The Silently Accepted Menace of Disease Burden from Drinking Water Quality Problems

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We are faced today in India with an alarming concoction of water quality related diseases – nowhere else and never before have all these problems surfaced together. The challenge becomes daunting because the specific health impacts and disease burden caused by these water quality problems are exacerbated by two main reasons – poverty and malnutrition.

Official figures from Department of Drinking Water and Sanitation (DDWS) state that out of 593 districts from which data is available, we have problems from high Fluoride (203 districts), Iron (206 districts), Salinity (137 districts), Nitrate (109 districts) and Arsenic (35 districts) (DDWS, 2006). Biological contamination problems causing Enteretic disorders are present throughout the country and probably constitute the problem of major concern, being linked with infant mortality, maternal health and related issues. Estimates made for some of these water quality related health problems suggest a massive endemic nature – Fluorosis (65 million (Susheela 2001), Arsenicosis (5 million in West Bengal (WHO 2002), but several magnitudes more unestimated from Assam and Bihar). Fluorosis caused by high Fluoride in groundwater leads to Crippling, Skeletal problems and severe Bone deformities. On the other hand, Arsenicosis leads to skin lesions and develops into cancer of lung and the bladder. Both these diseases have also been related to a variety of other problems including brain disorders etc. Apart from adults who are already affected, these two problems alone threaten a whole generation of children from physical and psychological disabilities and life-threatening diseases. Being physically distinguishable, these diseases create a social stigma for affected persons and lead to several misconceptions about the root cause of problems.

The incidence of these diseases within the affected areas varies with the intensity considered. For example, in many Fluorosis endemic areas it is common to find almost 90-100% of children having some symptoms of Dental Fluorosis, but instances of Skeletal Fluorosis would be lower, eg., a 16% incidence in studied 25 villages of north Gujarat (Indu and Shah, 2004).

Disease burden estimated for these diseases also show high impacts in affected population – Fluorosis (DALY[1] of 38.5 per 1000 population (Devotta et al, 2007); disease burden up to Rs. 5000 per capita per family due to disability (Indu et al, 2007)), Kidney stones related to poor hydration in water quality affected areas (Rs. 7500 per family per year (Indu and Rawal, 2007)), Diarrhoel (overall DALY > 22 million years

[1] The DALY measure combines the years of life lost due to premature death (YLL) and the years lived with disability (YLD) for varying degrees of severity, making time itself the common metric for death and disability. One DALY is a health gap measure, equating to one year of healthy life lost.

annually and 4,25,000 deaths due to Diarrhea annually in India (NICED 2004)). Arsenicosis producing skin lesions and leading in extreme cases to cancer of lung and bladder has a high DALY of 5-27 per 1000 population (Fewtrell et al, 2005).

These health problems have a significant poverty signature – Fluorosis can be resisted to some extent by a diet rich with Calcium, Magnesium and Vitamin C (Zhongua 1988, Reddy 2008); Diarrheal problems are worsened by Anemic conditions etc. Simple technology fixes are also possible for many water quality problems (combined domestic water filters can be developed for less than Rs. 1000), but even that is not affordable to the affected poor. Also, manufactures are not ready to target this market segment for water filters.

Table 1: The extent and impact of Drinking Water Quality problems in India

Quality problems	**No. Districts**	**Population affected/exposed**	**Cause**	**Impact**
Salinity	137	No estimates available	Inherent(geogenic)/Manmade (eg. coastal saline intrusion due to overpumping)	Kidney stones due to poor hydration in such areas (Rs. 7500 cost per family per year)
Fluoride	203	65 million	Inherent(geogenic), but aggravated also by over-exploitation; increased by malnutrition	Fluorosis; DALY = 38.5 per 1000 population; > Rs. 5000 per capita annual expenses
Arsenic	35	5 million in WB; more in Assam, Bihar	Complex geogenic processes not yet well understood; but suspected to be related to excessive use and related water table fluctuations; increased by malnutrition	Arsenicosis ; DALY 5-27 per 1000 population
Iron	206	No good estimates	Geogenic mainly;	Iron overload; Cirrhosis; suspected Diarrhoel linkages; Cardiac linkages
Biological	No good estimates	No good estimates	Related to poor sanitation and hygiene practices; increased by malnutrition	Diarrheal problems; DALY > 22 million years annually; total 4,50,000 deaths annually
Agrochemicals	No good estimates	No good estimates	Related to pesticide/fertilizer use in agriculture	Multiple impacts; not understood well
Industrial effluents	No good estimates	No good estimates	Due to effluents from Industries	Multiple impacts; not understood well

Table 1 summarizes some of the statistics related to water quality problems in India. It must be noted, however, that this summary is based on poor nation-wide data and represents only the tip of the iceberg. The reality could be much grimmer than what is presented here.

These figures reflect not only the state of poor water services provided to the rural population, but also the state of rural public health facilities which fail abysmally short of identifying these problems and exposing the root cause. As of date, there is resistance within health agencies of accepting Fluorosis, say, as an endemic problem and merging it as a part of surveillance programs. The current medical education system does not prepare doctors to deal with these problems too.

The following steps will need to be undertaken towards addressing these water quality problems:

a) Comprehensive geological and geochemical understanding of aquifers

The conceptual base today is weak. Research is needed on the cause behind problems. There is debate on the release processes of various contaminants in aquifers and therefore it is first important to encourage research studies for understanding these processes better. However, current research within university and government institutes is inadequate to answer these questions. Perhaps a "*Water quality Research Fund"* needs to be made available for partnership based research between academic and civil society groups to work together on water quality issues.

b) Continuous monitoring of water quality

The current concepts behind contaminant release and pollution of aquifers need to be strengthened by widespread and frequent water quality monitoring in a participatory manner. The responsibility of such monitoring may be carried out by district level laboratories along with civil society groups and the PRIs. The laboratories need to be accessible to citizens upon request, even under a nominal payment for water testing. Currently such facilities are lacking across the country. To begin with therefore, we would need such "*District Water Quality Laboratories*" in all districts referred to in Table 1.

c) Identification of Health impacts of poor water quality

The priority on health research comes last for problems affecting the poor. Today we do not have ready answers on how to tackle Fluorosis and Arsenicosis by nutrition enhancement. We do not have techniques for widespread easy detection of these diseases. District hospitals need to have "*Specialized Health Referral Centres"* for these diseases so that detection of health impacts can be made.

d) Creation of demand for mitigating impacts of poor water quality

Many mitigation programmes such as the Fluorosis mitigation programmes in Rajasthan and Andhra Pradesh in 1990s have failed because they could not generate inherent demand within affected people for the solutions. Demand creation is a definite challenge. Doctors have a significant role to play in this since only they can link the symptom eg. pain, to the root i.e. water (eg. in Fluorosis). Instead, if the doctor recommends a pain-killer, an opportunity is lost. Therefore, a national level *Communication Program* through mass media, doctors and other avenues needs to be activated eg. the Polio program, the HIV program etc. Specific celebrity ambassadors can be identified for each such problem.

e) Services offered for mitigation of health problems

The *"Specialized Referral Centres"* mentioned before hosted within hospitals need to offer services for treatment of these health problems. Today, doctors in these areas are unaware of what needs to be done. Therefore, a large amount of capacity building needs to be achieved and a range of solutions – nutrition enhancement, corrective surgeries, ameliorating interventions – have to be tried together on already affected patients.

f) Preventing further problems due to poor water quality. A variety of measures could be adopted:

- Low cost filters (domestic level) – One approach could be to develop and support the market for low cost filters. Field studies show that people tend to use locally made material for filtration and might be acceptable to technologies with low maintenance. Such technologies are available – Activated Alumina (Fluoride and Arsenic removal), Rice husk and clay candle for Iron removal etc. The government should initiate a company as a project to produce and market a *Combined filter for less than Rs 1000*. It needs to be branded properly and sold across these affected areas.
- Innovation in rapid spread of better sanitation and hygiene practices is necessary. There have been success stories on rural toilets, but these are few. There has to be fast learning from these examples and rapid spread of domestic or common-use toilets across the country.
- Water harvesting and recharge: Many of the geogenic or anthropogenic problems have an overexploitation angle to them. They can be tackled to some extent locally by aquifer recharging. But such option should not be considered a panacea since the contaminant release mechanisms are not properly understood. Also, with the current level of groundwater over-use, protection of recharged water for water quality dilution is a difficult proposition.
- Nutrition programmes for mitigation of health problems eg. for Ca-Mg-Vitamin C in case of Fluorosis need to be developed. We cannot escape the fact that malnutrition has a strong link with many of these water quality problems. Several western countries with high Fluoride are not affected as much by Fluorosis. Much can be achieved by an increase in nutrition levels of the population.

- Providing alternative safer sources of water (from safer groundwater; safer surface water). In places with no alternative, piped schemes with treated surface water are being planned. However, the long term sustainability of such imported water schemes is difficult and must be resorted to when all other options are in-feasible.

In order to link all these activities from a) till f) above, a nodal agency at the district or a larger regional level (4-5 districts) will be needed to coordinate across departments, PRIs, civil society groups, research groups and patients. Such institutions could be initially hosted within existing groups that are working on these issues eg. civil society groups, research institutes etc.

Summarizing, we need specific action on knowledge creation (a,b), on health detection and mitigation (c, e), communication (d), and new solutions such as water filters, water harvesting, and addressing nutrition need to be explored together (f). The measures would require energizing local universities for research, bringing civil society for demonstrating pilots, empowering the PRIs towards problem identification and mitigation.

Safe drinking water is a basic service which when denied is leaving millions of Indians suffering from high morbidity. Experiences show that addressing the problem of safe drinking water is probably one the best governance tools for creating goodwill and building confidence in the population. We need to grab this opportunity and press for much more investment and urgent action on this front.

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