

Table 11
Reasons for surgery

Reason for surgery	Area I -Mulyar N=6107		Area II- Banam N=3742	
	Number N=274	Per 1000 population	No N=219	Per 1000 population
1. Uterus - Except delivery	41	6.7/1000	45	12.1/1000
2. Appendicitis	44	7.2/1000	27	7.0/1000
3. Hernia	33	5.4/1000	9	2.4/1000
4. Heart	14	2.3/1000	5	1.3/1000
5. Genito urinary / Kidney	16	2.6/1000	10	2.6/1000
6. Mouth throat	15	2.5/1000	19	5.1/1000
7. Cleft lip	4	0.7/1000	1	0.3/1000
8. Hand / Foot anomaly	4	0.7/1000	3	0.8/1000
9. Un descended Testis	2	0.3/1000	3	0.8/1000
10. Ovary	2	0.3/1000	4	1.1/1000
11. Tubal pregnancy	0	00/1000	4	1.1/1000
12. Cancers	22	04/1000	16	4.2/1000
13. Brain/ CNS	2	0.3/1000	6	1.6/1000
14. Bone	10	1.6/1000	10	2.6/1000
15. Abdomen	5	0.8/1000	9	2.4/1000

Surgeries for hernia, Heart disease and cleft lip were higher in Area 1 as above.

Further analysis of those below 40 years of age showed that surgery for heart disease, hernia and genitourinary causes were higher in area 1 and being young, most of these surgeries are presumed to be for congenital diseases.

Limitations

1) Due to resistance from the community, collection of blood samples for insecticide residue analysis could not be done.

2) The comparison group in the study is from the same district. As endosulfan has the property of drifting far distances through soil, air or water its effects cannot be ruled out in the comparison area.

A third control area from another distant part of the state free from endosulfan spraying needs to be studied

3) Since the data has been collected from a large population, the response rate for items were variable but above 95% for most items.

Summary and Conclusion

A community based descriptive field study on the health status and morbidity of the population in Kasargod district, Kerala was conducted in two areas from October 2010 to February 2011.

Area 1 : Muliya subcentre area (Muliya panchayat) -Endosulfan affected area

1156 households with a population of 6103 were surveyed.

Area 2 : Banam subcentre (Kodum belur panchayat) Less affected comparison area . 842 households with a population of 3714 were surveyed.

The following were the key observations:

Demography :

Total population covered in area 1 was 6107 and in area 2 was 3742.

Age composition was similar in both areas .

In area 1, the sex ratio of 957 females/1000 males was lower than that in area 2 (1016/1000 males).

Environment:

Dug wells were the major drinking water sources for 57% of the households in both areas. Bore wells were used more in Area I (20.29%).

In the area 1 - 52% of the house holds are staying within 1 km distance from the PCK estate and 17% are within 100 meters while in the area 2 all house holds were more than 10 Km away from any of the PCK estates

Health events in domestic animals: In the area 1 – 41 (3.5%) of the informants have noticed health events like abortion, death or birth defects in their domestic animals compared to 4 (0.5%) in area 2 which was significantly higher.

Morbidity :

Hospitalization rate: Recent hospitalization rate in the last one year was almost double in area 1 of 4.8% vs 2.9% in area 2.

Prevalence of diseases : Presently the prevalence of kidney(5/1000), liver diseases(0.5/1000), and behavioural problems (5/1000) were higher in area 1. Most of the other diseases like cancer, asthma, seizure ,skin diseases were slightly higher or equal prevalence in area 2.

Congenital anomalies: Among the living persons any congenital anomalies like limb deformities(7/1000), Congenital heart diseases(5/1000) , undescended testis (<1/1000)were similar in both areas. The reported prevalence of cleft lip (1/1000) and hernia (4/1000) was high in area 1.

Physical disability in those below 20 years : In the 10-19 years category there was 6.7 times higher risk of deformities in area 1.

In area 1 the incidence of physical disability showed a reduction in time trend over the 2 decades from 1.1% in the 10-19 age group. to 0.5% in those less than 9 years.

Reproductive health events :

The mean age at menopause in all age categories were lower in area 1.

All the reproductive health events like treatment for infertility, history of abortion, history of intra uterine death (IUD)/ still birth, neonatal/ child death had significantly higher risk in area 1 (OR ranged from 1.5 to 2.3).

In area 1 among the women of age group 30-39 years all the events were higher than in area 2, however in area 1(affected area) in the 20-29 age group we have noticed a time trend of reduction of these events during last 10 years as compared to that in the 30-39 years .

*Previous surgery :*274 persons in area 1 and 219 in area 2 had undergone previous surgeries in their lifetime.

Among the population below 40 years surgery for heart diseases , hernia , genitourinary causes and cleft lip were higher in area 1.

*Deaths in the family :*Deaths among the family members were reported from 17% of houses in the area 1 (231 deaths) and 16.3% houses from area 2 (157 deaths).

The proportional mortality due to cancer, kidney diseases and brain tumor was high in area 1.

Recommendations:

- Health check up and medical care programmes for the diseased should be ongoing.
- Screening programmes among antenatal women for early detection of congenital anomalies should be arranged .
- Rehabilitation and support measures for the chronically disabled should be ongoing.
- Periodic field monitoring of the morbidity and mortality in the district to elicit time trends is recommended.
- Environmental monitoring of the soil and water samples for insecticide residues in the area should be done periodically.

STUDY I --ENDOSULFAN HOUSE HOLD STUDY

Name of Field workers

NO	CODE NO.	NAME	ADDRESS
1	A	Ashokan.M V	Junior Health Inspector, PHC Belloor
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Field Work Coordination

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Study II

Report On School Based Study

**Epidemiological school based study on
the Health Status of Adolescents in
Areas Exposed to Endosulfan
Spraying in Kasargod district of
Kerala 2010-11**

Conducted by

**Department of Community Medicine,
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Epidemiological school based study on the health status of adolescents in areas exposed to endosulfan spraying in Kasargod district of Kerala 2010-11

Objectives:

- 1) To study the morbidity status among adolescents from schools in areas exposed to endosulfan spraying and in a comparison area.
- 2) To assess the pattern of growth and development among these adolescents.
- 3) To estimate the related hormone levels in a sub sample of the study groups.

Methodology.

Study design : Cross sectional descriptive comparative study.

The study population included 642 adolescents from 2 randomly selected schools in Kasargod district

Area 1: BAR High School Bovikanum (aided school)

The school is located in **Muliyar Panchayath** where aerial spraying of Endosulfan was reported till 2002 for 20 years in the Plantation Corporation Kerala (PCK) estates of the area.

The students of this school were included as **STUDY GROUP**.

Area 2: Government High school Kalichandukam.

The school is located in **Kodom Belur Panchayat** with no history of aerial spraying of endosulfan and no PCK estate in the area.

The students of this school constituted the **COMPARISON GROUP**.

In these areas the school enrolment rate was almost 100%. Most of the children were students of corresponding field areas and were representative of respective areas. Being from the same district, the ethnicity and socioeconomic status of their parents were also comparable.

As per order 1550/2010 H&FW dt 9-4-2010 of Government of Kerala permission for conduct of the study, were obtained from the District Medical officer of Health Kasargod, Deputy Director Education, Kanhangad, respective school head masters, staff, PTA and parents.

One week before the study, letters were sent to the parents explaining about the study and inviting their presence on scheduled dates to ensure maximum validity of the data collected.

Subject selection.

All the children enrolled in the school register in classes 8, 9, 10, willing to participate and who attended the screening camps were selected as subjects in the respective study and comparison groups.

Study Period

Area1 BARHS Bovikanum :

Data was collected over 3 days from November 29th to December 1st 2010.

Area 2: Government High school Kalichanadukam.

Data was collected over 3 days from December 6th to 8th -2010 for 3 days.

Data Collection :

Data was collected by a field team consisting of 3 child specialists, 2 medical officers, 1 lab technician and 1 paramedical worker.

A validated proforma was used and data collected by various methods:

1) *Direct interview*: Relevant demographic, morbidity related and details on health status of the subject and family, were collected by history taking and from past records.

2) *Anthropometric and clinical examination*:

The anthropometric measurements were done by using validated instruments and standardized procedures. The pulse and Blood pressure was recorded by electronic BP apparatus (Omron).

The boys and girls were examined separately by male and female doctors including sexual maturity, ensuring full privacy in closed rooms.

3) *Collection of blood samples for hormone assessment*

From selected sub sample population of 100 each from each group the blood samples were collected by venepuncture from antecubital vein using 6 ml vacutainer syringes following all aseptic precautions by the lab technician.

It was then centrifuged for 30 minutes (5000 RPM) and the plasma was separated and collected in tightly capped glass tubes and kept in ILR below 4 degree centigrade. The transportation was done in a fully sealed carrier with ice packs below 4 degree centigrade to the laboratory at Calicut Medical College and kept at -20 degree centigrade till taken for estimation..

4) *Laboratory assessment :*

Hormone studies were done by the Department of Nuclear Medicine Government Medical College Calicut Kerala. The method used was enzyme immunoassay using robotics reader and paired serums.

The following hormones were estimated.

Thyroid hormones :

T3, T4, TSH.

Sex hormones;

Leutinsing hormones (LH).

Follicular stimulating hormones.(FSH)

Oestradiol

Testosterone.

Data Analysis

The collected data was crosschecked for reliability and completeness at the end of each day and suitable corrections were made. The variables were numerically coded and the entered data was analysed using SPSS software.

Results:

In this study, 642 students from 2 schools were included as follows:

1. BARHS Bovikanum 386 students (Study group)
2. GHS Kalichanadukam 259 students (Comparison Group)

Demographic details

Table 1
Class wise distribution of student groups

Class	Study group BARHS Bovikanum		Comparison group GHS Kalichandukam	
	N=386		N=259	
	No	%	No	%
VIII	111	28.7	84	32.4
IX	150	38.9	95	36.7
X	125	32.4	80	30.9
Total	386	100	259	100

Table 2
Age distribution of the students

Age in years	Study group n=383		Comparison group n=259	
	No	%	No	%
12	9	2.3	9	3.5
13	75	19.4	61	23.6
14	145	37.6	70	27
15	95	24.6	64	24.7
16	42	10.9	38	14.7
≥17	17	4.4	17	6.5
Mean age	14.38 ± 1.19		14.45 ± 1.32	

The mean age of both groups were comparable.

Table 3

Study population by gender

Gender	STUDY GROUP BARHS Bovikanum		COMPARISON GROUP GHS Kalichandukam	
	No	%	No	%
Male	182	47.5	140	54.1
Female	201	52.5	119	45.9
Total	383	100	259	100

Anthropometric measurements

Table 4

Age wise height of male students

Age	BOYS <i>Height in cms (Mean & SD)</i>		P value
	Study group	Comparison group	
12	140.20±6.53	146.75±4.35	0.14
13	146.30±6.53	149.22±9.82	0.17
14	153.20±8.86	156.90±8.81	0.064
15	162.25±7.24	163.53±8.49	0.47
16	164.81±6.13	166.55±7.59	0.384
≥17	167.23±6.82	167.75±8.96	0.871

Table 5

Age wise height of female students

Age	GIRLS <i>Height in cms(Mean & SD)</i>		P value
	Study group	Comparison group	
12	147.75 $\pm$ 5.44	152.00 $\pm$ 6.38	0.35
13	149.02 $\pm$ 6.56	150.80 $\pm$ 6.22	0.32
14	152.63 $\pm$ 5.81	152.89 $\pm$ 6.18	0.82
15	153.80 $\pm$ 6.89	154.71 $\pm$ 6.07	0.56
16	154.88 $\pm$ 5.37	152.59 $\pm$ 5.28	0.32
≥ 17	151.50 $\pm$ 10.79	155.20 $\pm$ 9.01	0.59

Table 6

Age wise weight of male students

Age	BOYS <i>Weight in Kg (Mean & SD)</i>		P value
	Study group	Comparison group	
12	31.80 $\pm$ 4.09	34.80 $\pm$ 1.48	0.16
13	36.09 $\pm$ 9.25	35.66 $\pm$ 6.57	0.83
14	40.30 $\pm$ 7.88	42.57 $\pm$ 6.44	0.17
15	45.43 $\pm$ 6.29	49.44 $\pm$ 10.24	0.03*
16	49.81 $\pm$ 7.89	53.00 $\pm$ 12.66	0.30
≥ 17	50.12 $\pm$ 8.46	58.09 $\pm$ 8.70	0.05

Table 7
Age wise weight of female students

Age	GIRLS Weight in Kg(mean & SD)		P value
	Study group	Comparison group	
12	38.75±4.79	40.75±13.45	0.79
13	36.54±5.56	44.15±8.88	0.001*
14	42.50±7.70	41.77±6.87	0.61
15	46.59±10.59	46.18±7.63	0.80
16	44.50±6.37	48.67±7.48	0.11
≥17	44.00±9.41	50.60±1.82	0.13

Age wise the mean of heights and weights of the children in the study group were lower than that of the comparison group, but were not statistically significant.

Mean Blood Pressure & Pulse Recordings

Table 8
Mean BP & Pulse

	(mean & SD)	
	Study group	Comparison group
Systolic BP(mm Hg)	115.31 ± 13.12	118.79 ± 16.75
Diastolic BP(mm Hg)	68.10 ± 10.11	71.32 ± 13.35
Pulse Rate	92.95 ± 37.19	95.44 ± 16.43

Scholastic performance

Scholastic performance was measured by average marks and retention rate in any class. Data on average marks/grades were unreliable as most of the students are not aware of their grades

The retention rate in any class was lower in the study group 91(23.8%) at Bovikanum and 73(28.2%) in the Comparison group but was not statistically significant. These may be due to difference in criteria for promotion in both schools.

Morbidity details:

The past history of seizure, asthmatic attacks and jaundice were collected by recall or by verifying past records. Skin disease and eye/vision problems were assessed by presenting complaints and clinical examination by doctors.

Pesticide use are known to be associated with seizures, asthma, skin diseases, congenital anomalies and to alter liver enzymes. Morbidity included any of these reported illnesses.

Table 9

Morbidity profile of the adolescent population

Morbidity	Study group BARHS Bovikanum		Comparison group GHS Kalichandukam		Risk Odds ratio	95% CI	P value
	No	%	No	%			
Any current illness **	96	25.6	20	8.6	3.65	2.18-6.07	0.000*
Seizures	12	3.1	4	1.5	1.63	0.587-4.68	0.257
Asthma	25	9.7	18	4.8	1.36	.626 - 2.95	0.281
Skin diseases	76	19.8	29	11.2	1.94	1.23 - 3.08	0.003*
Vision problem	70	18.0	17	6.6	3.15	1.81 - 5.50	0.000*

Current morbidity**

Current morbidity was perceived morbidity during the survey and history of current medication. They mainly consisted of minor illness like head ache, respiratory tract illness, eye strain, asthma and skin problems.

The study group (BARHS Bovikanum) had a higher prevalence of any current reported morbidity of 25.6% , Vs 8.6 % in the comparison group, the odds of reported morbidity being 3.65 times higher in this group (OR 3.65 , $P < 0.0001$) which was statistically significant.

Skin diseases and eye problems were also significantly higher in the study group.

Seizures:

In the study group, 12 students gave a history of seizures in the past of which 3 reported current episodes while in the comparison school only 4 had seizures in the past with one having current episodes.

Asthma:

In the study group ,25 (9.7%)students reported asthma of which only 5 (1.3%) had an attack during the last 1 year. In the comparison school 18(4.8%) reported asthma of which, 3 (1.2%) had an attack during the last one year.

Skin disease: All current skin problems were enlisted by the doctors Allergic/contact dermatitis and eczematous lesions were considered. The odds of a skin problem in the study group was 1.94 times higher as compared to the comparison group which was significant.(OR=1.96 ,CI 1.23 to 3.08, $p < 0.003$)

Eye problems: The eye problems were refractory errors, eye strain,reading difficulties, increased watering, pain etc. The study group had a 3.15 times significantly higher odds of eye problems also (OR= 3.15 , CI 1.81-5.50, $p < 0.000$).

History of jaundice: This was similar in both groups being 10(2.6%) at Bovikanum and 6 (2.3%) in the comparison area.

Hypersensitivity disorders: The ratio of the presence of any hypersensitivity disorder (Allergic dermatitis, Eczema, Bronchial asthma) was 101 : 47 in the study group vs the comparison group.

Details of congenital anomalies

Congenital anomalies were assessed by clinical examination by pediatricians. Children with severe anomalies and disabilities may not attend the schools and may be at home or enrolled in special schools for challenged children. So the anomalies recorded may not reflect the true picture of disabilities prevalent in the community.

Table 10

Congenital anomalies among study population

Anomaly	Study group BARHS Bovikanum		Comparison group GHS Kalichandukam	
	No	N=383 Per 1000.	No	N=259 Per 1000.
1. Limb anomaly	3	7.8	1	3.9
2. Any organ anomaly	8	20.7	2	7.7
3. Congenital Heart disease	3	7.8	1	3.9
4. Undescended testis	1	2.6	1	3.9
5. Cerebral Palsy	2	5.2	0	00
6. Congenital Talipes equinovarus	1	2.6	1*	3.9
7. Poly dactyly	1	2.6	1	3.9
8. Marfans syndrome	1	2.6	1	3.9
9. Cong: adrenal hyper plasia	1	2.6	0	00
10. Short stature	10	25.9	0	00

**The native place of the mother was in bovikanum*

Any organ anomaly and Congenital heart disease were higher in the Bovinakum school. Congenital heart disease was diagnosed either from old records or by detailed clinical examination and history. Ten Children with short stature were recorded from Bovikanum and also had delayed mile stones of puberty

Table 11

Any congenital anomaly

	Study group BARHS Bovikanum N=383		Comparison group GHS Kalichandukam N=259		Risk Odds ratio	95% CI	P value
	No	%	No	%			
Any congenital anomaly	10	2.2	3	1.6	16.03	4.20 – 61.11	0.000*

Odds of any congenital anomaly was significantly higher at Bovikanum .

Death among the siblings

Table 12

Sibling deaths

Details	Study group BARHS Bovikanum N=386		Comparison group GHS Kalichandukam N=259		Risk Odds ratio	95% CI	P value
	No	%	No	%			
History of Sibling death	35	9.5	17	6.6	1.41	.770-2.57	0.167

History of sibling deaths was higher at Bovikanum.

Death among the siblings were collected by verbal autopsy from the parents and students .Most of the deaths were during neonatal period, infancy and children under 5 years of age and were attributed to either preterm deliveries or congenital anomalies. Most of the recalled congenital anomalies were related to the brain or CNS with symptoms of seizures. Few neonatal deaths among twins were also noticed.

History of previous of surgery

Previous surgeries recorded in both groups were as below:

Table 13
Details of previous surgery

Previous Surgery	Study group N=383		Comparison group N=259	
	No	%	No	%
Any previous surgery	16	4.1	11	4.2
Birth defect	6	1.55	1	0.386
Appendicectomy	3	0.77	2	0.772
Hernia	0	0	2	0.772
Fracture	2	0.158	3	1.158
.Brain related	1	0.26	0	0
Genitourinary system	1	0.26	0	0

Hormone study

Goitre was examined by clinical examination and graded according to WHO grading as 0, 1 and 2.

Table 14

Goitre in the study population

Thyroid grade	Study group N=369		Comparison group N=243	
Grade 0	206	55.83	151	62.14
Grade 1	101	27.37	46	18.93
Grade 2	62	16.80	46	18.93

Students in the study area had significantly higher proportion of goitre of 163 (44.17 %) compared to 92 (37.86 %) in the Comparison area (odds ratio 2.09 (CI 1.51- 2.90) $p < .001^*$)