



# ENDOSULFAN

The Kerala Story



Government of Kerala  
India



**REPORT ON HEALTH EFFECTS OF ENDOSULFAN  
AND PROGRESS OF REHABILITATION ACTIVITIES  
IN KERALA**



Department of Health and family welfare, Government of Kerala

20<sup>th</sup> April 2011







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**V. S. ACHUTHANANDAN**

CHIEF MINISTER OF KERALA



### Foreword

This is an attempt to convey our grave concern over the issue of health effects caused by endosulfan in our state with a pray to support the global ban on this dreaded pesticide. Our experts on systematic review of literature realised that Kasaragodu district in the state is just one of the places in the country and the world which has witnessed the ill effects of this poison. I am indeed surprised to know that there are hundreds of studies which have cleared beyond misgiving the deleterious health effects of this endosulfan.

We as a state have withheld the use of this pesticide since over a decade and now involved in rehabilitation of the victims of endosulfan in Kasaragodu. Kerala have been voicing this to the centre at several occasions since 2002. Now I have no hesitation in revealing that the centre has always tried to down play the issue and resisted the global movement to ban the use of this Persistent Organic Pollutant.

This report is a mark of our struggle against the use of endosulfan, a reflection of what has happened in part of our state and what we are doing to rehabilitate them and a hope for safer healthier nation and world.

V.S. Achuthanandan.

Thiruvananthapuram, Dated 22<sup>nd</sup> April, 2011.





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DATE : 21/04/11.....

Endosulfan, a Persistent Organic Pollutant, has emerged as a grave public health and social issue which warrants immediate global action. The experts in health and several committees including the NIOH under the Indian Council of Medical Research has reiterated the harmful effects of Endosulfan on various systems of the human body.

This report mentions few of the studies done by independent researchers and several prestigious institutions from various parts of the world and published in peer reviewed scientific journals. But it is unfortunate that there are few people in power at the centre, who still needs more 'local' proofs on health effects of this dreaded chemical. I must say that this attitude accounts to abusing science. What happened in Kasaragodu is not something unique but a reflection of many of such occurrence in the country as evident from reports from our neighbouring state.

This report is our humble effort to portray our experience in identifying and rehabilitating the probable victims of Endosulfan and the scientific basis for the same.



# Introduction

## **History and Background**

Endosulfan, a highly toxic organochlorine pesticide was sprayed in the cashew plantations in Kasaragod District since 1978, till 2001 regularly three times every year. The aerial spraying of Endosulfan was undertaken to contain the menace of the tea mosquito bug.

As early as 1979, stunted growth and deformed limbs were noticed among new born calves. By 1990s health disorders of very serious nature among the human population came to the lime light. Children were found to be the worst affected with congenital anomalies, mental retardation, physical deformities, cerebral palsy, epilepsy, hydrocephalus etc. Men and women were also affected with various chronic ailments, many irreversible and difficult to treat. From the mid of 1990's, the community living near plantations had been complaining against the spraying of Endosulfan.

## **Enquiry Commissions**

Govt of Kerala and Govt. of India had appointed 11 various commissions to inquire about the issue. Various Non-Government Organizations also made some studies at their own level. Most of the studies revealed the hazards of Endosulfan use and its impact on the food, water and beverages. These enquiry reports in one way or other infer that pesticide Endosulfan is responsible for the horrendous mutations and ailments that many in the villages of Kasaragod district are suffering from. From 2000 onwards committees of various departments, Non-Governmental Organizations, Indian Council of Medical Research and other agencies conducted visits to the area and submitted reports to the Government regarding this issue.

Prominent among them are:

1. Committee appointed by Kerala Agricultural University with Dr. Abdul Salam as Chairman.
2. Committee appointed by Government of Kerala with Dr. Achuthan as Chairman.
3. Committee from National Institute of Occupational Health, ICMR, Ahmedabad.

Following reports in public domain have been published which are available on website [www.endosulphanvictims.org](http://www.endosulphanvictims.org)

**The major conclusions of NIOH (under ICMR) in 2002 were:**

- There is significantly higher prevalence of neurobehavioural disorders, congenital malformations in female subjects and abnormalities related to male reproductive system in the study group (Padre village, Enmakaje Panchayat) as compared to the reference group (Miyapavadu village of Meenja Panchayat).
- Regarding the aetiological factors, responsible for these health problems, various factors were compared and it was found that the two groups differed mainly with respect to exposure to endosulfan.

**Court Orders:**

A victim, Smt. Leela Kumari Amma approached a lower court (Munsif Court, Hosdurg) in 2001 and the court temporarily stayed aerial spraying of Endosulfan in Cashew plantations. In 2003, the High Court of Kerala upheld the order of lower court and it permanently stopped Endosulfan spraying.

**Since then, the Govt.of Kerala imposed a ban on the use of Endosulfan.**



Adding to these the Government of Kerala ordered for three scientific studies in 2010:

1. Calicut Medical College: for epidemiological study: Submitted preliminary report.
2. Rajiv Gandhi Centre for Biotechnology: for genetic study. : Proposal submitted.
3. Kerala state council for science and technology for environmental study

**Major conclusion of the epidemiological study by Calicut Medical College (Dec 2010- Jan 2011):**

- The reproductive health events including infertility, precocious puberty, abortion, intra uterine death (IUD)/ still birth, neonatal/ child death were found significantly higher in study population when compared to control population.
- Among the youth population (below the age of 40-) the rate of surgery for any heart diseases , hernia and genito urinary causes were higher in area study group than control group.
- When the prevalence of morbidity in adolescents were assessed it was found that any organ anomaly , birth defects, congenital heart disease, seizure, skin problems and reproductive disorders were significantly higher in study group when compared to control groups.

## 2. Rehabilitation: 'snehasanthwanam' progress till date

### HEALTH SECTOR

#### **1. Identification of patients and scientific evaluations:**

Though the efforts for identification of endosulfan victims were on from 2003, an active search for affected patients started in later half of 2010.

##### **Progress till date:**

1.1 **Two house to house surveys and series of specialty medical camps** were conducted in November, December 2010 and January 2011:

A. **Socioeconomic survey:** primarily aimed at ascertaining the economic status , loss of livelihood due to ailments , loan indebtness , patient status , loss of education , problems in getting married due to social stigma and other such issues.

B. **Health survey:** for identifying self-reported ailments in the affected panchayats. This was done by health workers and ASHA volunteers.

##### **C. Specialty Medical camps:**

Though the health survey gave a bird's eye view of disease load of the affected areas, it failed to identify specific ailments. So it was decided that the

best available experts should be pooled in to conduct specialty medical camps with following objectives:

- To identify endosulfan medical victims, diagnose their specific ailments, prescribe long-term treatment for them by a team of expert medical colleges.
- To quantify and keep an account of all required treatments and the institutions from which these treatments can be availed.
- To enroll patients for providing treatment smart card and prioritize the need for specialized care.

### **Conduct of camps:**

One specialty Medical camps were conducted in each panchayat from 16.12.2010 to 09.01.2011 in all the affected 11 Panchayaths, followed by 1 'mop up' camps for two panchayat, taking the toll of specialty camps to 17.

About 125 specialist from Govt. Medical Colleges and 175 doctors from health services were roped in to the camps.

**Camp pattern** was as follows:

- **Registration:** There were 8-10 registration counters with 3 staff at each counter. Details of all patients were meticulously registered. The patients were provided with 2 forms (enclosed as annexure ):
  - a. Form 1: for details of the clinical condition and treatment suggested, which was entered and analyzed using SPSS after the camps.
  - b. Form 2: drug prescription forms which were given to the patient.
- **Screening:** 10 to 15 general practitioners from health service screened the registered patients and referred them to respective specialty clinics (may be more than one). ASHA workers and volunteers directed and often accompanied the patients to the specialty clinics.
- **Specialty clinics:** Separate rooms were provided for each specialty clinic. Apart from specialists each consultation rooms were provided with:

- c. Two nursing students or one staff nurse + one nursing student
- d. One field staff
- e. Nursing assistant (in O&G) and refractionist (in Ophthalmology)
- f. General equipments and facilities including BP apparatus, Steth, Torch, antiseptic hand rub/wash, tissue paper
- g. Specialized equipments like: ophthalmoscope, slit lamp, tuning fork, knee hammer etc

**The specialties included:**

Sl no	Specialty	No. of specialist at each camp site
1	General Medicine	2 to 4
2	Neurology	3 to 4
3	Gynecology	2
4	ENT	2
5	Psychiatry	2
6	Dermatology	2
7	Orthopedics	2

8	Ophthalmology	2
9	Oncology	1-2
10	Surgery	2
11	Pediatrics	2
12	Chest diseases	1-2

- **Lab:** Facilities were provided for routine investigations. Patients requiring advanced investigations will be availed the same after consolidation.
- **Pharmacy:** For the drugs not available at Pharmacy, a register was maintained and efforts are on to supply it to the patient as soon as possible.
- **Lunch and refreshment:** Lunch and light refreshment will be provided here for doctors (in rotation), staff and volunteers at 11 am and lunch at 2pm. Patients who had to wait afternoon were provided lunch in the third and fourth camps. This may be replicated elsewhere.

**Transport of patients:** 10 Vehicles (including 2 ambulances) were provided for to and fro transportation of patients. Health worker or ASHAs accompanied the patients whenever warranted. **Special care was taken to ensure public participation and the involvement and cooperation of LSG institutions were inspiring.**



<b>Dates</b>	<b>Panchayats</b>
<b>16-12-10</b>	<b>Kayyur Chemeni</b>
<b>17-12-10</b>	<b>Muliyar</b>
<b>18-12-10</b>	<b>Enmagaje</b>
<b>19-12-10</b>	<b>Panathur</b>
<b>06-01-11</b>	<b>Periya</b>
<b>07-01-11</b>	<b>Bellor</b>
<b>08-01-11</b>	<b>Kumbadaje</b>
<b>09-01-11</b>	<b>Badiyaduka</b>
<b>10-01-11</b>	<b>Kallar, Enmagaje, Kumbadaje (3camps)</b>
<b>11-01-11</b>	<b>Mulleria, Pullur, Kayyur (3camps)</b>
<b>12-01-11</b>	<b>Ajanur, Muliyar, Kallar (3camps)</b>

**Total number of patients attended in the camps: 15698**

## **The scientific basis for including a disease as due to endosulfan**

### **Probable Endosulfan victim: Inclusion criteria:**

The history, diagnosis and treatment required were entered in SPSS and analyzed using PASW. The factors which were considered for labeling a case as suspected endosulfan victims are as follows:

1. History of Exposure: This can be :
  - a) Occupational
  - b) Non- occupational
  - c) Mother to child through placenta and breast milk

(Details in monograph on endosulfan enclosed as annexure)

2. Evidence based:

**Based on evidence from over 140 published studies about health effects of endosulfan, from various parts of the world.**

(References attached as annexure 1)

**However the benefit of doubt favored the patients.**

From the systematic literature review of scientific journals published in peer reviewed journals, it became evident that, not only the association between endosulfan and its health effects, but also even the mechanism by which it harms the body is also established:

**1. Endosulfan affects nervous system of even during gestational period.**



**NERVOUS SYSTEM**

Endosulfan is significantly associated with Neuro-behavioral disorders, Cognitive disorders, Hydrocephalus, Mental Retardation, Cortical blindness, Seizure disorders and Parkinson's disease.

(Cabaleiro et al 2008, Saiyed et al 2003, ATDSR 2000)

നാഡീവ്യവസ്ഥയെ എൻഡോസൾഫാൻ സാരമായി ബാധിക്കുന്നു

The infographic features a red background with a collage of images showing children and adults. The text is in white and yellow. The Malayalam text at the bottom is in white with a blue outline.

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## 2. Endosulfan affects reproduction:

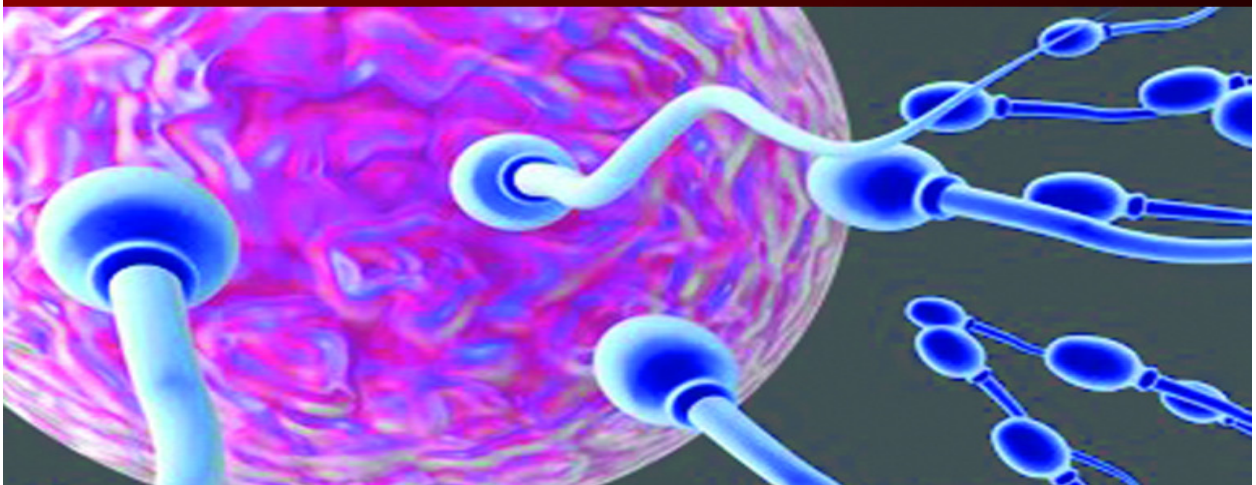
### EFFECTS ON MALE REPRODUCTIVE SYSTEM

Endosulfan causes number of adverse effects

- Degeneration of seminiferous tubule epithelium
- Reduced sperm count
- Altered spermatogenesis and increased number of abnormal sperms
- Testicular necrosis
- Aspermatogenesis

(Dalsenter et al 1999, ATDSR 2000, Sinha et al 2001)

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വന്ധ്യതയുണ്ടാക്കുന്നു



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3. Endosulfan is an endocrine disruptor:

## ENDOCRINE SYSTEM

Endosulfan is an endocrine disruptor. It has shown dose related decrease in testosterone, luteinizing hormone and follicular stimulating hormone.

(ATSDR 2000)

Endosulfan is also associated with precocious puberty, cervical cancer, endometriosis, recurrent abortion and other oestrogen dependent disorders.

(Foster & Agarwal 2002)

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ശ്രമികളുടെ  
പ്രവർത്തനത്തെ  
ബാധിക്കുകയും  
ഹോർമോണുകളുടെ  
ഏറ്റക്കുറച്ചിലുകൾ  
ഉണ്ടാക്കുകയും അങ്ങനെ  
ശരീരത്തിന്റെ സന്തുലിതാവസ്ഥയെ  
തകിടം മറിക്കുകയും ചെയ്യുന്നു.



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4. Endosulfan is genotoxic, cytotoxic and mutagenic:

## GENOTOXICITY & TERATOGENICITY

Endosulfan is associated with many congenital malformations including skeletal and neural abnormalities.

(Le maire et al 2005, Sayed et al 2003, Sing et al 2006)

Endosulfan shows mutagenic and genotoxic effects in human lymphocytes and liver hepatoblastoma cells.

(Yadav et al 1982, Pandey et al 1990)



എൻഡോസൾഫാൻ ജനിതകവൈകല്യങ്ങൾക്ക് കാരണമാകുന്നു

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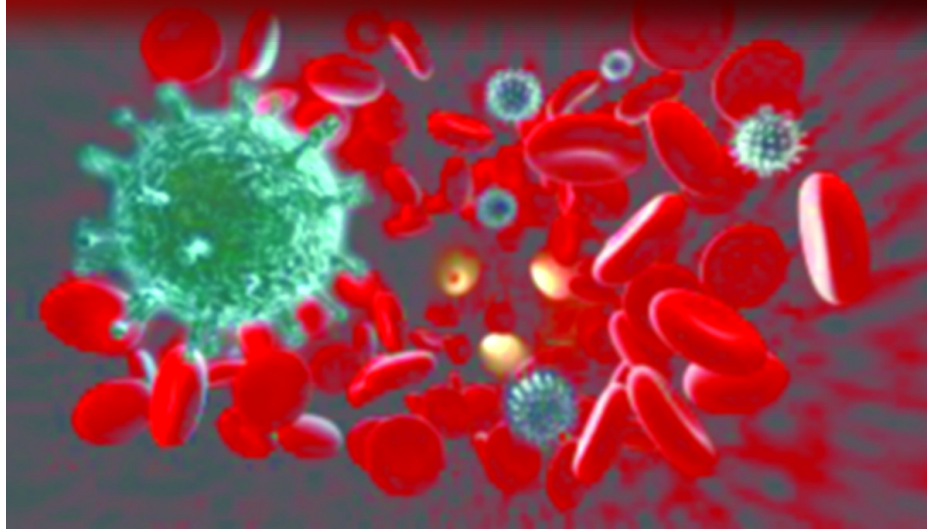
## IMMUNE SYSTEM

A number of studies shows that endosulfan is toxic to, and suppresses the immune system as well as promotes allergic responses.

Effects include decreased serum Ig G levels, decreased antibody titre to tetanus toxin, inhibition of leucocyte and macrophage migration and enhancing mast cell degranulation.

(ATSDR 2000, Abadin et al 2006, Narita et al 2007)

എൻഡോസൾഫാൻ മനുഷ്യരുടെ രോഗപ്രതിരോധശേഷിയെ ബാധിക്കുകയും വിവിധ അലർജിക്കൽ ഉണ്ടാക്കുകയും ചെയ്യുന്നു.



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**Based on these inclusion criteria, 3435 patients were identified as suspected by these camps. Their disease distribution was as follows:**

However, it was identified that some patients were not able to make to the camps. In order to address this issue definite procedure was evolved for further inclusion of patients in the list of beneficiaries. This was as follows:

⊕ **For already known patients (in earlier surveys):** house to house visits were conducted by Medical Officers of concerned PHCs to assess the condition (category) of the patients. By that another 838 patients were identified thus taking the total number of patients to 4273.

⊕ **For patients not diagnosed already and neither able attend the camps:** a mechanism was established. A 10 member expert committee was formulated which consists of:

1. Neurologist
2. Physician
3. ENT specialist
4. Ophthalmologist
5. Gynecologist
6. Physiatrist
7. Psychiatrist

8. Dermatologist
9. General surgeon
10. Orthopedic surgeon

The functions of this committee included the following:

- The committee conducts regular sittings at district hospital Kanhagad and GH Kasargode:
  - a. Once in two months for initial 6 months, so that maximum number of genuine medical endosulfan patients can be identified, diagnosed and treated.
  - b. There after yearly once for identifying new medical endosulfan patients.

The committee will examine the patients referred by the District Medical Officer (DMO).

**The procedure of referral to the expert committee:**

The snehasanthwanam cell in the district will receive applications from the patients and hand it over to DMO Kasagode. The DMO will order for enquiry in to these cases in a standard enquiry report form by the medical officer of concerned PHC or by the Mobile Medical Team. Based on the report the DMO will decide on whether a case should be referred to the committee or not.



As a result of this by February 28 we received 1097 complaints.

The first sitting of expert committee was conducted as follows:-

	Total of Patients
Kanhangad District Hospital 04 & 05 <sup>th</sup> March 2011	494
Kasargod General Hospital 6 <sup>th</sup> March 2011	244
Total	738
<b>Total Number of patients identified as suspected endosulfan victim : 257</b>	

257 of them were identified as suspected endosulfan victims based on clinical features. Their address verification completed and list submitted to District Collector for approval.

**Benefits are now being provided only to the approved list of 4273 patient.**

Distribution of diseases in the identified endosulfan victims:

		Out of the total identified cases (4273)
1.	Neurobehavioral and cognitive disorders	1624 (38%)
2.	Endocrine and reproductive disorders	641 (15%)
3.	Multiple congenital disorders (including skeletal deformities)	748 (17.5%)
4.	Allergic diseases, skin and respiratory illness	1145 (26.8%)
5	Cancers	342 (8%)

\*Same patients can have multiple conditions

## **2. Provision of comprehensive and free treatment to identified patients:**

A comprehensive and sustainable mechanism is established to ensure appropriate and uninterrupted quality treatment and palliative care to the diagnosed patients.

As part of this, following activities are underway and proposed for financial support.

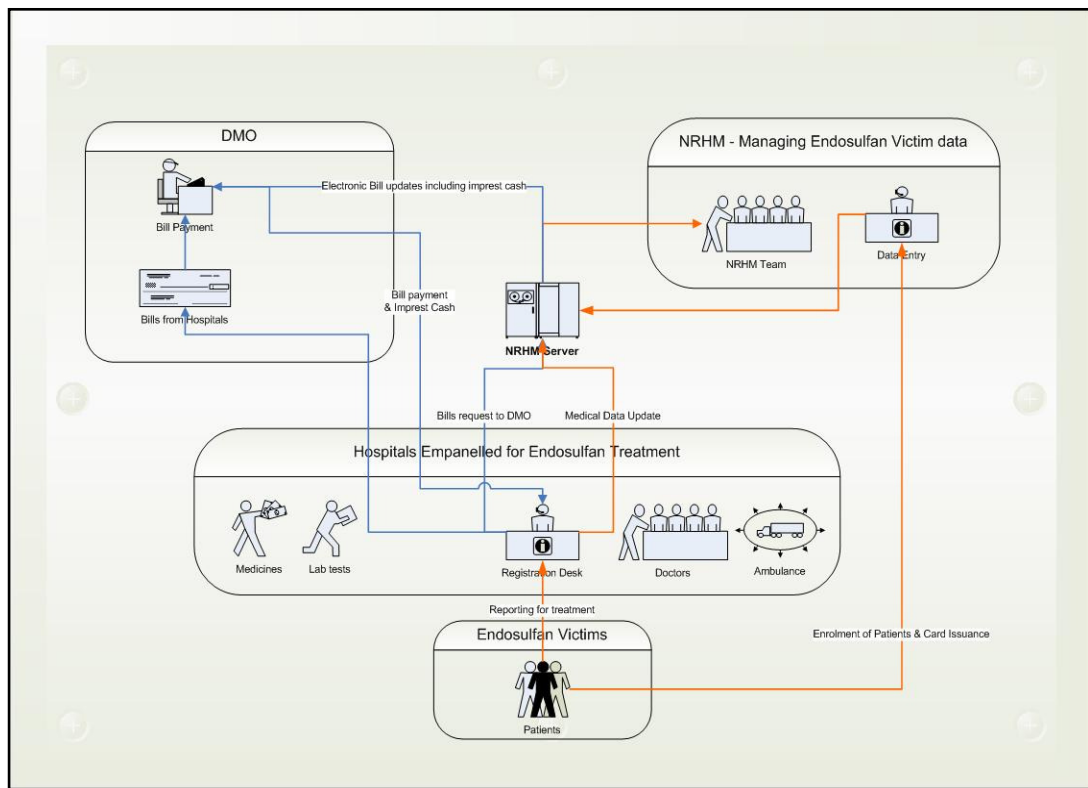
## **2.1 Treatment smart card:**

### **2.2.1 Overview:**

The rationale is to provide cashless treatment to Endosulfan victims of Kasargode at various hospitals empanelled for this project. Identifying the victims at empanelled hospitals will be done with the help of a smart card and online software accessible through internet, the server located at National Rural Health Mission. All the empanelled hospitals will have provision for login to the Software. Keltron is the nodal agency in providing the smart card and establishing the system. The complete personal data like Name, Address, Guardian Name, Photograph will be entered into the software application with a unique number.. All the relevant data will be encoded into the Smart card for future verification and Health History.

### 2.1.2 Functional Modules:

- a) Admin Module with all reports.
- b) NRHM Module - For Data Entry and Enrollment with reports.
- c) Hospital Module - For Patient registration for Treatment and Billing module to claim the bills from DMO with reports.
- d) DMO Module - For review the bills and Imprest cash and sanction accordingly with reports.



*Overall flow diagram of smart card system:*



*Jeevan Raj and his brother (both of them are blind due to optic atrophy) with the treatment smart cards*

**Progress:**

- ⊕ Treatment smart card is already issued to 2800 patients. The rest of the cards will be issue by 30<sup>th</sup> April.
- ⊕ Software for cashless treatment in empanelled hospitals is finalized and is being installed in the 11 empanelled hospitals.
- ⊕ Trainings and orientation sessions for the implementation of these were conducted at NRHM, Trivandrum.

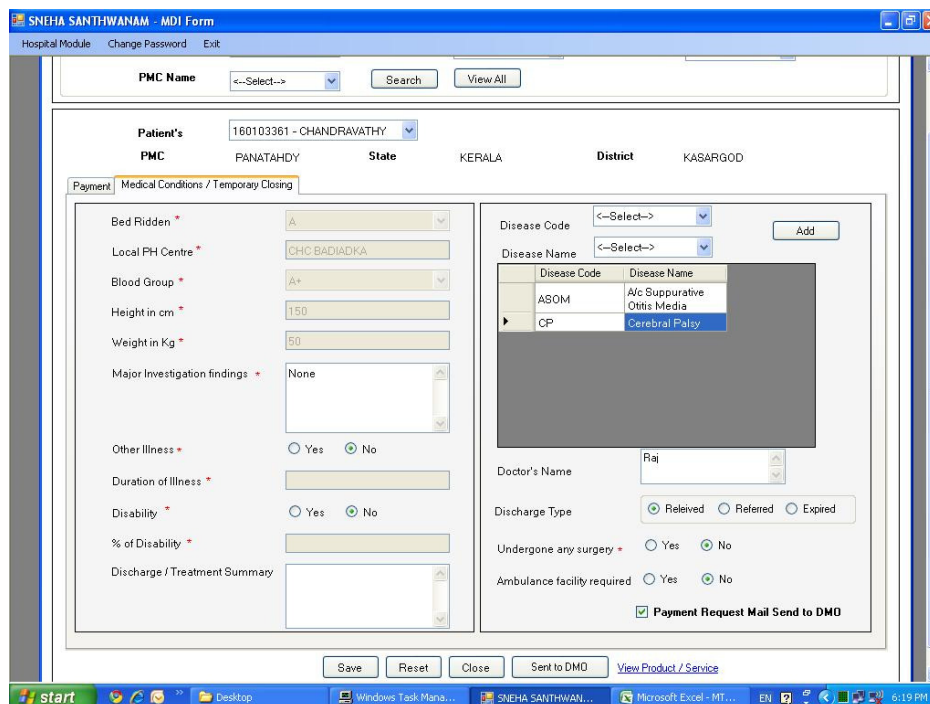
Schedule of trainings:

07.04.11	For Superintendent/RMOs of empanelled hospitals (over view on all modules – NRHM, DMO and Hospital Module)
08.04.11	For District Medical Officer of Health, Kasargod (On DMO Module)
11.04.11	For Public Relation Officers and Data Entry Operator (On Hospital module)

**The patient can avail this service in all 11 empanelled hospitals from 15<sup>th</sup> April 2011.**

However, while this is being implemented, the patients in the list who require emergency treatment are provided free treatment at all empanelled hospitals with a request letter from DMO. The payments for them are done promptly on receipt of the bills from the hospitals.

*Screen shot of a window in 'snehasanthwanam' software.*





## List of empanelled Hospitals

1	General Hospital, Kasragodu
2	District Hospital, Kanhagad
3	Pariyaram Medical College, Pariyaram
4	General Hospital, Thalassery
5	District Hospital, Kannur
6	Malabar Cancer Centre, Thalassery
7	W and C hospital, Mangatuparamba
8	Govt. Medical College, Calicut
9	ICCONS, Shornur
10	Regional Cancer Centre, Trivandrum
11	Sree Chithra Thirunal Institute for Science and Technology, Trivandrum

### **3. Mobile Medical Units:**

**3.1 Overview:** for specialized home care for identified patients.

A full mobile medical team consists of:

- a) one doctor each from Modern Medicine, Ayurveda and Homoeopathy
- b) 1 Physiotherapist
- c) 1 clinical psychologist
- d) 1 psychiatric social worker
- e) 1 speech therapist
- f) 1 special trainer for mentally retarded person.

#### **Progress made till date:**

Three mobile medical units have been setup, so as to provide service six days in a month in each of 11 affected panchayats. (22 days for each team at their allotted area).

However only one of the team (called as major team) is provided with all the members in the team and the other two is having only a modern medicine doctor, one physiotherapist and one supporting staff.



*Mobile medical team providing home care*

#### **4. Palliative care:**

##### **4.1 Overview:**

The goal is to prevent and relieve suffering and to improve quality of life for people facing serious, complex illness. The Home Based Palliative Care team is intended to provide specialist nursing care and support to people with an advancing life limiting illness who choose to be cared for in their home environment.

**Progress made till date:**

- One vehicle for each panchayath has been provided for the palliative care team.
- Two additional staff nurses have been posted in each of 11 panchayats. They were provided specialized training in palliative care at Institute of Palliative Medicine (IPM) at Calicut. One of them will provide institution based palliative care while the other will cater home based care.
- One Physiotherapist has been posted in each panchayath for both home based care (apart from the mobile team) and institution based care.
- Additional medicines and equipments like catheters, BP apparatus are also provided to the palliative care team.



*Palliative care team reaching for care*

## **5. Strengthening of health service delivery system:**

Health system preparedness in the affected panchayaths are getting improved and fine-tuned to cater to specific demands of the prevailing scenario.

Numerous improvements are proposed and in the process of implementation which includes:

### **5.1 Salary Incentives to Medical Staff:**

Kasargode district is one of the least preferred regions in the state for doctors and other medical staff to work. Though the reason for this is multifaceted, additional incentives may be and has proved to be a motivating factor for doctors to work in this part of the state.

So it is proposed that salary incentive may be granted to doctors and other medical and paramedical staff, who chose to work in these endosulfan affected panchayats.

### **5.2 Physiotherapy units in PHC/ CHC:**

Physiotherapist posted in the panchayath is provided with a physiotherapy unit at one CHC/PHC in the panchayath. The unit will have facilities for providing appropriate physiotherapy equipments for inpatient and outpatient service.

### **5.3 Modernization of GH and District Hospital:**

- Kasargode General Hospital and Kanahghad District Hospital are two major Government hospitals in the district. Efforts are now on to upgrade the hospital with modern facilities. GH Kasargodu and DH Kanhagad are now provided with a full-fledged physiotherapy centre with Physiatrist, physiotherapist and modern equipments, advanced laboratory and other investigation facilities.
- A specialized unit for training of Mentally Retarded children are also functioning in GH kasargodu

### **5.4 Ambulance:**

Ambulances with basic life support system including equipments like portable oxygen unit, portable suction unit, traction splints and spine board, would help for shifting the patients from home to referral hospital. Few ambulances with advanced life support including ventilator may be provided for shifting the patients between referral hospitals.

The ambulances may be provided in line with 108 emergency services, with a toll free number. As of now two ambulances with advanced facilities are provided to the district.



## SOCIAL SECTOR

### 1. Compensation:

The families of the suspected endosulfan medical patients can be provided with one time compensation as follows:

Bedridden, seriously ill patients and patients who have already died	100,000 Rs
Other patients	50,000 Rs

Since 2006, 178 families are provided with a exgratia of 50,000 Rs. each.

### 2. Family pension:

Based on the condition and disease of the suspected endosulfan medical patents, they have classified in to three categories:

Category-I	- Bed ridden patient
Category-II	- Ambulant but requires assistance for routine activities
Category-III -	- Ambutant with minor disabilities.

Category 1 and 2 patients will receive a monthly pension of Rs. 2000 (inclusive of disability pension, if already available).

Category 3 patients will receive a monthly pension of Rs. 1000.



*The Honorable Chief Minister inaugurating the family pension scheme*

**Progress:**

Family Pensions for 3 months (January to March) sent as Money Order in patients address.

The distribution was as follows:

Category 1 & Category 2	₹ 2000 or ₹ 1700 (for those who already receive disability pension)
Category 3	₹ 1000

### 3. Loan write off:

As per the socio- economic survey conducted by the district administration through ICDS workers, it was estimated that about 3500 endosulfan affected families may have an average loan of Rs.50,000. The loans add to the misery of these families, who by now have spent massive amount on treatment of the suspected endosulfan medical patient in the family. So it is proposed and actions are on to write off their loans.

#### **4. Centralized Residential relief and rehabilitation centre:**

The demographic profile of these affected panchayats and the history of patients points to the facts that:

- Most of patients (often with severe disability) are cared by their aged mother or father who are also often affected by serious diseases. Their demise or inability to care will push the patient either to a phase of non-recovery, debilitation or even death.
- Caretakers are often unaware or incapable of providing quality care and assist patient in carrying out their daily activities.

These facts warrant the need for a comprehensive residential rehabilitation institution in the district.

#### **5. Vocational training:**

It is proposed to provide vocational rehabilitation for the handicapped person so as to enable him to secure suitable employment which he could retain and advance a permanent base with an ultimate aim of integrating or reintegrating him in the society.

## **6. Special school:**

It is proposed to establish a day care cum residential school for children with Multiple Disabilities (i.e. Down Syndrome, Mental Retardation, Slow Learners, Learning Disability, etc.), Autism, Cerebral Palsy, Hearing Impairment, etc. for providing them with special training and education, featuring advanced teaching aids and through computer games and other activities. Their participation in various social & cultural programmes shall also be ensured.

# Literature Review

## Ecological effects of Endosulfan: studies

### *Fish:*

As well as having caused massive fish kills in Africa and USA, endosulfan has a number of sublethal effects on fish

### *Fish kills:*

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### *Sublethal effects:*

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1. Broomhall S. 2002. The effects of endosulfan and variable water temperature on survivorship and subsequent vulnerability to predation in *Litoria citropa* tadpoles. *Aquatic Toxicol* 61:243-50.
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*Endosulfan suppresses the immune system in birds:*

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#### **Bees:**

*As well as being toxic to bees, endosulfan has sublethal effects on bees:*

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#### **Beneficial Insects:**

*Endosulfan is highly toxic to a number of beneficial insects and is not suitable for IPM*

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**Countries that Have Banned, Are Phasing Out, Don't Use, or are Still Using Endosulfan.**

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<b>COUNTRIES THAT HAVE BANNED OR ARE PHASING OUT</b>			
	<b>COUNTRY</b>	<b>DATE</b>	<b>PHASE-OUT</b>
1	Australia	2010	2 years
2	Austria	2005	6 months
3	Bahrain	pre-2008	info supplied to POPRC in 2008
4	Belgium	2005	6 months
5	Belize	1985	
6	Benin	2008	
7	Brazil	2010	3 years
8	Bulgaria	2005	6 months
9	Burkina Faso	2007	1 year
10	Canada	2010	6 years
11	Cambodia		
12	Cameroon	2008	
13	Cape Verde	2007	1 year
14	Colombia	pre 2002	
15	Cote d'Ivoire	2004	notification to PIC
16	Croatia	2007	
17	Cyprus	2005	6 months

18	Czech Republic	2005	6 months
19	Denmark	2005	6 months
20	Egypt	1996	
21	Eritrea		
22	Estonia	2005	6 months
23	Fiji		
24	Finland	2005	6 months
25	France	2005	6 months
26	Gambia	2007	1 year
27	Germany	2005	6 months
28	Greece	2005	6 months
29	Guinea Bissau	2007	1 year
30	Hungary	2005	6 months
31	Indonesia	2002	
32	Ireland	2005	6 months
33	Italy	2005	6 months, except for derogation on hazelnuts
34	Iran	2008	
35	Jamaica	2010	end of stocks
36	Japan	2010	
37	Jordan	1994	
38	Kenya		
39	Korea	2010	end of 2011
40	Kuwait		
41	Latvia	2005	6 months
42	Lebanon	2010	6 months or till stocks used
43	Liechtenstein		
44	Lithuania	2005	6 months



45	Luxembourg	2005	6 months
46	Malaysia	2005	
47	Malawi	2010	
48	Mali	2007	1 year
49	Malta	2005	6 months
50	Mauritius	pre- 2008	Notification to POPRC
51	Mauritania	2007	1 year
52	Morocco	2010	6 months
53	Netherlands	2005	6 months
54	New Zealand	2008	1 month
55	Niger	2007	1 year
56	Nigeria	2008	
57	Norway	1999	
58	Oman		
59	Paraguay	2010	
60	Poland	2005	6 months
61	Portugal	2005	6 months
62	Qatar		
63	Romania	2005	6 months
64	Saudi Arabia		
65	Senegal	2007	1 year
66	Seychelles	1995	
67	Singapore		
68	Slovakia	2005	6 months
69	Slovenia	2005	6 months
70	Spain	2005	6 months
71	Sri Lanka	1998	

72	St Lucia		
73	Sweden	2005	6 months
74	Switzerland	2009	
75	Syria	1990	
76	Tchad	2007	1 year
77	Tunisia		
78	United Arab Emirates	pre-2009	
79	United Kingdom	2005	6 months
80	USA	2010	6 years
81	Venezuela	2009	

**NOT Permitted, but  
not banned**

- 1 Armenia
- 2 Azerbaijan
- 3 Belarus
- 4 Georgia
- 5 Kazakhstan
- 6 Krygystan
- 7 Moldova
- 8 Russia
- 9 Tarjikistan
- 10 Turkmenistan
- 11 Ukraine
- 12 Uzbekistan

STILL LEGALLY USING AND NO  
PHASE-OUT ANNOUNCED

- 1 Argentina
- 2 Botswana
- 3 Burundi
- 4 Chile
- 5 China
- 6 Costa Rica
- 7 El Salvador
- 8 Ethiopia
- 9 Ghana
- 10 Guatemala
- 11 Honduras
- 12 India
- 13 Israel
- 14 Lesotho
- 15 Madagascar
- 16 Mexico
- 17 Mozambique
- 18 Nepal
- 19 Pakistan
- 20 Sierra Leone
- 21 South Africa
- 22 Sudan
- 23 Tanzania
- 24 Uganda
- 25 Uruguay
- 26 Zambia

endosulfan  
**victims**



endosulfan  
**victims**

