

Strategy for Fluorosis Mitigation Program in India

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SUMMARY: An innovative approach for fluorosis mitigation in endemic areas of fluorosis in India is developed, due to the previous major failures met with, and due to the subsequent corrections made which led to reasonable success. The strategy involves networking between health, education and public health engineering department personnel besides the NGOs (Non-Governmental Organisations). The implementation is framed in three stages. Stage I implies preparation in terms of multi-disciplinary human resource development. In stage II three surveys are carried out: first one on dental fluorosis in schools leading to short listing of affected villages, second one house to house health survey and third one on water sources and water quality. The data emerged are summarized and reviewed. Decisions are then taken, how, in the third stage, to provide safe water and nutritional counselling. 'Village' is the operating unit. Priority is laid on existing safe sources for provision of adequate water for cooking and drinking purposes. If all sources are contaminated, the community is informed of the technologies for removal of fluoride, using either the activated alumina or the Nalgonda techniques either in domestic units or in hand-pump attached plants. The community is made aware of the experience that recovery from fluoride poisoning is achieved in 10-15 days, if the victims practise a diet with adequate calcium, iron, Vitamin C, E and other anti-oxidants through dairy and agro products (vegetables and fruits). The impact of the interventions is demonstrable in a matter of a few days and recovery from non-skeletal fluorosis is assured.

Key words: Fluorosis mitigation, India strategy, implementation, interventions, recovery, impact assessment.

INTRODUCTION

A survey carried out in 1992, has shown that among the 29 fluorosis mitigation projects implemented in 29 districts in 10 endemic states of India only 34 % met with reasonable success, while 66 % failed miserably¹. The main reason for the failure that led to the collapse of promoting fluorosis control and prevention activities could be summarised in three points².

- Lack of initiative on the part of the Health & Public Health Engineering Departments to follow-up the activities.

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- The surveys were done but summarizing of the field data was never taken-up.
- Those who understood the pros and cons and was taking the responsibility of implementing the project, were transferred as usually happens in Government Departments and the successor never understood the project implementation strategy and therefore could not devote time by himself / herself to get the programme going.

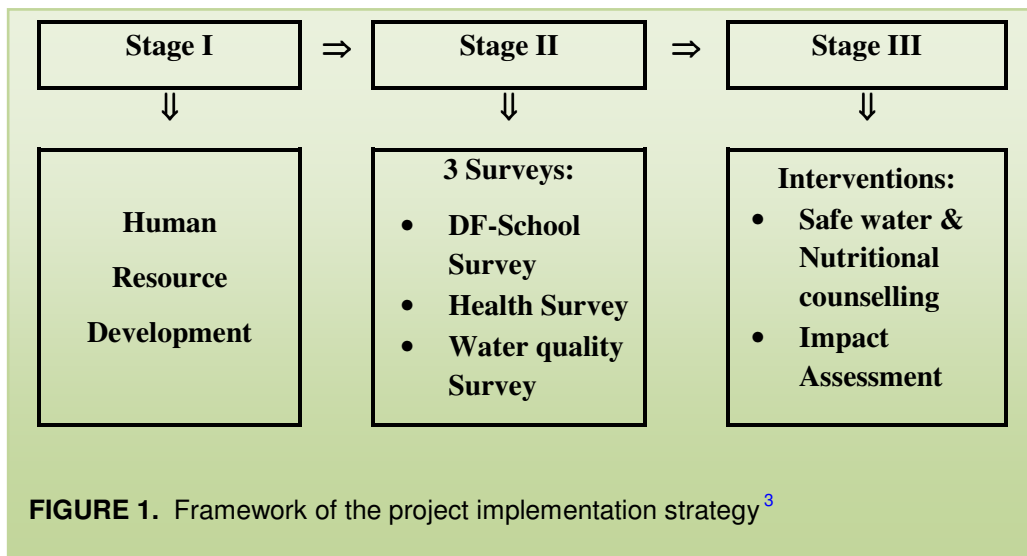
This paper presents our present project implementation strategy, developed due to the major failures met with, and due to the subsequent corrections made which led to reasonable success. As an example we are highlighting the events and the data generated from projects under implementation in Nagoan and Karbianglong, two highly endemic districts in Assam, India.

STRATEGY COMPONENTS & STAGES

Strategy components:

- Identification of endemic villages.
- Diagnosis of fluorosis at early stages.
- Conduct of house-to-house health survey with focus on fluoride poisoning effects / health complaints.
- Analysis of 100 % of ground water sources for fluoride.
- Record of dietary habits of the families.
- Interventions in terms of:
- Promotion of consumption of fluoride safe water, either defluoridated water or water from alternative low fluoride sources.
- Provision of nutritional counselling.
- Assessment of the impact of the interventions.
- Record of recovery among the family, the duration taken for recovery being considered.

Implementation stages: The project implementation goes through 3 stages as indicated in Figure 1:



HUMAN RESOURCE DEVELOPMENT

Stage I: Stage I concerns human resource development and comprise of four trainings, each of one-day duration, of following groups:

- Doctor's training on all aspects on fluorosis mitigation.
- Training of the Public Health Engineers from Water Supply Agency on water quality testing and provision of safe water.
- Training of schoolteachers on identification of dental fluorosis and differentiation from caries and other dental disorders.
- Training of village level workers / NGOs on how to conduct house to house health surveys, how to collect water samples and how to fill-up the pre-coded survey formats.

For the human resources development, the training team comprises of resource persons from the following four departments / disciplines.

- Community Medicine.
- Dental Surgeon (Paediatric).
- Water Quality & Water Defluoridation.
- Health Sciences Expert & Coordinator.

However, presently, the Foundation is also involved in up-dating the faculty and clinicians of medical colleges in the endemic states / districts, so that every batch of Medical / Dental students graduating from the respective university are taught on all aspects of Fluorosis, so that in the years ahead, training of Doctors may not be necessary. The training team for the Medical/Dental Faculty comprises of:

- An orthopaedic surgeon
- A dental surgeon
- An endocrinologist
- A gastro-enterologist
- A paediatrician
- A community medicine specialist
- A health science specialist and coordinator

These specialists are chosen from those who have many years of research experience and who have dealt with patients of fluorosis during their clinical practise.

DF, HEALTH & WATER SURVEYS

Stage II: This stage focus on 3 surveys: one on school dental fluorosis, one on health and one on water quality.

Dental fluorosis survey: The survey on dental fluorosis among school children is carried out for short-listing the villages endemic for fluorosis and to identify the percentage of children who are victims of fluoride poisoning. For reliability of results, children of 8 years and above are screened. The trained schoolteachers do the survey. The teachers are often provided with colour charts revealing the various types of derangements and characteristics of dental fluorosis.

Health survey: Fluorotic individuals are mostly confined to their homes. They are seldom entertained in hospitals except for research. Therefore, to conduct a health survey of fluorosis victims, hospital records are not helpful. The only alternative to get reliable information on the prevalence of fluorosis (all 3 types) is to visit the houses in the endemic villages and record the disease prevalence. A house-to-house health survey with focus on health complaints, suggesting fluoride poisoning effects are recorded in the pre-coded formats.

Water quality survey: The water quality survey with focus on fluoride is done from the water samples collected by the health workers who visit the homes, cf. Table 1. Water samples are not to be collected by the water supply agencies. The health workers would communicate to the family the reason for collecting the samples of the ground water and the family would then be informed of the test report for fluoride during the subsequent visit of the health worker. This is also a method of sensitising the family; the dangers of fluoride and the family would anxiously await the test report.

However, the testing of the water samples is done by the water analyst who is under the administrative jurisdiction of the water supply agency. Fluoride estimation needs to be carried out by the ion selective electrode method, as it is the best method for getting reliable and precision data.

TABLE 1: Results of school dental fluorosis survey and water quality of samples brought by the students in Rongkhang block in Karbianglong district of Assam.

Number of villages where schools are located	100
Dental fluorosis prevalence (DF)	1.16 - 39.20 %
The number of villages where the DF children come from	245
Water sources brought and tested for Fluoride	72
Existing safe sources (F < 1mg/L)	59 (0.06– 0.94 mg/L)
Contaminated water sources (F > 1mg/L)	13 (1.1 – 2.3 mg/L)

While the health survey is carried out, the information on the food habits of the family is recorded. This includes the consumption of high fluoride containing food products, viz. drinking black tea (i.e. tea without milk); use of black rock salt; use of fluoridated dental products, fluoride containing drugs for treatment of any ailment, preserved and canned / bottled, food products viz. fruit juice, fish (tuna) and others where fluoride may have been added as a preservative. It is important that the field workers are trained and use pre-coded, field-tested, proforma.

Some results from health and diet survey is summarised in Table 2.

Review of the data: The water testing data would reveal the linkage to the user family and would also be linked to the health complaints recorded through the house-to-house survey. The data of the 3 surveys, with linkage established, would be summarized by an agency not involved in conducting the survey and reviewed, village by village by all the agencies involved in programme implementation.

It is of considerable importance for all the agencies responsible for the project implementation i.e. the funding agency and the departments of the health, education, water supply and others, who are responsible for the project implementation to meet for review of the data emerged from all the 3 surveys. This includes the linkages established between the water sources and the consumer families. The information on the extend of contamination of the ground water sources with fluoride besides the safe sources existing are taken into consideration when a decision is taken for provision of safe water to the village / community / families.

TABLE 2: Information on health complains and diet habits, as gained from Binnakandi Village, Nagoan District.

I: General Information:	
• Total number of members / population surveyed in a village	758
• Total number of families surveyed in the village	120
• Number of adults in the village	413
• Number of Children in the village	325
• Number of pregnant women at the time of survey	8
• Breast feeding women at the time of survey	39
II: Health complaints of the community in %⁴	
• Knock- knee in children	0.31
• Pain in the joints	0.13
• Non-Skeletal changes / early warning signs ⁵	40.76
• Still birth / abortion	0
III: Food and other habits of using items with high fluoride content %	
• Chewing of Supari (Aracnut)	44.2
• Chewing of Tobacco	18.9
• Consuming Black tea (without milk)	71.5
• Consuming canned food	16.5
• Using Black rock salt in cooking	28.9

The review meeting would provide an opportunity to the agencies involved, to assess the gravity of the problem / the prevalence of the disease, the number of villages / habitations that are endemic for fluoride and the safe sources existing in the same village and fluoride contaminated sources. The information is used to decide upon the course of action for provision of safe water to the community in a village. It is highlighted that in a district project implementation process, the village is the unit, the family and the members are the focus and the community is the beneficiary.

DOUBLE INTERVENTION & IMPACT ASSESSMENT

Stage III: In stage III the events are mainly focusing and promoting interventions i.e. 1) Safe drinking water and 2) Nutritional / diet counselling. The community has 3 options to choose from for pursuing interventions i.e. collecting safe water for cooking and drinking purposes.

1st Intervention: The 1st intervention is the provision of safe drinking water, which is done in one of three options:

- Option 1 is establishment of new stand-posts to provide water from an existing safe water source that might be available at a central location in the village. These stand-posts should operate at certain time intervals during the day, e.g. 2 hours in the morning or the evening in order to meet the requirements for collecting safe water for drinking and cooking only.
- Option 2 is the establishment of a new safe water source, be it a hand pump, a tube well or a dug well. It is necessary for the community to ensure, that the wells never dry up in the summer months. This is achieved by putting-up bunds and getting the rainwater during the rainy season to stagnate and percolate to the underground thus recharging the aquifer. The community leaders need to be adequately sensitised and they undertake the work on a voluntary basis.
- Option 3 is selected when no safe water sources are available. It implies introduction of defluoridation to existing high fluoride water sources. The community may choose between activated alumina (AA) domestic filter, AA based treatment plant attached to hand pump and the Nalgonda bucket system using lime and alum.

The community also need to be informed about the cost involved, how to re-use the same activated alumina, by regenerating / washing of the AA using dilute acid and alkali followed by washing with water. The community should be aware that they have to choose from AA technology, domestic filter made of food grade plastic, stainless steel and/or terracotta. This exercise need to be undertaken with village women involved in the exercise, so that they understand and should have the right to opt for, from the available options.

2nd Intervention: The diet/nutrient counselling is based on five principles, i.e. 1) avoidance of fluoride contaminated food and beverage from the daily diet, 2) adequate consumption of health promoters, 3) easy to practise, 4) affordable and 5) consideration of family's likes and dislikes^{6,7}.

The focus of diet counselling is primarily to drive home the essential message that for combating fluoride toxicity/poisoning, it is of prime importance to consume through diet adequate Calcium, Iron, Vitamin C, E and other antioxidants. If the daily diet is rich in vegetables and fruits for obtaining the vitamins and other antioxidants, in a matter of 10 – 15 days the poisonous effect of fluoride can be nullified. Recovery would be remarkable.

Impact Assessment: Prevention and Control of Fluorosis is easily achievable in an endemic area. The acceptance of safe water and practise of better nutrition on a sustainable manner in a household/community need to be evolved. Depending upon

the awareness status of the community, if considered necessary, a KAP study (Knowledge, Aptitude and Practise) workshop should be held for sensitising the community.

In the final stage of the project Implementation, the impact of the 2 interventions practised need to be assessed at certain intervals. The first interval should be between 15 – 20 days after practise of interventions. The second may be commenced between 3 – 4 months and the third, during 10 – 12 months. It is our observation that, those afflicted with fluoride poisoning and detected very early would have regained health in a relatively short time frame of 3 to 4 months.

The impact assessment is essentially focusing on the repeat of the health survey with focus on non-skeletal fluorosis only in 50 %, 75 % or 100 % of the families. If it is an urban sector, besides non-skeletal fluorosis manifestations, the blood and urine fluoride levels could also be assessed which shall drop to normal limits i.e. serum = 0.02 mg/L; urine = 0.10 mg/L within the period of recovery.

The communication should enable investigators to implement a successful fluoride mitigation program within a shortest span of time, through lessons learned from India from our failures and successes extended over a decade. Necessary checks have been introduced at various stages. Eventually the out come of the project success shall be a great satisfaction to those involved in project implementation whichever part of the world, they may belong to.

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