000 live births[1]	Life time risk of maternal death, in: (2000)[1]	Skilled attendance at delivery 1995-2001[1]	Health Expenditure[2]		
					Public % of GDP 2000	Private % of GDP 2000	Total per capita $ 1997-2000
India	136,000	540	48	43%	0.9	4	23
Nigeria	37,000	800	18	42%	0.5	1.7	8
Pakistan	26,000	500	31	20%	0.9	3.2	18
Congo, Dem. Repub	24,000	990	13	61%	1.1	0.4	9
Ethiopia	24,000	850	14	6%	1.8	2.8	5
Tanzania	21,000	1,500	10	36%	2.8	3.1	12
Afghanistan	20,000	1,900	6	DNA			
Bangladesh	16,000	380	59	12%	1.4	2.4	14
Angola	11,000	1,700	7	23%	2.0	1.6	24
China	11,000	56	830	89%	1.9	3.4	45
Kenya	11,000	1,000	19	44%	1.8	6.5	28
Indonesia	10,000	230	150	56%	0.6	2.1	19
Uganda	10,000	880	13	39%	1.5	1.4	10

[1]Adapted from Lynn Freedman, 2004
[2] World Development Report, 2004

It is difficult to estimate the investment gap in health care infrastructure as there are no global norms for MNH infrastructure other than for EOC. Just to get some indication of public investment in health infrastructure we have calculated cost of the entire PHC system in India below the district hospitals - taking the current costs (replacement cost). We have also tried to make an estimate of the cost of the gap in infrastructure needed in the PHC system in India based on the government norms for infrastructure[4] (see table 8).

[4] GOI norms for infrastructure are – 1 CHC for 100,000 population, 1 PHC for 30,000 population and 1 SC 5,000 population

Table 8: Building Position for Health Centers in India for the year 2001, with total investment required to reach the norms set by government.

	CHC	PHC	SC
Total Buildings Required as per government norm	6,597	26,387	1,58,338
Functioning in Government owned Buildings	2,730	15,760	69,584
Shortfall of Government Buildings (Total Required-Functioning in Government Buildings)	3,867	10,627	88,754
Estimated Unit cost (INR)	10,000,000	2,500,000	400,000
Total new investment required (INR)	38,670,000,000	26,567,500,000	35,501,600,000
Total new investment by type of facility (in millions of $)	859.33	590.39	788.92
Total new investment needed (Million $)		2,239	
Total replacement value of exiting infrastructure at current prices (INR)	27,300,000,000	39,400,000,000	27,833,600,000
Total replacement value of exiting infrastructure at current prices in (in millions of $)	606.67	875.56	618.52
Total replacement value existing infrastructure (Million $)		2,101	
Total new investment as % of replacement cost of existing infrastructure		107%	

Source: Rural Health Statistics in India 2002

Even though the investment needed to bridge the infrastructure gap looks large (2.2 Billion $), it is not very high compared to other government investments. For example, India is expanding the existing highway network connecting four main cities of the country at an estimated cost of $18 billion. India also recently purchased an old Russian Aircraft carrier for the navy at a cost of about $1 billion.

In many countries we have visited, there are obvious quality shortcomings in infrastructure even when the infrastructure is available. It is very hard to estimate the investment needed to make all the MCH / PHC facilities functional in the world. In the state of Rajasthan in India, 83, mainly sub-district level facilities were repaired or renovated for improving EmOC services in 7 districts with help from UNFPA and AMDD. The average cost of the civil works needed was only about $7000 per facility (Dwivedi, 2002). In a much more elaborate project in Bangladesh, the cost of renovation and new construction (additions) to the MCWCs (district level facilities) was $ 65,000 per centre while investment in equipment per centre was $5000 (Gill, 2004). However, the cost of similar improvement to EOC facilities in Africa

could be higher due to higher input costs as many of the equipment and the supplies have to be imported.

Growth of Private infrastructure

One of the possible ways to make a rough assessment of under-investment in public infrastructure is to track the growth of private infrastructure and the use of private health services. Unfortunately in many countries there is no good registration of private infrastructure for health, even though the private sector is expanding rapidly. Government of India data shows that 75% of the hospitals and 38% hospital beds are in private sector. (GOI, 2003) The private sector share is higher in the state of Gujarat. A recent study done in a rural district in Gujarat shows that 81 % of all institutions providing in-patient care are in private sector. (Mavalankar et al, 2001). Of late, many private companies are also setting up large multi-speciality hospitals in urban areas with very high investments. Infrastructure in health is rapidly expanding and becoming sophisticated in the private sector.

Data from the Bangladesh EmOC survey in 1999 also brings out a similar picture. Out of a total of 726 facilities which can potentially provide EmOC, 472 (65%) are in the private sector (see table in the annex 6). In many countries, private sector health care institutions are coming up rapidly in urban areas. Besides direct competition for patients, the private sector also competes for skilled staff such as Obstetrician and Gynaecologists (Obgyns), anaesthetists and nurses or midwives. In Africa, private sector hospitals in cities are luring away key medical personnel from rural areas and thus making designated rural EmOC facilities more and more dysfunctional.

Is there un-necessary investment in infrastructure?

Generally, there is under-investment in infrastructure in the health sector in many developing countries. There are also examples where there is unnecessary over investment in infrastructure. For example, buildings are larger or the hospital is more sophisticated than what the community needs (example District Hospital in Bhuj, Kutch, India - see the box). There is also a tendency to construct hospitals or health centres without providing adequate staff, equipment, supplies or maintenance provision. Also, the poor location of hospitals - away from the main town or village, or not at the transportation hub of the area - leads to gross under utilization as it is inconvenient for people to use them. Duplication of facilities is also common. Many cities have hospitals under different agencies - government health

department, NGO, private, para-statal agencies such as Railway, Army, social security systems (such as Employees State Insurance Scheme in India), municipal government, and so on. Many of these hospitals and health centres are for specific user groups and hence are underused, while other government hospitals available for general public are congested and overcrowded - especially by the poor.

Box 2: Reconstructed District Hospital in Bhuj, Kutch, India:
The 200 bed district hospital in Bhuj city collapsed in the major earthquake that struck Gujarat state in 2001 January. This took a toll of about 200 people including some doctors, nurses and patients. Prime Minister of India visited this site and pledged to rebuild this hospital out of Prime Minister's relief fund. Normally a district hospital of 200 beds with basic specialties can be constructed at the cost of about 3-5 million $ in India. But instead of reconstructing a basic simple district hospital, the central government decided to make a very modern hospital with a highly earth quake resistant (up to 10 Richter scale) structure. Total of 20 million $ were allocated instead of 3-5 million $ needed, from the Prime minister's relief fund. The hospital was designed like a five star hotel with central air conditioning. It has many facilities like a modern hospital in western country with highly sophisticated equipment. It took about 3 years to complete the hospital. After completion the state government who has to run the hospital now finds it difficult to operate the hospital to its full design capacity as its annual running costs are very high (about $ 3.3 million instead of previous $ 670,000) and the required staff is not available in this some what remote town. The hospital has become only partly functional.

There are forms of wasteful investments such as purchase of expensive and sophisticated equipment which remains under utilized, vehicles which are unused for want of staff, or inadequate fuel and maintenance budget. Investments in computers would also become wasteful, if they are not effectively used to support the delivery of services. We discuss such wastages in detail under various issues in the following sections.

In sum, the infrastructure is improving in the developing world, but the progress is uneven. Secondly, in many countries the infrastructure is not fully functional for MNH services. This is partly due to lack of focus of the health managers on these critical services for mothers and newborns. There is also substantial under investment in the infrastructure in many countries. But at the same time there is evidence to show that the existing infrastructure can be made functional and productive with comparatively minor expenditure. In many regions the basic health infrastructure already exists which needs some repair, renovation and upgrading of capacities to make it fully functional. Example of this is from UNFPA-AMDD supported project in Rajasthan which is discussed above.

6. Assessment of functionality/utilization of the infrastructure and its quality

Functionality, Utilization and Quality of infrastructure

It is not enough to have buildings, equipment and vehicles, all of them should be functional. The functionality and utilization of infrastructure is also affected by various factors such as availability of skilled staff, supplies and proximity to the communities etc.

There are many PHCs and CHCs (30 bed rural hospitals) in India, where the labour room and operation theatres are not available or in such poor condition that it would not be safe to conduct deliveries and operations in such facilities. The common problems seen in rural health infrastructure in many countries are: flaking paint, plaster falling off from the wall and ceiling, leaking roofs, broken or uneven floor, cracked walls, windows that do not close, lack of water supply, drainage and electricity. In many countries the quality of construction is poor, designs are inappropriate for health facility and maintenance is neglected. Poor quality infrastructure affects the image of the facility as well as its utilization and safety. By and large, poor quality infrastructure has low utilization.

Our observations show that the functionality and quality of infrastructure is poor and/or has deteriorated in many developing countries, over the years. There are very few sources of published information reporting measures of functionality and quality of infrastructure. There are papers and documents which refer to general lack of infrastructure or poor quality of infrastructure in rural areas as a key constraint for maternal health, even though they do not specifically mention infrastructure for MNH (World Bank 93, PRB 2003). Studies on quality of family planning (FP) services in India also show that PHC infrastructure where FP and MCH services are offered is of poor quality. (Bhatia JC, 1999, Mavalankar and Sharma, 1999b, Townsend, Khan & Gupta, 1999, T K Sundari Ravindran, 1999). Since in India most rural PHCs and district health system infrastructure is primarily used for FP and MNH care, we can conclude that rural infrastructure for MNH care is also unsatisfactory. Sundari cites many studies which show that lack of infrastructure, equipment and supplies (including blood) led to delays in treatment of women with complications of delivery and to higher mortality and morbidity (Sundari, 1992).

Evidence from Sri Lanka and Malaysia shows that as a result of improvements in rural health infrastructure in the last 50-70 years, the proportion of institutional deliveries has gone up

and MMR has been reduced (Pathmanathan, 2003). Similar patterns of rapid increase in institutional deliveries following expansion of health infrastructure is also seen in the state of Kerala, India. But it is not necessary that infrastructure creation alone will lead to more institutional deliveries or declining mortality rates. Experience from other states in India indicates that even after infrastructure was created it did not lead to rapid increase in institutional deliveries. This indicates that infrastructure is a "necessary" condition for higher utilization, but definitely not a "sufficient" condition.

AMDD- supported projects in several countries show that if infrastructure improves along with the capacity of staff and services, then the utilization of obstetric care also increases. For example in Rajasthan state, India, where UNFPA and AMDD are supporting EmOC improvement in seven districts, the proportion of institutional births has gone up from 9.96% in 2000 to 11.6% in 2003, and the number of complications managed in facilities has also gone up by 63% between 2000-03 after the project improved the infrastructure and provided training to the staff (Dwivedi et al, 2004). In the same state, utilization of services has also gone up in district hospitals where UNCIEF and AMDD helped improve the services by minor repairs, renovation, improvement in blood transfusion and communication etc (Dickson, 2004).

The UNFPA- supported project in Rajshahi division of Bangladesh improved availability of CEmOC in MCWCs followed by substantial improvement in utilisation (Gill, 2004). UNICEF and AMDD supported WRLH project in 123 facilities in Bangladesh also showed improved utilization after improvement in infrastructure and services (Naree, 2003). The AMDD program evaluation also reported several country projects where the use of EmOC services improved substantially after improvement of EmOC facilities which included infrastructure upgrading and supply of equipment (Caro, 2004)

But in all these projects, physical infrastructure improvement is only one of the components of service improvement. It is obvious that only physical infrastructure improvement will not increase the utilization of services. Infrastructure has to be supported by appropriate staff and other resources for delivering quality services.

7. Issues in Infrastructure

Various attributes of any service infrastructure such as location, design, maintenance, quality etc, affect the provision of services to the community. This is more so for health infrastructure. To understand the various aspects of how health infrastructure affects health services in general, and MNH services in particular, we would discuss various issues related to infrastructure and its impact on delivery of MNH services in detail below. We have divided infrastructure into 4 categories – 1. Physical Infrastructure, 2. Equipment and furniture, 3. Information and Communication Technology Infrastructure and Vehicles, 4. Essential Drugs and other Consumable Supplies.

7.1 Physical infrastructure (Buildings, fixtures and utilities)

7.1.1 Location of infrastructure and access by the poor and vulnerable

Location of service facilities is a very important determinant of access and hence service utilization (Fitzsimmons, 1994). Poor location of health facilities is not an uncommon problem in centrally planned government facilities. Sometimes, even private sector facilities especially those developed by philanthropic organizations are poorly located. Even though there is no systematic study of location of health facilities in a country or province, we have observed a number of health facilities which are poorly located. Some common location problems are that the health facility is located away from the main town or located in a small village or no proper connecting road to the health facility. Some common causes for poor location of health facilities are:

- No understanding of the importance of location of health facility among the health managers and policy makers.
- No clear policy or guidelines on location of health centres.
- Local political and group influences or sentimental value of the place by the donors (philanthropists).
- Unplanned and rapid expansion of infrastructure – without thinking about its access and utility to the public.
- Lack of norms on geographical basis.
- No knowledge and understanding of mathematical (Operations Research) techniques available to arrive at optimal location.

There are cases of good locations turning out to be inappropriate after a period of time. For example, many old hospitals are in the heart of the city where the roads are narrow and the traffic so bad that reaching the facility quickly is not always easy. As roads and highway networks develop in rural areas, hospitals and health centres which are not located on major roads become less accessible and hence under utilized.

Historically, hospitals were built in urban areas where there was a concentration of population. Hence access to health facilities is poor in rural areas. The population in rural areas is very sparse and in small clusters. The average village size in India is about 1000 people, while in Africa the average size of a population of a village could be as small as 200-500. It is not possible for many developing countries to provide any form of health services to small population clusters. In India, one PHC was originally developed to cover a population of 100,000 (or about 100 villages), roughly a sub-district area. In the mid 1980s, these norms were revised to have one PHC for a population of 30,000 (or about 30 villages) to make services more accessible. Many other developing countries also expanded their rural infrastructure facilities prompted by the philosophy of taking health services "close to the community". In the process, many PHCs were opened in small villages and some of these were located away from the transportation hubs, which made access to the health facilities very difficult. Secondly in such facilities findings competent staff also becomes difficult. Hence even though infrastructure expanded, their utilization remained low due to poor access.

7.1.2 Design of infrastructure and quality of construction

WHO and other agencies have developed guidelines on how to design and construct health centres and hospitals in the rural areas in developing countries (WHO, 1985, WHO, 1996). But in many countries, health centres and hospitals are designed based on prototype designs developed by Public Works Department (PWD). PWD engineers and architects do not have much expertise in designing health buildings. Hence these buildings tend to have many problems that hamper the quality of services they provide. The quality of construction, materials available and supervision during construction are usually not of very high standard in rural and remote areas. Our study of PHC buildings designed and constructed by PWD in India (Mavalankar et al., 2000) and observations in other countries show that rural health centres and hospitals have many design problems such as:

1. Lack of proper patient and material flow

2. Lack of privacy - especially in Labour room, OT and examination rooms.
3. Lack of proper / adequate working spaces in various rooms.
4. Lack of hand washing arrangements & utility room.
5. Lack of comfortable waiting areas for patients and relatives.
6. Lack of utilities and public conveniences such as electricity, drinking water, toilets etc.
7. Lack of waste disposal arrangements.
8. Lack of boundary walls to keep out animals etc.

The above mentioned problems lead to a poor working environment. Patients and relatives do not like to visit such centres lacking privacy, cleanliness, and hygienic environment. Poor design and unhygienic environment lead to an increase in hospital induced infection, which may have much more devastating effect on the poor who are more likely to be malnourished, have less resistance and unable to buy antibiotics to treat the infection. The problems related to poor quality of construction are more acute in remote and rural areas as compared to urban or peri-urban areas, and hence they have more regressive impact on the poor people who live in remote areas. Poor infrastructure including staff is also a deterrent to housing highly skilled staff such as specialist doctors in rural areas, and hence quality of services in such areas location of deteriorates due to non availability of specialists. The literature in the service management field also shows that a poor service environment is not conducive to good interaction between the service providers and their clients (Bitner, 1992).

7.1.3 Repair and maintenance of infrastructure

In many developing countries, health infrastructure is not properly maintained or repaired. The following repair and maintenance problems are commonly seen.

1. Lack of proper painting and surface finish in buildings
2. Lack of repair of doors and windows
3. Lack of repair of plumbing, water supply and sanitary fixtures for hand washing and toilets.
4. Lack of proper repair of electrical fixtures
5. Leaking roofs and cracks in wall

This happens because key managers in health department do not give priority to repairs and maintenance (R & M), lack of overall budget for R & M, inappropriate allocation of the available budget, and unavailability of properly trained technicians who can carry out good

quality of repairs in rural areas. New constructions seem to be getting high priority because of political considerations, while maintenance is seen as a boring, routine job and hence gets low priority.

The neglect of repairs and maintenance leads to rapid deterioration of the functional quality of infrastructure. For example, flaking paint, leaking roofs, and improper electrical fixtures could be dangerous in vital areas such as operation theatres or labour room. The staff and patients also prefer to avoid facilities which are not well maintained. Lack of maintenance to staff houses make the staff stay elsewhere - where better housing is available. When staff does not stay at the facility, their availability is much less, particularly for emergency services. This leads to under utilization of the facility and lack of access to care, especially in emergency.

This effect of lack of maintenance on the utilization of facilities is not unique to health infrastructure; it is seen in all public infrastructure including roads, irrigation systems, educational buildings, etc. Hence, the World Bank in its World Development Report, has commented that lack of investment in repairs and maintenance is the most common and major mistake which developing countries make when they are faced with budgetary constraints (World Development Report, 1994).

A small study done by us in Ahmedabad district showed that government is allocating only 13-15% of amount which should have been allocated for maintenance as per government's own norms. The norms for budget allocation for repair and renovation set by government are themselves inadequate as the original quality of construction and workmanship in rural areas is poor, and hence it needs higher amounts of maintenance budget. A study by World Bank in India also showed that hospitals allocate very little money in their budget for repair and maintenance. (World Bank, 1997)

There are very few developing countries where the system of repairs and maintenance of health buildings is well developed and functional. For example, in China and Vietnam, the health infrastructure is much better maintained than in India, Bangladesh, Nepal or in African countries such as Tanzania or Ethiopia. This may be partly because of higher investments in health systems in the former communist countries but is also because of higher priority and better systems for maintenance of health infrastructure.

7.1.4 Monitoring quality of infrastructure

Quality of public infrastructure in many developing countries is highly variable. Public infrastructure is usually built by the PWD or other government departments. The quality of their work is usually not satisfactory due to lack of adequate budgets, poor management practices, and lack of standards. There is no monitoring of the quality of health infrastructure in many countries. Many health buildings are substandard when they are built. Recent proof of this was the destruction of many hospitals and health centres in several districts due to earthquake in the state of Gujarat in 2001. Even though it was known that certain regions of the state lie in seismic zone IV (high risk), health buildings in such areas are not designed to withstand earthquakes. A similar situation also exists in Nepal.

Due to poor design and maintenance, over a period of time many public health buildings tend to become unsafe, unfriendly and neglected.

7.1.5 Under utilization of infrastructure due to lack of equipment and staff

A mismatch between the availability of building infrastructure, equipment and staff for providing services is another common reason for under utilization of health facilities. It is common in India and other countries to notice health facilities which have operation theatres, which are dysfunctional due to lack of equipment or staff. The following table from a facility survey done in India clearly highlights this situation. Even though 93% of the FRUs had operation theatres, only 62% had the required number of standard surgical kits, 48% had Obgyns, only 22% had an anaesthetist and 12% had regular blood supply. If we assume independent probabilities of each of these 4 inputs then the joint probability of having all four inputs becomes very small (0.7%). It is no surprise that FRUs and CHCs are underutilized (IIPS, 1999). See Table 9.

Table 9: Availability of staff and facilities at various levels of hospitals in India.

Staff and facilities	District Hospitals	First Referral Units	Community Health Centers
Operation Theaters	98	93	86
Obstetrician/ gynecologist	78	48	28
Anesthesiologist	70	22	10
Regular Blood supply	60	12	8
Probability of having all 4 inputs (%)	32	1.2	0.2

Source: International Institute of Population Studies - India Facility Survey, 1999.

Underutilization of existing infrastructure also arises due to medical care policies. For example, the government of India does not encourage or ensure that MBBS qualified doctors (medical officer - MO) are trained to do emergency Caesarean section or any life-saving surgery or EmOC procedures at district hospitals or FRUs. Hence, many district hospitals and FRUs do not provide 24- hour EmOC services as Obgyn specialists are very limited or absent as seen from above table. (Mavalankar & Rosenfield, 2005)

Underutilization of facilities is also caused by the staff not staying at the place of posting. In India, it is estimated that only about 34% of the medical officers posted at the PHCs stay there (Dadhich, 2004). When the MO or nurse is not staying in the village/town where the health centre is located his or her availability at the place of work becomes much reduced. This further compounds the problems of lack of staff. Also the staff allocation is not based on workload but on the number of beds in the hospital. This means that in some hospitals there are excess staffs while at others there is a relative shortage of staff.

7.1.6 Systems to monitor utilization/productivity of infrastructure

Monitoring of health facility performance is focused on monitoring certain vertical public health programmes. For example in India, the key parameters of PHC functioning are the number of sterilizations and immunizations done, as compared to the allotted targets or quotas. Almost no peripheral health institution (CHC, PHC, Sub-centre) is monitored on deliveries conducted or emergency obstetric and neonatal care provided. This has lead to a situation where bed utilization in PHCs and CHC in India is very low and they offer very few delivery or EmOC services. On the other hand, in the case of district hospitals and medical college hospitals, utilization is much higher than the capacity in terms of beds, equipment and staff. Here, the infrastructure has not expanded based on demand, leading to congestion in the hospitals and thereby deterioration in some quality of services.

Utilization/productivity of the equipment is also unmonitored in many hospitals and therefore much of the equipment purchased is not utilized. Estimates of unutilized equipment in developing countries are as high as 50-80% (WHO, 1986). Our field observations also indicate similar proportions.

Thus lack of monitoring of the productivity of health infrastructure (building and equipment) in developing countries hides the gross inefficiencies in the health sector.

7.2 Equipment and furniture

In a recent paper we have discussed in detail various issues related to equipment management for EmOC. (Mavalankar et al., 2004). Many of the issues raised above for buildings are also applicable to medical equipment and furniture in health centres. But there are some particular issues, such as the choice of appropriate technology, training of staff for use of equipment etc. These issues are discussed below.

7.2.1 Appropriateness of technology to the level of care

Medical equipment covers a wide range, from simple to very complex technology. Over the last 40 years medical technology has made very rapid progress. There are major trans-national corporations making and selling such equipment. The cost and complexity of equipment is also increasing over time, and therefore decisions on capital investments in medical technology are becoming complex. However, new technology development for basic maternal and child care is minimal.

It is not uncommon to see developing countries buy and install inappropriate equipment, especially under donor-assisted programmes. Highly sophisticated equipment is very difficult to maintain in rural area where electricity is irregular and maintenance services are non-existent. Many times equipment comes from various sources, which include donations and purchase, and it is installed in rural facilities where it performs sub-optimally. It would be better in many rural hospitals to have much simpler (preferably nationally made) equipment, which may not be as sophisticated, but is robust enough to withstand the conditions in rural hospitals. (WHO, 1987)

Acquiring medical equipment for rural hospitals must take into account the realities of rural areas, the need and availability of repairs and maintenance services. Health managers should not be swayed by the recommendations of the clinicians, who always want “the latest equipment” or the equipment that companies want to sell which is usually the most expensive. On the other hand, the managers should guard against the tendency of administrative systems to purchase the cheapest equipment, disregarding quality. Health managers must balance the “life cycle cost” of medical equipment which includes cost of

acquisition, running cost including maintenance cost with reliability, ease of use, speed and accuracy of the equipment.

7.2.2 Training and HR issues related to equipment

Much equipment, as opposed to building infrastructure, requires training of staff for proper use and maintenance. In many projects, such training is not incorporated and hence the equipment supplied remains unused. In a large project in India, very expensive imported vacuum extractors were provided to FRUs, but the doctors were not trained in this procedure and hence this expensive equipment remained unused (MotherCare, 1996). Lack of training may also cause improper installation and improper use of equipment leading to rapid damage and deterioration. Many times human resource policies and procedures are not linked to equipment policies, causing mismatch of skills and equipment.

7.3 Information and Communication Technology Infrastructure and Vehicles

Delivering health services involves a number of health workers and health institutions at different levels. Infrastructure for ICT is critical to facilitate the coordination between various levels of health workers so as to effectively deliver the services. ICT infrastructure includes telephones, wireless, fax, TV, computers, internet etc. Unfortunately in many developing countries, ICT infrastructure is either poor or non-existent. In India only 20 % of PHCs have telephone facilities. (IIPS, 1999) Even higher-level hospitals such as district hospitals with 100-300 beds have only one or two telephone lines. Lack of finances to pay telephone bills, non accountability for telephone usage, and misuse of telephones for private and personal needs are some of the causes mentioned in the literature for the poor availability of telephone facilities. Fax machines, email etc. are still not very common modes of communication in health institutions. In some countries, especially in Africa, wireless radio call system is used for communication between hospitals but in other countries such as India, Bangladesh etc. wireless communication is only available to security forces and police. Due to such restrictions on wireless use, most ambulances also do not have wireless communication, which if made available would be very useful to improve the efficiency of emergency medical services.

Basic transportation facilities are also minimal in many developing countries. The availability of vehicles and their functioning, maintenance etc. are major problems in health departments

across many countries. Many health centres and peripheral health staff do not have any vehicle and so depend on public buses or commercial trucks to reach various villages. Only 29% of PHCs in India have a vehicle (IIPS, 1999). The management of vehicles for repairs and maintenance, availability of fuel and drivers etc. are also poor and hence many a times vehicles are not functional. Health departments do not see their role as providers of emergency services, which needs rapid communication. It is ironical that the very same countries offer reasonably good ICT and vehicle facilities to the police and defence organizations. Low or no priority for ICT in health, and not mere lack of ICT infrastructure in the country, is a major concern.

Even when telecommunication and transportation facilities are available, many a times there is no protocol or system of using these facilities for improving the management of health services in general and referral of emergency cases in particular. There is no protocol in India where a PHC medical officer could telephone the obstetrician or paediatrician at a district hospital for advice on how to treat a particular difficult case. Even simple things-such as alerting the higher-level facility to expect an emergency case that is being transferred from a peripheral centre- is not done even when both the centres may have telephones.

Use of mobile telephone communication is rapidly expanding, even in Africa and Asia. Many health professionals (including doctors and nurses, even in remote areas) are already using personal mobile phones. But health departments in India or Africa have not yet started investing in mobile phones or regular telephones for their communication needs. Simple devices such as intercoms between departments or staff houses on campus to quickly respond to emergency needs are not available at most places. Instead, doctors and nurses on emergency call are called by sending a messenger to their homes on foot or in a vehicle. Some times even patient's relatives have to go and call doctors or nurses.

Health planners in many countries have not woken up to the ICT revolution which has happened over the past 20 years. Of course, there are isolated uses of one or two electronic gadgets in use, but there is no planned use of ICT in health departments of developing countries. It is possible today to invest in low-cost electronic gadgets for data collection, recording and analysis to support health systems planning (see annex 7). Health administrators have not yet understood the enormous importance of data-based planning to meet the healthcare needs of people. Health planning, as mentioned elsewhere in this paper,

is still supply driven based on norms for population coverage, but not demand driven to respond to community needs. There are interesting examples of use of tele-medicines through satellite links being used for diagnosis and education at tertiary levels (see annex 8). It will take much time for use of ICT to become routine in the majority of developing countries.

7.4 Essential medicines and other consumables supplies

Essential medicines and consumable supplies are vital to service delivery. Infrastructure and staff cannot provide services without an assured supply of medicines and consumables. New medicines are often more expensive than the older, simpler drugs. Hence the selection of proper drugs and ensuring their supplies become important management functions to support service provision for MCH. About 2 billion people do not have access to essential medicines. Second to staff salaries, medicines represent a large proportion of the spending in health care. It also represents a substantial proportion of costs to women and their families and contributes to the wider economic deterrent to utilization of maternal services identified by some studies. The impact of shortages of drug and supplies is more severe in case of emergencies as it would mean difference between life and death. Such emergencies are common in pregnancies and childbirth. Hence management of drugs and consumables is critical to MNH services.

7.4.1 Shortage of medicine supplies

The impact of the lack of essential medicines in the health centres and hospitals is much more regressive on the poor. They end up buying medicines from private chemists paying very high prices. The treatment of the poor is delayed or even denied if they are not able to purchase the required drugs. It is a routine practice in many hospitals and health centres in Africa and Asia to ask the patients' relative to buy gloves, suture material and some medicines before attending to normal delivery or an emergency procedure. This could be a major deterrent for poor people in seeking care at the facility.

In India, the amount of money available for medicines at primary health care level is about 1.5 rupees per person per year (3 cents per person per year) (Mavalankar, 1999c). Global data indicates that most developing regions of the world spend between 0.59% to 0.75% of GDP on pharmaceuticals which translated to 8-31 dollars per capita per year (Managing Drug supply, 1997). Such a miniscule allocation for medicine serves very little purpose. This forces

the poor people to buy medicines and supplies from the private market. There is a substantial difference in the prices for medicine between government bulk purchase and retail purchases. District hospitals, as well as state medical college hospitals, also face budget constraints. Lack of medicines is one of the important reasons why patients do not come to the government hospitals for treatment.

Some countries have developed systems of running a non-profit pharmacy in the government hospitals where patients can buy medicines at prices which are much below the market price. For example, in Rajasthan state in India, the government has a policy to appoint an NGO to run a non-profit pharmacy in district and sub-district hospitals. Tamil Nadu government has set up a para-statal organization called Tamil Nadu Medical Services Corporation which ensures availability of drugs and medicines in more than 110,000 government institutions in the state (see annex 9).

7.4.2 Essential medicine list and utilization review

Central (national or state) level essential drug lists are not regularly updated. Hence that some of the medicines that research has shown are superior to the previous regiment are still not included in the essential drug list and therefore not available in the public system. For example: magnesium sulphate, which is better than diazepam for control of convulsions due to eclampsia is not included in the essential drug lists in several states in India and some countries in Africa.

Shortage of drugs is further worsened by misuse and overuse of drugs and consumables. Very few developing countries conduct systematic utilization reviews to ensure rational use of medicines. Due to lack of a formal review mechanism, and pressure from the drug industry to prescribe more and newer drugs, the budgets of health centres and hospitals are rapidly exhausted. This situation again leads to the regressive impact on the poor patients as described elsewhere.

7.4.3 Purchase and distribution-logistics/stores management

Inadequate medicine budgets in developing countries are further aggravating improper purchase and distribution systems. Most health departments do not have professionally qualified or well trained staff for purchasing and distributing medicines. This function is handled by doctors or pharmacists, who have little training in modern techniques of logistic

or supply-chain management. Substantial savings could be realized with better management of purchases and logistics of medicines. There are a few examples where governments have tried to improve the medicine and supply system. One of the good examples is the para-statal organization set up in the state of Tamil Nadu state of India with help from DANIDA for procurement and supplies of medicines and equipments. This organization called Tamil Nadu Medical Supplies Corporation (TNMSC) has not only improved the procurement and distribution in the state but has also saved substantial money and ensured better availability of medicines in rural areas.

7.4.4 Effect of trade/import policies

In many countries especially in Africa, much of the medicines and supplies are imported from developed and other developing countries. Trade and import policies govern what is imported in the country. Sometimes, the suppliers also are selective in importing only profitable drugs. They do not import simple medicines as they are cheap and do not produce much profit. For example, in one country in Africa, Lignocaine for spinal anaesthesia was not available but more expensive general anaesthetic was available.

Imports also increase the cost of medicines and equipment to developing countries. Some countries such as India which did not follow the product patent regime but had a process patent could manufacture some drugs cheaply. But this scenario is changing with GATT and other global trade agreements coming into effect.

8. The impact on MNH infrastructure of the various reforms and aid flows

Health sector reforms have five major goals: Improve efficiency, quality, equity, client responsiveness and sustainability (WHO, 2000). Major reform measures have been in three areas: Financing, Organizational structure, and Policy changes (PHR plus, 2003). All these reform measures impact the infrastructure for health and specifically MNH. Literature available on specific impact of reforms on infrastructure is very limited (Reproductive heath matters, 2002, EC PROD website, 2004). A review of the impact of reforms on maternal health points to the fact that reforms have not had any significant impact so far and hence more research is required. (Mc Donagh, Goodburn, 2001). Below, we summarise some of our observations based on available literature on reforms and reform like initiatives on infrastructure.

Most of the reform initiatives are on decentralization, cost recovery/user fee, increased funding to health sector, and pooling of donor resources into sector wide approach (SWAP).

8.1 Effect of decentralization on infrastructure

Decentralization of infrastructure means handing over the heath infrastructure from higher levels to local administrative units. Primary health care infrastructure in Gujarat State, India was handed over to the district governments (Zilla Panchayat) around 1964. The experience of this initiative has not been very satisfactory: district governments (Zilla Panchayats) have much less capacity to manage (repairs, innovation and up-gradation) of health facilities and their overall systems are much more lax than the state government, their level of accountability is much lower, local political interference is higher, and so on. As the districts do not have much of their own resources (money, skilled staff etc) the maintenance of infrastructure further suffers (Mavalankar & Patel, 1998). The state governments also seem to develop a step motherly attitude towards health infrastructure handed over to lower levels of government.

Some recent efforts under European Commission supported Sector Reforms Project in Gujarat wherein more financial powers are given to PHC medical officers for repairs and renovation of infrastructure, have shown promising signs. PHC infrastructure has improved and MOs have developed more confidence and interest in their work.

Other examples in India and other developing countries have shown underutilization of centrally planned infrastructure. There are PHCs and rural hospitals in which new OTs were created under a project but remained unused due to lack of staff, equipment or other complementary inputs. Many of the centrally planned projects are very inflexible and provide inputs in a uniform way (cookie cutter approach), where as the needs of each health centre or hospital is somewhat different from others resulting in wastage of infrastructure. Thus decentralization should help to reduce wastage of infrastructure. But it has to be backed up by adequate capacity building and systems development of lower levels.

8.2 Effect of donor assistance/aid flows on infrastructure

Over the past several years, donors and development banks have financed substantial part of rural health infrastructure in developing countries. In India, donor assisted programmes invested heavily in the construction of sub-health centres and PHCs. Donors seem to prefer investments in infrastructure development, as they are a visible parts of the health system development. Substantial amount of donor funds was sunk into creating rural infrastructure, which remained underutilized or unutilized due to lack of other complimentary resources. Donors did not seem to be concerned about the utilization of the infrastructure they fund. For example, the World Bank's Implementation Completion Report for Child Survival and Safe Motherhood programme in India, (worth about 300 million dollars) merely mentions that not many FRUs became functional, and offers no detailed analysis of the reasons for non opreationalization under utilization of FRUs (World Bank, 1997). Hardly any donors carry out systematic utilization review of infrastructure they fund.

8.3 Cost recovery - impact on infrastructure and use by poor

Introduction of user fees for cost recovery is to support the recurring costs of the health services towards medicines, consumables, maintenance of equipment and infrastructure. There are hardly any studies on impact of cost recovery on infrastructure. Anecdotal evidence and observations in the field show that cost recovery generates resources which, in turn could improve availability of medicines, consumables and maintenance of infrastructure - which will have positive impact on the quality of services. For example in two states in India - Rajasthan and Madhya Pradesh-cost recovery through user fees has improved the availability of medicines, hospital hygiene, and timely repairs of equipment and infrastructure. However, the literature on the impact of cost recovery on access to health services by poor is not extensive. International experience is mixed on cost recovery and access/ utilization of maternal services by the poor (Mc. Donagh & Goodburn 2001).

9 Public Private Partnership (PPP) in infrastructure

One of the directions of reforms is to ensure better utilization of resources by pooling the resources of both the public and private sectors. The concept of Public Private Partnership (PPP) is very old but has become more popular in the context of reforms. Many such public

private partnerships in infrastructure are observed, for example: (1) development of medical colleges and some large hospitals in India where philanthropists donate to public agencies, (2) Church and other religion related organizations developed hospitals in rural areas in India, Bangladesh and Africa, (3) some state governments and the central government in India and African countries have been financially supporting NGO-run hospitals and health institutions, (4) involving NGOs in the delivery of super-speciality care (such as cancer and kidney disease, basic maternity care through maternity hospitals), (5) providing training and other support services to government programs, (6) The Employee State Insurance Corporation (ESIC) of India has a formal tie with State Departments of Health and some private health service providers, (7) involvement of private doctors in FP program to provide sterilization services in India.

Recent approaches to PPP have been more in the nature of contracting out services or having partnerships with the private (for profit) sector for public health programs and services. Government of India has recently tried to invite private ObGyn and anaesthetists to give safe motherhood and EmOC services in rural areas where government facilities do not have such specialists. The experience of this has been mixed and not very encouraging.

The impact of PPP on infrastructure has not been studied. But it can potentially improve the use of infrastructure and reduce wastage in terms of under-used assets in the health system. It can also increase the availability of the care and access as the reach and reliability of the clinical services through private sector is much better than the public system at least in some developed states of India (Mavalankar 2001). Somehow in many countries the health planners and managers are not willing to integrate the private sector in health plans which lead to wastage of resources in the health sector. Thus there is scope of PPP in extending services to the poor and needy.

10. Conclusions and Recommendations

Infrastructure forms a critical part of health service delivery. Availability, accessibility, affordability, equity, efficiency and quality of MNH services substantially depend on the distribution and quality of infrastructure. Most developing countries have invested substantially in developing health infrastructure in rural areas which provides a base for

extending MNH services to the poor. Still, there is clear evidence that in many countries there are gaps and inadequacies in health infrastructure. The functionality and utilization of health infrastructure has been sub-optimal or poor due to a variety of reasons. The key reason for this has been under-investment in health infrastructure; managerial neglect towards infrastructure, lack of complimentary inputs (such as staff, equipment, supplies etc,) and lack of monitoring of productivity/utilization of infrastructure.

Health centers and hospitals do not have proper buildings and amenities. Buildings need major repairs and maintenance. Neglect of planning for maintenance of infrastructure has led to deterioration, and hence the under utilization of the health facilities. Lack of administrative and political will to improve the performance of health sector, weak management systems for planning, implementation and maintenance of infrastructure and poor understanding of the vital role of infrastructure and supplies in the delivery of health services are some of the key reasons for neglect of infrastructure for MNH services. Fortunately over the last few years, some international agencies have scaled up their investments in maintenance and upgrading of health infrastructure for MNH care. The experience from these projects demonstrates that financial resources needed to improve the quality of infrastructure are not very large. Evidence from AMDD supported and other projects from various countries such as Bangladesh, India and Nepal show that the quality of services and their utilization increase, over 2-3 years, with improvements in infrastructure and other complementary inputs.

There is substantial underinvestment in medicines and supplies, equipment, vehicles and ICT infrastructure in developing countries. Health sector has not exploited the potential of ICT infrastructure to support the logistics planning for delivery of services. Health service delivery continues to be supply driven and not demand based. Consequently, the facilities built for service delivery have become less functional.

Lack of research and documentation is a major concern in the area of health infrastructure. Very few systematic studies are reported on the status of infrastructure and its impact on the utilization of services especially by the poor. Poor design, ad hoc locations, sub standard construction, lack of maintenance and insufficient funds for complementary inputs (such as equipment, medicines and staff) all have adverse impact on the health outcomes on the poor, much more than on the non-poor.

The impact of reforms on infrastructure is difficult to assess, as much of it is very recent and hardly any published papers are available on this issue. Decentralization of the health services does not seem to have positive impact on infrastructure, as resources needed for maintenance and upgrading are not available with local governments. International assistance has helped build and improve the available infrastructure including equipment in rural areas, but without proper management systems, monitoring and accountability mechanisms and administrative priority, much of such infrastructure investments are not very productive and have deteriorated substantially over the years. Some of the successful PPPs have helped to keep the infrastructure in a better condition and lead to higher utilization, but such PPPs are not very common in MNH areas and its impact on the poor is not well documented. Similarly the impact of cost recovery on infrastructure and supplies seems to be positive but its effect on access and quality of MNH services to the poor is not clear. There is a urgent need to do more specific and in-depth research on the impact of reforms on infrastructure to deliver services to the poor.

The following key recommendations emerge from our analysis:

- National and states / provincial governments should pay much more attention to development and maintenance of infrastructure for MNH. Substantial, but not very large, amounts of additional resources are needed to bridge the gap in infrastructure and make facilities fully functional.
- Health departments should have an infrastructure management cell or division with qualified architects, engineers and specialists to plan and maintain health infrastructure. It is necessary to move away from complete dependence on PWD for infrastructure so as to ensure functionality of health infrastructure.
- Mechanisms need to be developed to plan and monitor the use and productivity of health infrastructure.
- International agencies which support health services – especially infrastructure-should ensure that the recipient countries have the required management systems to maintain and make effective use of the infrastructure created. This also includes allocating required staff and supplies for the health infrastructure.
- Health sector reform initiatives should focus on reforms related to infrastructure so that the existing infrastructure in public and private sector will be optimally used to serve the needs of the poor.

- World Health Organization and other technical agencies should develop materials and technical programs to improve infrastructure management in developing countries. Available capacities of the local and regional institutions should be used in this effort.
- Procurement, reimbursement, training and donations of drugs should be based on proper use of few essential medicines concept.
- Focused research is urgently needed to study the state of infrastructure, the impact of reforms on it, as well as impact of reforms on the access of services to the poor.
- All governments and donors must prioritize repairs, maintenance and rehabilitation of the infrastructure instead of merely focusing on creating new infrastructure.
- The positive influence of improved infrastructure on health outcome should be documented and disseminated so that other countries can learn from these.
- Efforts should be made to document infrastructure management practices from countries like Sri Lanka and Malaysia which have made substantial progress in MNH so that other countries can learn from them.
- Special emphasis should be given to identify how the newer technologies such as mobile telephone, computers and other ICT tools can be used and integrated in the infrastructure to ensure better use of "brick and mortar" infrastructure. ICT tools for computing and communication needs should be used wherever possible.

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Annexes

Annex 1: Map of Bhutan showing geographical distribution of the EmOC facilities

Source: 1. AMDD Brochure, 2003
2. Wagmo D, Tobgyel, Sharma H, Network conference 2003.

Annex 2: Growth of Hospitals and Health posts in Nepal.

Year	Hospitals	Health Posts
1934	33	0
1954	-	24
1964	-	9
1965	36	-
1971	-	153
1974	58	251
1975	-	351

Source: Justice Judith, 1989 Policies, Plans and People

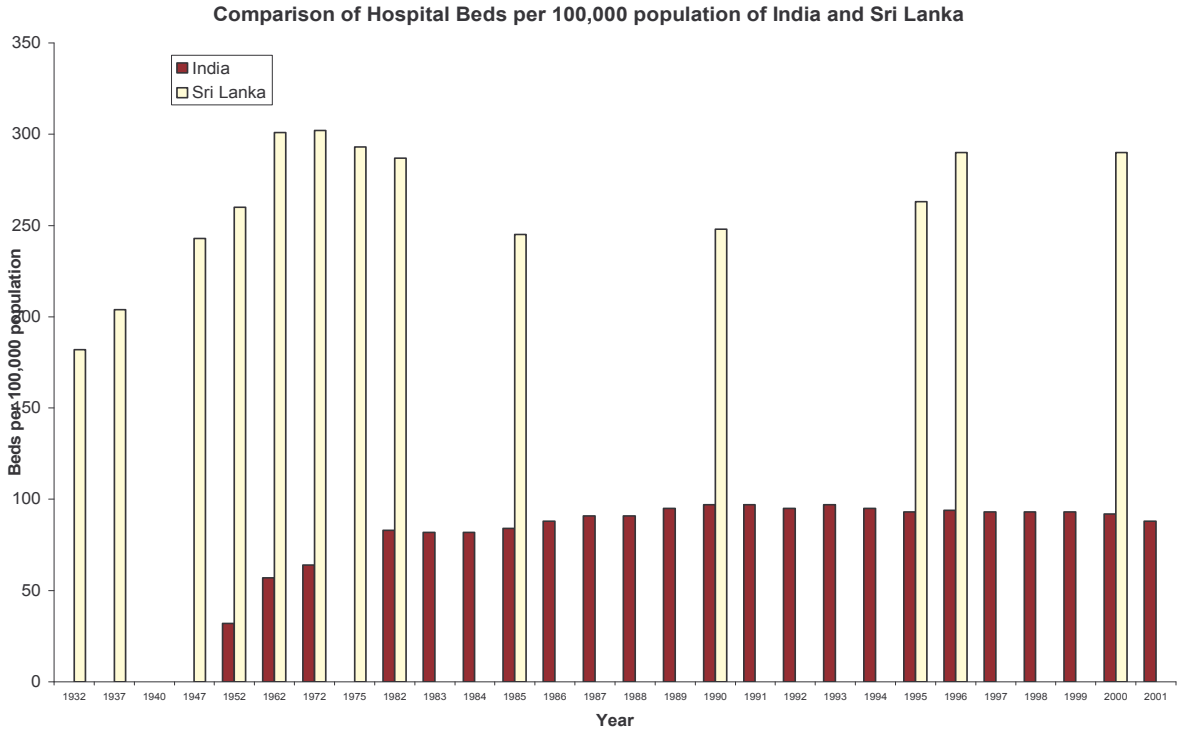
Annex 3: Percent distribution of health facilities by level of EOC services, according to type of institution, Bangladesh 1999

Service level	Medical college hospital	District Hospital	Upzilla health complex	Maternal and Child Welfare Centers	Private	Total
Comprehensive EmOC	100.0	81.4	18.3	27.4	41.7	40.9
Basic EmOC	0.0	6.8	25.8	19.4	5.7	10.2
Non EmOC	0.0	11.9	55.8	53.2	52.5	48.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of facilities	13	59	120	62	472	726

Source: Figures for the medical colleges hospitals, some upzila health complexes, the maternal and child welfare centers and child welfare centers, and private facilities are based on the 1999 survey by the Associates for community and Population Research.

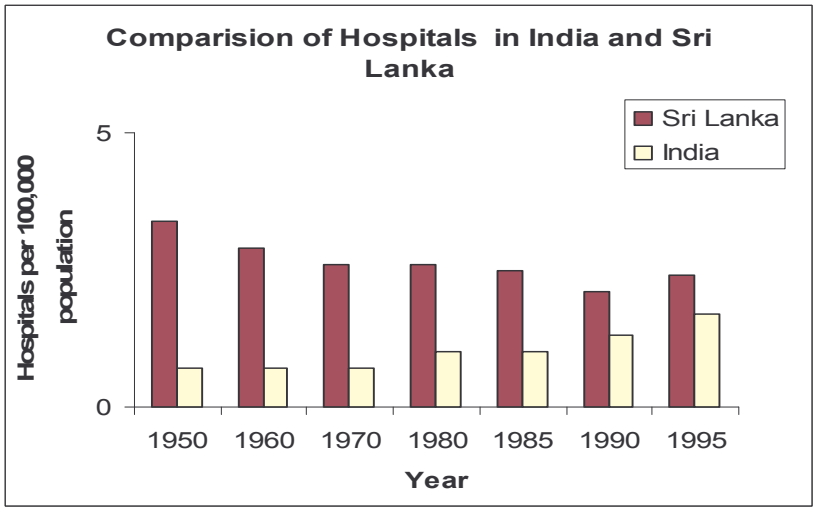
Source: Bangladesh Maternal Health Services and Maternal Mortality Survey 2001

Annex 4: Graph showing Comparison of Hospital Beds per 100,000 populations of India and Sri Lanka



Source: 1. Pathmanathan et al. 2003, Investing in Maternal health,
2. Health Information of India 2001-02

Annex 5: Graph showing Comparison of Hospitals per 100,000 Population in India and Sri Lanka



Source: 1. Pathmanathan et al. 2003, Investing in Maternal health,
2. Health Information of India 2001-02

Annex 6: Achievements of the Averting Maternal Death and Disability Program in Selected Countries[5]

Country	Implement-ing Partner	MMR per 100,000	Total Population	AMDD Investment	# of Expected Births per Year (target pop.)	Increase in Utilization of EmOC Services	Decrease in Case Fatality at Facilities
Bangladesh	UNICEF	est. 320-400	128 million	$4,762,000	39,350,232	-123 functioning facilities - 54% increase in births at targeted facilities -127% in # of women admitted with obstetrical emergencies -56% increase in c-sections (to 2.3%)	2.16% in 2002 in facilities (comparison not available for whole country)
Bhutan	UNICEF	420	657,548	$ 616,000	23,672	-19 facilities upgraded -% of births in facilities doubled from 11% to 20.5% -% of c-sections increased from 1.28% to 2.6% (5% is target)	Around 1.5% in 2003 (held steady despite doubling of births attended
India	UNICEF/ UNFPA FOGSI	540	31.5 million in the 13 districts in Rajasthan and Maharastra	$1,500,000 $1,400,000 $25,000	761,000	-Increased functioning CEmOC facilities from 17 to 24 -Increased functioning BEmOC facilities from 26-55 -25% increase in deliveries at facilities -30,000 women with complications received care -11,000 women had c-sections -62% increase in met need (to 14.3%)	- Decreased by 50% from 1.8% to .9%
Mali	SAVE/ UNICEF	1200	434,976 in the 2 districts of Bougouni and Yanfolila	$670,0682 $50,000	21,314	-42% increase in # of women treated in 2 facilities (396 in 2003) -11% increase in c-sections (2003)	40% decrease to 5% at Bougouni Hospital/ -92% decrease to 1% at Yanfolila Hospital

Source: Caro, 2004

[5] These are the countries that the evaluation team visited (Bhutan, Bangladesh, India, Nepal, Vietnam, Peru, and Tanzania) or were notable because of the size of the program (Morocco) or unique challenges (e.g. Mali). Data for the rest of the AMDD countries can be compiled by the grantee and should be requested directly from them. It was not possible to get totally comparable information for all countries given differences in data collection and scale of projects.

Annex 7: Indian Healthcare Project: **Electronic Support to ANMs**

India healthcare project[6] began in 1994 as a collaborative project between the Government of India and APPLE Computer Incorporates in order to provide electronic support to Auxiliary Nurse Midwife (ANM) for data collection, compilation and report generation.

As a female health worker attached to a specific health centre within a PHC, an ANM is responsible to attend to the healthcare needs of a rural population of about 5,000 on matters such as safe water, hygiene, immunization, maternal care etc. By virtue of her direct contact with rural people, each ANM is expected to prepare a brief on periodic reports on population growth, birth rate, immunization rate etc. She prepares all these reports by hand which is very laborious, time consuming and often interferes with her primary task of healthcare delivery. Many data items get entered in more than one report and thereby lead to data redundancy and inconsistencies. These reports, though incomplete and inconsistent are often used to monitor to the status of healthcare delivery in the villages.

The main objectives of providing electronic support to ANMs are therefore the following:

- Reduce ANM's time for data collection and compilation into reports.
- Increase accuracy of data flowing upwards through the healthcare reporting systems
- Facilitate data analysis
- Provide timely feedback to ANMs for improved service delivery

As the project begun to unfold, the core team co-opted more partners –CDIT, CMC and NID. The technology used for electronic data collection was the Newton's message pad tailor-made to improve the local weather conditions and the work practices of the ANMs. The system design had features to link the ANM's Newton's clients with a desktop PC at the PHC. The pilot project initiated in a remote area near the city of Ajmer in Rajasthan state faced cultural, geographic, social and technical challenges. Yet the results were encouraging. The Newton based electronic system did provide considerable relief to the ANMs from the enormous paper work responsibilities and thereby leave her with additional time and energy to attend to the healthcare needs of her villagers. Also it was possible to eliminate data redundancy and inconsistencies and there by create a reliable database on the community healthcare needs. Such a reliable database could also provide information support to monitor

[6] Mike Graves and Naresh Kumar Reddy, Chapter 2 "Electronic Support for Rural Health-care Workers",

the delivery of health services. But the Newton Pad was expensive, and no company came forward to invest in Newton's technology. With the extent of development in electronics technology, and the price of hardware constantly declining, there is enough justification to explore an appropriate electronic support for ANMs, which would give the ANMs more time to focus on healthcare delivery services for the poor.

Annex 8: A Telemedicine project: Service Delivery in a Rural District Hospital

In India, district hospitals receive very poor allocations for capital expenditure, and thereby face acute shortages for diagnostic facilities. As a result, many poor patients depend on private diagnostic centres for radiological investigations, by paying very high service charges. We state below the experience of a telemedicine project at a district hospital in Mehaboobnagar district in the state of Andhra Paradesh[7]. This district is one of the poorest in the state and is about 100 kms away from the state capital Hyderabad. The autonomy enjoyed by this district hospital under a World Bank assisted project facilitated the state health authorities to enter into a public-private partnership to provide telemedicine facilities at the district hospital.

The telemedicine infrastructure consists of a Telemedicine Specialist Centre (TSC) at CARE hospital, which is a private hospital in Hyderabad and a Telemedicine Consulting Centre (TCC) at the district hospital in Meheboobnagar. The TCC houses an ultrasound, a 500m x-ray unit and a CT scan interfaced with the telemedicine software. Patients now present themselves for radiological investigations at the TCC in the district hospital. The TCC has a high-end scanner for scanning images and transmitting to the TSC, a web camera for net meeting, and videoconferencing equipment to videoconference with the specialists at TSC. The specialists at TSC interact with the patient and the medical staff at TCC, views the lab reports, carries out live radiological investigations by viewing the transmitted images, and recommends an appropriate line of treatment. Telemedicine is also used by the general practitioners at the district hospital to get second/special opinion from super-specialists at the TSC to confirm diagnosis, plan treatment, provide acute interventional plan in case of medical emergency, and also to seek and prevent and respond to typical disease patterns in

[7] Ramani KV: "IT Enabled Applications in Government Hospitals, India: Illustrations of telemedicine, e-governance, and BPR", IEEE Proceedings of the Thirty-Seventh Hawaii International Conference on System Sciences, Information Technology in Healthcare Track (HICSS-37), Hawaii, January 5-8, 2004.

their areas. Besides long-distance clinical healthcare, the district hospital is also using its telemedicine center for patient and professional health related education, continuing medical education and public health administration. Future plans include using the telemedicine infrastructure as a channel for communication, assist "community-reach" programs in getting the message across (potable water, village sanitation, etc.), facilitate successful implementation of population control programs, create a channel for AIDS awareness and so on.

The experience of the patients, healthcare professionals at the private and district hospitals and the government healthcare officials are very satisfying. Encouraged by the success of this initiative, the private hospital is now setting up telemedicine centres at a few more district hospitals.

Since 65-75 percent of treatments and/or healthcare services do not require surgical interventions, telemedicine offers immense possibilities to offer quality healthcare services to poor patients in far away cities and remote areas.

Annex 9: ICT Infrastructure for Purchase and Supply of Drugs & Medicines: Tamil Nadu, India

The Tamil Nadu Medical Services Corporation Ltd. (TNMSC) commenced its functions of purchase, storage and distribution of drugs and medicines from January 1995. Its primary objective is to ensure ready availability of quality drugs and medicines in more than 11,000 government medical institutions throughout the state which includes about 9000 sub health centres, 1500 PHCs, 250 Taluka Head Quarters Hospitals, and 285 veterinary institutions.

TNMSC deals with about 75 vendors for about 600 items consisting of 280 drugs, 100 sutures, 70 surgical items and 150 veterinary items for an annual purchase Rs.120 crores. The corporation has scientifically designed and structured drug warehouses across 23 districts of Tamil Nadu to facilitate the logistics management of receipt, storage and distribution. The corporation ensures distribution of quality medicines through rigorous quality testing process conducted by reputed and government approved analytical laboratories. All the tender notices for tenders invited by TNMSC and the L1 rates are published in websites, besides publication in leading dailies. Such an extent of transparency in the working of TNMSC is highly

welcomed by all the stakeholders. Some of the benefits are (i) lower rates due to bulk purchases by TNMSC, directly from the manufacturers as opposed to purchases in loose forms from dealers by the heads of various departments, (ii) quality assurance through rigorous testing of each batch and opposed to testing sample batches earlier, (iii) all payment through TNMSC as opposed to payment from different sources, etc[8].

Besides its normal functioning of procurement and supply of drugs, the corporation has also expanded its activities to improve the health system in the state of Tamil Nadu. TNMSC manages a master health check up scheme at the Government General Hospital Chennai and also manages the special class maternity ward in the Institute of Obstetrics and Gynecology at Chennai on a very nominal fee fixed by the government. TNMSC has provided infrastructure facilities to the payment ward in the Government Kasturba Gandhi Hospital, Chennai and started maintaining the same from May 2004. The corporation also manages 36 CT scan centres and 2 MRI scan centres in the government hospitals at the state and district levels. Last year the state government accorded sanction to TNMSC for the procurement of equipment to the various government medical institutions.

The good infrastructure maintained by TNMSC has led to a significant improvement in the management of health services and health systems in the state of Tamil Nadu. TNMSC is now an ISO 9001: 2000 certified company. Several other states have approached TNMSC to help them to manage the purchase and distribution of medicines and drugs in other states. The World Bank also has acknowledged the excellent work done by TNMSC in one of its recent reports. TNMSC has thus demonstrated the importance of good infrastructure to provide cost effective quality healthcare to the people of Tamil Nadu.

[8] Tamil Nadu Medical Services Corporation Limited, 10th Annual report, 2003-04.