Fluorosis Mitigation Programme: Approaches to Activate Activities

Abstract: This communication is addressing mitigation of Fluorosis and linked disorders. The focus is to activate the activities. In a severely endemic state for Fluorosis, i.e., Rajasthan, a project investigated to find out the road blocks, if any. Firstly in 5 Teaching Hospitals and secondly in 6 District Hospitals the activities were launched. The programmes were assessed for its impact and views of the Doctors were ascertained. The District Hospital Doctors cater to urban to rural communities. ANMs and ASHAs are linked to activities and they in turn reach out to every household in a village or habitat. Management of the disease(s) through diet editing and diet counselling were practical to get relieved of the disease in a shorter span of time. Drug prescriptions are important but nutrients through diet play a major role. The project implemented revealed the inadequacies in making arrangements for conducting MEs, the reason for failures of MEs in the past in other states. Lack of interdepartmental collaborations, strengths and weaknesses of the programme highlighted. The programme conducted revealed the novel approach to yield beneficial outcome both in the social and developmental sectors. (186 words).

Keywords: Fluorosis mitigation; Medical education; Doctors; Sensitization of ANMs & ASHAs; Impact; Community participation; Interdepartmental activities; Novel approach; Beneficial aspects.

INTRODUCTION:

This article addresses Fluorosis and linked disorders, a public health problem prevalent in India over 8 decades (Shortt, H. E. et al., 1937). Activation of activities by the state health departments for its mitigation are of importance. Although investments made in basic and applied researches and the wealth of information that India has, no other nation can claim to possess. The enormity of the health problem and patient material availability for research attracted the scientific community from diverse disciplines to investigate the issues (Susheela, A. K. 1999; Susheela, A. K. et al., 1999; Susheela, A. K. et al., 2010a; Susheela, A. K. et al., 2010b; Susheela, A. K. et al., 2018a; & Susheela, A. K. et al., 2018b). A multidisciplinary approach essentially required to understand the activities of fluoride causing Fluorosis and linked disorders. Water supply engineers played a prominent role for decades. Besides water, fluoride entry is through food adulterated with calcium fluoride (CaF₂) with 157 ppm fluoride (Analytical Test Report, 2018), as a spice to enhance aroma and taste of food. It is added to pickles and snacks. Rock salt lead to addiction and the issue seldom discussed. Rock salt is added to fresh lime water and served as a beverage. In urban settings, refrigerated water sold near bus stops, petrol stations and offices display lime, sugar and rock salt on the cart and a glass of fluoridated water is sold for Rs.2 – 3 / glass. The common public is unaware rock salt has high F⁻ and it is a poison. Fluoride is also consumed through chewing tobacco, aracnut, as these are rich in fluoride content (Nanda, R. S., & RS, N. 1972; & Susheela, A. K. 2016). ‘Churans’ with high rock salt sold is labelled, indicating rock salt added. The supermarkets are loaded with masala powder for pav bhaji, chana, rajma and a variety of other dishes. The ingredients added are indicated on the packet which include black and white salts. The white salt is the iodized salt recommended for use.

The public and the patients of Fluorosis should be alerted to avoid consuming snacks with rock salt and not used in cooking (Susheela, A. K., & Toteja, G. S. 2018). During the present times, the disease has become more complex to understand. The conventional Dental, Skeletal and Non-skeletal forms of Fluorosis were easily identifiable (Susheela, A.K., 2007). The fact remains fluoride being a highly reactive, electronegative element has other bio-chemical characteristics; it is an enzyme inhibitor, hormone disruptor and neurotoxin (Pouraelamani, H. R. et al., 2011; Grandjean, P. 2019; Susheela, A. K. et al., 2015; & Wang, M. et al., 2020), and when the level of fluoride in circulation get higher, diseases surface in various organs and systems, which the health professionals never anticipated. The fluoride linked disorders, which need to be detected through tests focussing on fluoride levels in serum, urine and drinking water. It is also mandatory to get an X-ray radiograph, preferably of the fore-arm when the calcification of interosseus membrane is visible at the earliest onset (Susheela, A.K. 2007). The complexity of the disease(s) is addressed through a novel approach. The aim of this communication is to ensure the activities for mitigation through a novel approach is activated.
MATERIALS AND METHODS:
The study was conducted in a highly endemic state of Rajasthan. The human resource in a sample of 5 Teaching Hospitals and 6 district Hospitals in the state were chosen for knowledge upgradation. Fig.1 shows the locations of the 2 different kind of institutions chosen.

Figure1: Showing the location of Teaching & District Hospitals in Rajasthan.

A doctor in a health delivery outlet, whether a Teaching Hospital or a District Hospital is unaware how to suspect the disease through health complaints unless it is at the very advanced stage when the patient has scoliosis, kyphosis and disability in walking. Unaware of the metabolic disorders linked to Fluorosis. Unaware of the diagnostic protocol. Unaware of the simplest procedure to control and prevent the disease(s). These are honest hard facts. Attention was not paid to mitigate Fluorosis except for supporting water supply agencies for provision of safe water. Those who consume safe water may also become victims of Fluorosis as a result of consuming fluoride from other sources. This article is based on the facts listed above and through a novel approach of interacting and probing the reasons.

Rajasthan state was chosen as it is one of the most severely endemic states for Fluorosis in India. All the 33 districts affected (Gautam, R. et al., 2011; Arif, M. O. H. A. M. M. E. D. et al., 2013; Agrawal, V. et al., 1997; & Report. 2013). The Public Health Engineering Departments are well informed of the hardware aspects as well as water treatment. But the aim of the project was to activate the programme in the state for the mitigation of Fluorosis and linked disorders where the doctors have a vital role to play (Susheela, A. K., & Toteja, G. S. 2018).
The project is structured differently from the earlier formats. The doctors were addressed through medical education programmes in 5 Teaching Hospitals located in 5 districts, ie, Ajmer, Bikaner, Jodhpur, Jaipur and Udaipur. Besides, the doctors posted in 6 District Hospitals in Ajmer, Jodhpur, Jaipur I, Jaipur II, Udaipur and Tonk were also addressed. Each district has 6 taluks (blocks). Doctors are deployed in district Hospitals in Commminuty Health Centres (CHCs), Primary Health Centres (PHCs) and urban dispensaries. The Sub-centres have no doctors; but grass-root level functionaries ie. Accredited Social Health Activists (ASHAs) and Auxiliary Nurse Midwives (ANMs) posted. The project is brought under one umbrella, the manpower ie. Doctors and paramedicals, updated. This approach was adopted for the first time in India. The Teaching Hospital doctors are under the jurisdiction of the Principal and District Hospital doctors under the Chief Medical and Health Officer (CMnHO). All the 5 Principals and 6 CMnHOs attended the programme, besides their doctors.

Medical Education programme for Doctors in Teaching Hospitals:  
The target audiences were ●Principal, ●Head of Department, ●Senior Grade Professors of Pre, Para and Clinical Departments of 5 medical colleges. Each medical education (ME) session lasted for a 3 hour duration and dealt with all aspects of fluoride poisoning and Fluorosis, The effects of F– on cancellous and cortical bones are distinctly different and revealed. The pathogenesis in soft tissues viz. the musculature, red blood cells, spermatozoa were dealt with. It was also of interest to the participants, how the gastro-intestinal system was severely damaged due to the environmental toxin fluoride. The affliction was traced to the sub-cellular levels and also corroborated with biochemical abnormalities. The diagnostic procedure for Fluorosis, differential diagnosis required when overlapping clinical manifestations were observed with other health problems. It was a rewarding experience for the doctors to know the recovery from the disease in a shorter time span through practice of interventions when the disease detected early.

Medical Education (ME) on Fluorosis and linked disorders for other Faculty members and Junior Doctors in teaching hospitals were also held in separate sessions during a second round of deliberations. This was the first time such an in-depth sharing of information on Fluorosis took place citing case studies. Doctors recorded that it was the first time during several years in their service they learnt and understood the complex nature of the disease and severity of the problem which was addressed, through scientific means and recovery assured to the victims. The attendance sheets with the details and their speciality, research interest, if any, contact details obtained from the doctors, a record for their participation in the MEs. Doctors were informed to write their views on the ME any suggestion they wish to offer in terms of the gain from the ME, suggestions to improve the presentation if any and finally they grade the ME; and return the sheets to the organizers of the ME. These were evaluated for assessing the impact of the ME.

Medical Education programme for Doctors in District Hospitals:  
Doctors from each district comprising of 6 blocks from 6 districts, were updated. Each block is looked after by a Block-Chief Medical Officer (BCMO). Those sessions unlike in teaching hospitals, were held as a part of a monthly review meetings held by Chief Medical and Health Officers (CMnHOs). Conducting ME with the monthly review meeting had its merits and demerits. Besides doctors, accountants, administrators and others who look after district hospital activities were attending the meetings. The information shared had wider circulation among the non-medical section of the employees of the district hospital. But the number of doctors was limited. The CMnHOs coordinated and the discussions were focused on the budget; directed to expedite payment of bills and submit accounts. Views on medical aspects were on maternal and infant death and vaccination schedule, any epidemic disease in the district. But fluoride and Fluorosis was seldom discussed. The expert team was able to gather information and understood why Fluorosis disease does not get attended to and why mitigation of the disease is not taking place. Fluorosis disease was alien to the health professionals in the districts where the programmes were executed.

Sensitization for Para-medicals (ANMs &ASHAs)  
Auxiliary nurse midwives (ANMs) and their Supervisors, Accredited Social Health Activists (ASHAs) and their Supervisors were included in the sensitization workshops as they are a part of the health system. Besides they were conveyed what they would communicate to the village community during home visits was dealt with as the most important issue. Those procedures were necessary to reach out to the individuals due to varying ailments they were likely to attend Outpatient Departments in the teaching hospitals or in CHCs, PHCs and/or Dispensaries. They ought to know how F– poisoning through water and food seriously affect their well-being. The Paramedical functionaries were informed to write down their details in the attendance sheet. They were evaluated for their understanding of fluoride and Fluorosis disease, through the answers provided in the precoded pre and post training questionnaires. The questions in pre and post training questionnaires were different. But would provide a reasonably good idea of the disease and information need to be conveyed to the village community.
RESULTS and DISCUSSIONS
The medical education sessions, discussions followed, led to the understanding of 3 major issues, that in the state ● Fluorosis Diagnostic Facility in teaching hospitals was non-existing. ● Libraries were devoid of literature on Fluorosis, ● The ME and associated activities had a significant impact as it was a novel approach.

Fluorosis Diagnostic Facility
Fluorosis Diagnostic facility was non-existent in the state, either in the government or private hospitals. As a result, patients having joint pain were considered and treated for Arthritis. Fluorosis was seldom considered as a possibility; joint pain is the common health complaint of the two diseases though has distinctly different etiology and pathogenesis. Arthritis affected small and large joints and formed inflammatory reactions. Whereas Fluorosis affects only the major joints and no overtly visible inflammatory reaction. The disease without confirming was treated by pain killers. It is considered unethical to treat patients with pain killers without correct diagnosis. Such treatment led to kidney failure (Lantz, O. et al., 1987; Dharmaratne, R. W. 2015; & Dare, A. J. et al., 2017), aggravating the agony of the patient(s) and their families. The Doctors were unaware of the linkage of Fluorosis with other metabolic disorders was amply evident.

Medical Books on Fluorosis
A list of important books on Fluorosis was provided to the Principals to procure for the medical colleges for the central and departmental libraries. This is the basic minimum requirement to introduce Fluorosis to the medical and dental fraternity. Unawareness of the disease looms large among the faculty of the medical colleges in the state and the community therefore were paying a heavy price for it.

Teaching of Fluorosis
In a medical college, besides Community Medicine all other disciplines viz. Medicine, Paediatrics, OBGY, Surgery, Anaesthesiology and some of the Super Specialities Viz. Cardiology, Gastroenterology, Endocrinology and Neurology are required to teach the undergraduates, interns and residents as the diseases emerge due to F⁻ toxin. The disease ought to get into the main stream medical education and patient care services. As F⁻ is a ●neurotoxin, ●hormone disrupter and an ●enzyme inhibitor (Susheela, A. K. 2018a; Susheela, A. K. et al., 2018b; Analytical Test Report. 2018; Nanda, R. S., & RS. N. 1972; Susheela, A. K. 2016; Susheela, A. K., & Toteja, G. S. 2018; Susheela, A.K. 2007; Pourleslami, H. R. et al., 2011; Grandjean, P. 2019; Susheela, A. K. et al., 2005; & Wang, M. et al., 2020), upon ingestion of fluoride, health issues surface which may fall under any of the disciplines mentioned above and doctors seldom suspect fluoride poisoning as the cause of the ailment. This is also to record all anaesthetic agents are with fluorine gas and special care to be taken in operation theatres (OTs) to prevent gas emission and inhalation; special masks to be worn by all personnel in OTs including the technicians and nurses. A study reported in Anaesthesiology as early as 1968 (Bruce, D. L. et al., 1968), revealed that in the US, over a period of 20 years, the cause of death of Anaesthesiologists ascertained was due to renal failure. Fluoride ingestion for a prolonged period either through ingestion or inhalation has disastrous consequences (Susheela, A. K. et al., 2013; & Susheela A.K (ed). 2015).

Impact of Medical Education
Following the conduct of ME for the doctors, there were extensive discussions. There was considerable excitement among the doctors for the knowledge gained. Participants did not know rock salt (CaF₂) having high fluoride was detrimental to health. Many ideas about research were discussed; to the extent possible. Many of the doctors had health issues among their family members who were non-responding to prescribed drug. This was explained as gastrointestinal mucosa lost microvilli due to fluoride poisoning leading to non-absorption of drugs orally administered. If the drug was administered through intramuscular / intravenous route, desired results would be achieved. The agonizing experiences of Fluorosis afflicted victims were discussed. The doctors were disappointed that the hospital authorities have not developed infrastructure for Fluorosis diagnosis.

Details of medical education
The total number of 222 doctors updated on Fluorosis and Linked disorders in the 5 medical college hospitals, the decisions arrived at and requirements specified, reported in Table 1.
Table 1: Shows the details of the Medical Education (ME) programmes conducted in the 5 Teaching Hospitals, with the total number of participants attended

<table>
<thead>
<tr>
<th>Teaching Hospitals where MEs held on Fluorosis and Linked disorders</th>
<th>Total participants (Principals, HODs and Senior Grade Professors from Pre, Para and Clinical Departments)</th>
<th>Focussed on Decisions arrived at by the Principal / HODs of the Department at the meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 JLN Medical College, Ajmer</td>
<td>21</td>
<td>1. Requirement for procurement of the equipment, ION Meter specifications for calling for tender provided.</td>
</tr>
<tr>
<td>2 RNT Medical College, Udaipur (2 sessions)</td>
<td>2386</td>
<td>2. Trained Technician / Scientist for conducting diagnostic tests and reporting results</td>
</tr>
<tr>
<td>3 Dr. SN Medical College, Jodhpur</td>
<td>26</td>
<td>3. A list of essential medical books for procurement for the main library / department libraries provided.</td>
</tr>
<tr>
<td>4 SMS Medical College, Jaipur</td>
<td>36</td>
<td>4. A central Fluorosis Diagnostic facility to establish diagnosing the disease and the same facility would also cater to testing samples of Residents for research, with nominal payment</td>
</tr>
<tr>
<td>5 SP Medical College, Bikaner</td>
<td>30</td>
<td>5. To set up a Central Fluorosis Diagnostic Facility in the Teaching Hospitals</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>222</strong></td>
<td></td>
</tr>
</tbody>
</table>

Doctors trained 281 in the 6 district hospitals of Rajasthan block-wise reported in Table 2.

Table 2: Human Resource Developed through conducting Medical Education (ME) programmes for Doctors of 6 District Hospitals functioning under Chief Medical and Health Officers (CMnHOs).

<table>
<thead>
<tr>
<th>No</th>
<th>District</th>
<th>Number of Doctors attended the programme</th>
<th>Participants attended from number of Blocks</th>
<th>Total number of Blocks in the District existing</th>
<th>Chief Medical and Health Officer (CMnHO) of the District who organized the programme in the District</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ajmer</td>
<td>58</td>
<td>5</td>
<td>8</td>
<td>Dr. K.K. Soni</td>
</tr>
<tr>
<td>2</td>
<td>Jodhpur</td>
<td>52</td>
<td>6</td>
<td>10</td>
<td>†Dr. Suresh Choudhary</td>
</tr>
<tr>
<td>3</td>
<td>Jaipur I</td>
<td>57</td>
<td>7</td>
<td>7</td>
<td>‡ Dr. Narottam Sharma</td>
</tr>
<tr>
<td>4</td>
<td>Jaipur II</td>
<td>47</td>
<td>6</td>
<td>6</td>
<td>Dr. Parveen Aswal</td>
</tr>
<tr>
<td>5</td>
<td>Udaipur</td>
<td>17</td>
<td>1</td>
<td>10</td>
<td>Dr. Dinesh Kharadi</td>
</tr>
<tr>
<td>6</td>
<td>Tonk</td>
<td>50</td>
<td>Not indicated</td>
<td>6</td>
<td>Dr. S. K. Bhandari</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>281</td>
<td>*25</td>
<td>47</td>
<td></td>
</tr>
</tbody>
</table>

*Among the 47 Blocks existing in the 6 districts, only 25 Blocks were represented in the Training Programme (i.e. 50%)
†Superannuated since then; CMnHO took keen interest in organizing the programme
‡Jaipur I ME was inaugurated by Shri Phool Singh Bhaindaji, MLA from Virat Nagar Block and Dr. Narottam Sharma CMnHO presided over the function.
The blocks from where doctors did not attend the ME sessions were also indicated. It was a new experience for the CMnHOs, to attend a ME with practical information in such great detail imparted for patient care services.

Total number of 503 doctors attended the MEs on Fluorosis and Linked disorders from the 5 teaching hospitals and 6 district hospitals in the state. The views expressed in writing by doctors randomly chosen from 5%, reproduced in Table 3.

Table 3: The views expressed and recorded by the Doctors; a sample of 25 from the 12 MEs conducted in the 5 Medical Colleges and 6 District Hospitals reproduced below

<table>
<thead>
<tr>
<th>S.No.</th>
<th>“Views on the ME &amp; its impact.” By Doctors from 12 MEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>”Superb explanation and useful information given in simple language and fantastic slides.”</td>
</tr>
<tr>
<td>2</td>
<td>“Linked disorders are more serious health problems than water intake of F–. This programme is very good and really need experience to deal with.”</td>
</tr>
<tr>
<td>3</td>
<td>“Very informative with ease to understand well in depth and influence the life of patients. Patients with back pain, joint pain, and feeling of fatigue require investigation. Avoid prescribing pain killers”</td>
</tr>
<tr>
<td>4</td>
<td>“It was indeed a very knowledgeable session. The myth about the kalanamak / sandha namak was a real eye opener. Such informative / workshops must be given to all field functionaries in Health Department and also to general persons because it has a reasonable protocol to promote health in general.”</td>
</tr>
<tr>
<td>5</td>
<td>“Highly informative regarding fluorosis. Many new concepts got to know from the workshop. Useful to all clinicians, administrators and health workers”.</td>
</tr>
<tr>
<td>6</td>
<td>“Really mind blowing with need based lecture. Basic issue to modify diet in such a beneficial manner. Was really awesome”.</td>
</tr>
<tr>
<td>7</td>
<td>“In all my study life and whole life, never heard such an Excellent lecture”</td>
</tr>
<tr>
<td>8</td>
<td>“The entire programme is very good. Wonderful explanation about pathogenesis by fluoride”</td>
</tr>
<tr>
<td>9</td>
<td>“The session on fluorosis was very knowledgeable. Nobody has taught us fluorosis like this team”</td>
</tr>
<tr>
<td>10</td>
<td>“The programme is an eye opener for me. I have a lot of patients with GI problems, muscle weakness problem, So now I can counteract with new information” Thank you for the wonderful advice, well done”</td>
</tr>
<tr>
<td>11</td>
<td>“The programme is very educative and excellent that never heard before, very useful to us”</td>
</tr>
<tr>
<td>12</td>
<td>“Serum fluoride, urine fluoride should be made mandatory in ANC screening tests”</td>
</tr>
<tr>
<td>13</td>
<td>“Necessary monitoring for all antenatal patients and school children”</td>
</tr>
<tr>
<td>14</td>
<td>“The lecture touched the very root of the disease which many people did not know. It was interesting. We are inspired.”</td>
</tr>
<tr>
<td>15</td>
<td>“Very useful for orthodox thinking which is a kind of incurable disease in the country. The programme provided basic concepts of Fluorosis. That can be prevented at primary stage and can stop the epidemic of Fluorosis in our state”</td>
</tr>
<tr>
<td>16</td>
<td>“Firstly very thankful to the team for the awareness given to us on such a topic. Please make it available in Rajasthan, the diagnosis of Fluorosis. Special thanks for awareness on kala namak / sandha namak”</td>
</tr>
<tr>
<td>17</td>
<td>“Really nice programme about Fluorosis. I never had idea about prepared chatmasala and other masalas have so high amount of fluoride. In villages during Antenatal care, Fluoride is such a problem. I never read in books (for IUGR and Anemia). So good team, very much appreciated”</td>
</tr>
<tr>
<td>18</td>
<td>“First of all a big thank you to all team for giving views over fluoride. It was very good information and best part was information on diet regularising. Will not only try myself but will influence my family and friends too. Thank you”</td>
</tr>
</tbody>
</table>
| 19    | “Good lecture. Thanks for the basic principal of diet and information on the disease fluorosis. My efforts are to spread knowledge about fluoride and adverse effects of kala namak in all patients of fluorosis in
Rajasthan."

"I have seen so many patients suffer from Fluorosis in my OPD. So fluorosis control programme to reduce such bulk of morbidity which the disease affecting productivity day by day"

"The whole ME was very informative and may change our approaches to patient care. Thank you for the workshop"

"Fluorosis control programme is necessary in this region as many people are suffering from high fluoride consumption."

"Much needed programme for treating the disease, good lecture, very good training”

"Eye opener, stunned and shocked also. Many of our food has fluoride and what we are giving to our children.”

"The training programme on fluorosis is an eye opener although Fluorosis is a known subject but not in the depth as introduced by the team. The whole society will get benefited by the lecture. All the clinicians will apply the approaches to the clinical practise.

The views recorded are from 5% doctors randomly chosen from the sheets with their views, were returned to the Organizers. The doctors, a high % graded the CME “Excellent. The language and expressions of the doctors retained, so that the excitement and inspiration of the doctors who were a part of the activities and how they propose to apply the knowledge gained specified.

Paramedical Functionaries and the sensitization workshop
The Paramedical functionaries 568 attended the workshops. The contents of the training programme indicated in Table 4a.

Table: 4a: Attendance in the sensitization workshops conducted for *Paramedical workers – ANMs, ASHAs and their Supervisors

<table>
<thead>
<tr>
<th>S.No</th>
<th>District</th>
<th>Number of paramedical functionaries attended Workshop</th>
<th>Sensitization through Experts creating awareness by using pre and post training questionnaires with a presentation with essential information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ajmer</td>
<td>69</td>
<td>1. Filling-up Pre-training questionnaire on Fluoride and Fluorosis. Multiple choice with single correct response type questions were provided</td>
</tr>
<tr>
<td>2</td>
<td>Jodhpur</td>
<td>96</td>
<td>2. Details of the Non-skeletal Fluorosis Dental Fluorosis Skeletal Fluorosis Shown through illustrations and simple explanations in Hindi</td>
</tr>
<tr>
<td>3</td>
<td>Jaipur I</td>
<td>173</td>
<td>3. Filling-up of Post-training questionnaire on all aspects of Fluoride &amp; Fluorosis. Multiple options with single correct response type question provided.</td>
</tr>
<tr>
<td>4</td>
<td>Jaipur II</td>
<td>118</td>
<td>4. The questionnaire has questions and answers on the advice to community during their field visits</td>
</tr>
<tr>
<td>5</td>
<td>Udaipur</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Tonk</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>568</td>
<td></td>
</tr>
</tbody>
</table>

*1. Auxiliary Nurse Midwives (ANMs)
2. Lady Health Visitors / Male (Supervisors of ANM)
3. Accredited Social Health Activists (ASHAs)
4. Public Health Supervisors (PHS- Supervisors of ASHAs)
5. Nurses (Only in Udaipur)

The number of different categories of the field functionaries attended the workshop shown in Table 4b.
The paramedical personnel were equally excited to learn such a lot in a day which has relevance to their daily life and activities in the “Rasoi” would lead to good health of the members of the family. Fluorosis mitigation activities in a state to achieve success, all the paramedical functionaries should attend the workshop; block-wise information required who attended the awareness generation workshops held by the experts.

**Inadequacies in the organization of the MEs**

It came to light that hundreds of doctors and paramedical functionaries were not informed to attend the MEs or the workshops. Therefore yet another activity was undertaken, to assess the actual number of personnel which include doctors and other staff working in the different blocks of a district. Assessment was made in one district Ajmer and results are reported in Table 5.

### Table 5: Total number of Doctors and others underwent training in Ajmer District against the existing Human Resource

<table>
<thead>
<tr>
<th>Number of Health delivery outlets</th>
<th>No. of Doctors (MOs)</th>
<th>NS</th>
<th>ANMs</th>
<th>ASHAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHCs</td>
<td>23</td>
<td>98</td>
<td>108</td>
<td>NIL</td>
</tr>
<tr>
<td>PHCs</td>
<td>62</td>
<td>62</td>
<td>475</td>
<td>NIL</td>
</tr>
<tr>
<td>Sub-Centres</td>
<td>378</td>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Urban Dispensaries</td>
<td>15</td>
<td>15</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>478</strong></td>
<td><strong>175</strong></td>
<td><strong>133</strong></td>
<td><strong>500</strong></td>
</tr>
</tbody>
</table>

*MOs – Medical Officers. NS – Nursing Staff
ANM - Auxiliary Nurse Midwife; ASHA - Accredited Social Health Activist

No ASHAs in CHCs, PHCs. They are only in Sub-centres and Urban dispensaries.

Considering the total number of manpower existing and those underwent training, it was evident that only a small percentage attended the workshops Table 6.

### Table 6: Total number of Doctors and others underwent training in Ajmer District against the existing Human Resource

<table>
<thead>
<tr>
<th>District</th>
<th>Total Doctors existing</th>
<th>Doctors attended ME</th>
<th>Total NS existing</th>
<th>Nursing Staff attended</th>
<th>Total ANMs existing</th>
<th>ANMs Attended</th>
<th>Total ASHAs Existing</th>
<th>ASHAs attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajmer Rural &amp; Urban</td>
<td>175</td>
<td>58 (59%)</td>
<td>133</td>
<td>13 (9.7%)</td>
<td>500</td>
<td>28 (5.6%)</td>
<td>1653</td>
<td>41 (2.4%)</td>
</tr>
</tbody>
</table>

The remaining doctors in the District would essentially require ME on Fluorosis by the Experts. To organize, finalize the date(s) and inform the Experts would be the responsibility of the CMnHOs / BCMOs of the districts.

There are large number of personnel with “No knowledge of Fluorosis” require update to achieve the best output for Fluorosis mitigation. During initial discussions with CMnHO for organizing MEs and sensitization workshops, the information on the total human resource existing in the district(s) need update was not made available; possibly due to underestimation of the importance of addressing the disease. The CMnHOs were also totally unaware of the usefulness of the MEs & sensitization workshops. To ensure all ANMs and ASHAs attend to the experts on the subject, would also require additional sessions. It is only then, the desired goals would be achieved. The information provided would be helpful to plan and execute the
activities in a district effectively. Such efforts would lay down a firm foundation to address the disease, block by block, district by district in a state. Those activities are absolutely necessary. The alternate suggestion offered by the CMnHOs was that the trained Doctors would train the remaining doctors and paramedical functionaries. The concept was based on “Training of the Trainers”. The doctors updated became trainers. Considering the complexity of Fluorosis, the neglect faced for decades, the experts were of the view that training by trained trainers may be considered at a later date. It was too early to hand over such a responsibility to the existing trained human resource, who had exposure for a few hours only. When they acquire adequate exposure to the disease, develop infrastructure for training, then only such a system would yield beneficial results.

Reaching out to village community
This is to record that paramedical functionaries were sensitized and informed their responsibilities for disseminating the essential information among the village communities. The most important information to convey is that:
- Every family should know the fluoride content in the drinking and cooking water by getting a sample from the source (half a cup of water in a plastic bottle) tested from PHED Lab in the district using Ion meter. In safe water, F⁻ would be <1.0 mg / L,
- fluoride is a poison and should not be consumed if it was > 1.0 mg/L,
- high fluoride 157 ppm is present in rock salt (Kala Namak) sold on wayside on carts in Rajasthan; community should not procure, for themselves or for their cattle,
- Pregnant women should not consume food items containing rock salt as it will cause anaemia and damage to the foetus leading to maternal and infant mortality,
- fluoride is present in many food items; which include achar, masala, habit forming substances like chewing tobacco, supari, churans, use of fluoridated mouth rinse, toothpaste etc.
- Change in dietary regime lead to recovery from Fluorosis and linked disorders in a short span of time. Drugs are not required for treating Fluorosis. It is the observation, antioxidants from fruits and vegetables are more effective (Susheela, A. K., & Bhatnagar, M. 2002) compared to commercially available antioxidant tablets. Those ought to be avoided from prescribing to the patients.

Impact of sensitizing paramedical
The training imparted to the paramedical functionaries particularly the ASHAs and ANMs an important entity is rather difficult to evaluate for its impact or usefulness served. The Rajasthan experience led the sensitization workshop evaluation based on the answers obtained from pre and post training questionnaires. The questionnaires were structured in such a manner, aimed to get the best out of the field functionaries. The results obtained, i.e. the number of functionaries participated, and their correct responses projected in Figure 2.

![Figure 2: Bar Diagram showing total participants (paramedicals) district-wise, who filled pre and post training questionnaires](image)

*In Jaipur I, although 92 attended only 80 submitted the filled questionnaires
†In Jaipur II, although 96 attended only 94 submitted the filled questionnaires.
‡In Jodhpur and Tonk, the attendance was 109 and 92 respectively, the filled answer sheets recovered are 90 in both districts.

The results obtained have been analysed statistically by STATA 14.0 software. The results indicate that the knowledge gained is highly relevant for the functionaries to communicate and convey important messages to the village community. They can convey correct massages on all aspects of fluoride and Fluorosis.
The data was analyzed by STATA 14.0 software. Scores are reported in terms of Mean ± Standard Deviation (SD) and paired *t* test was used to compare the change in scores before and after the training program. The p value <0.0001 is considered highly significant.

The activities for mitigation of Fluorosis and linked disorders carried out in Rajasthan state the achievements in obtaining the hidden facts have been substantial and the existing limitations in the system reported. The information imparted to doctors and paramedical functionaries were with a view that it should have lasting effect and Fluorosis mitigation programmes in the state; should set an example for other endemic states to follow in the nation.

**Reasons for failure in Fluorosis mitigation in the past:**

It is now evident that the innumerable MEs held in various endemic states across the length and breadth of the nation over decades sponsored by UNICEF, WHO and other national agencies, did yield the beneficial results, but 100% doctors were not trained. Introducing the system i.e., Training by trained doctors, did not yield the benefits. ASHAs and ANMs were not sensitized. These are revelations surfaced from the state project implementation. Lessons learned are activities required to be activated. The views of the doctors on the MEs reported in Table 3, is the testimony. Fluorosis mitigation activities can be speeded up to reach out to the community for availing benefits to lead a healthier and better life, provided there is integration of activities.

**Inter-departmental collaboration:**

It is considered necessary that inter-departmental cooperation would lead to better results. The Ministries dealing with education, health and water supply focus on provision of safe drinking water and sanitation should participate in the programme. School teachers from education department of the state should be inducted so that the health of the students and teachers improve. Rock salt adulterated masalas for cooking mid-day meal should be banned. The only salt for use is the white iodized salt, which is required to improve the health of the children and correct iodine deficiency disorders (Susheela, A. K. 2010b).

**School children:**

To involve schools so that every school should have safe water (F‾ <1.0 mg / L) for drinking and mid-day meal preparation. The above is to benefit the children, raise hemoglobin and correct anaemia (Susheela, A. K. 2018a). The parents when attended the Parent-Teachers meetings were informed to improve diet through diet editing and improved nutrients. This was adequate to correct anaemia and raise Hb upto 14.50 g / dL (Susheela, A. K. et al., 2016a). Weekly Iron & Folic acid supplementation (WIFS) introduced since 2012 to rectify anaemia did not yield beneficial results as children were consuming high fluoride containing food and water.

**Doctors:**

The state health department should involve doctors as there was a need, for updating the medical fraternity on the harmful effects of fluoride consumption through a variety of sources. Fluorosis Linked Disorders, viz., • anaemia, • maternal & infant and new born mortality, • pre-term delivery; hypertension • extreme weakness • gastro-intestinal problems, • kidney failure, • neurological disorders are now surfacing due to fluoride poisoning. The doctors are unaware of these aspects of fluoride poisoning.

ASHAs and ANMs are required to spread the message, the importance of consumption of safe water (F‾ <1.0 mg / L) and safe food to prevent Fluorosis and linked disorders in every household. Upon fixing a tap and providing safe water in households, the water supply engineers would no longer attend to community requirement. It is the ASHAs and ANMs, who ensure every household, consume safe water for drinking & cooking as there is a need to improve the health of the members of the family.

The above when get implemented, the nation would achieve health improvement in the social sector,
through integrating activities through the available manpower in different sectors. Presently information not reaching out to the community specifically in the lower socio-economic strata of the society. There is a need for school teachers and ANMs and ASHAs to get involved in the national programme of great significance.

Reduction / elimination of Fluoride intake
The Slogan on “Radio, TV, Print Media”,
- Hypertension mukth Bharat,
- Anaemia mukth Bharat shall be achieved only when F− intake is reduced to normal range in blood and urine of every individual. Infrastructure to test blood serum and urine for fluoride to be developed in all teaching and district hospitals across the country.

Strengths and weaknesses
This communication highlighting the strengths and weaknesses in addressing Fluorosis mitigation in India. The strength is highlighting the extensive researches carried out on the disease and voluminous literature on all aspects of the disease available in India for projects on Fluorosis for implementation. In spite of this major strength, why the concerned state government officials are inactive in endemic states? The major weaknesses may be responsible for it.

The weaknesses in state departments as evident from Rajasthan state are listed:
- The Directors of medical education and health services have not incorporated teaching of Fluorosis and patient care services in state medical colleges.
- The medical students, interns and residents are not taught the disease in detail like other diseases in their formative years of medical education.
- Therefore, the doctors in service in different avenues are unaware how to address the disease. It is the doctors, who advise bureaucrats and policy decisions are made. When the bureaucrats are ill-informed of the ground realities, implications of the disease, no decisions are taken. This is what is happening in present times.
- There is no infrastructure in hospitals to diagnose Fluorosis disease.
- Patients visiting OPDs whether teaching hospitals or district hospitals get a raw deal, treated with drugs uncalled for, aggravating the disease.
- Patients of Fluorosis do not recover, the condition get worsened, get crippled and paralyzed.
- When funds are made available for medical education on Fluorosis, it becomes the area of low priority and not conducted well.

CONCLUSION
The unawareness of health administrators in the state is appalling. The lethargy and unconcerned attitude towards the disease is glaring. The medical officers with a basic medical degree are important functionaries in the health system and with “0” knowledge what can be expected from such personnel. In a district 100% doctors ought to attend the MEs, great relief would then gained by the patients. There should be follow-up with proper guidelines. The disease therefore remained as a chronic health problem, can be easily rectified.

The Paramedical workers are a very useful work force are yet to be inducted into the programme as late as 2020. If the state health department take the lead, it would begin to move in the right direction.

In conclusion, the project activities carried out, provided insight into conditions prevailing and what can be done to rectify the issues. Fluorosis mitigation activities in a state shall yield successful outcome, when the following are taken into consideration.
- The district manpower available from all blocks, should get updated.
- Support facilities to be established viz. diagnostic facility, books to be made available in libraries.
- The “Training of Trainers” programmes to be held in abeyance.
- The information for paramedicals to convey to village community should be on their finger tips. Every doctor in a health delivery outlet should be answerable for mitigation of the disease. It is the firm belief that the vast array of important issues neglected for a long time and absolute unfamiliarity of Fluorosis mitigation procedures among the existing manpower have contributed to the problem. When positive steps taken at the right time would yield beneficial and long lasting effects in the country. A recent article addressing anaemia in pregnancy and school children through a field tested novel strategy by the author to alert senior medical consultants, who function as advisors to the government was contributed (Susheela, A. K., & Kumari, C. 2020). The British medical journal, The Lancet, recently reported on “Fluorosis, an on-going challenge for India”, which highlights on water fluoride, food fluoride through rock salt. It is stated corrections are required for settling issues right (Lou Del Bello. 2020).

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