CHANGING SPECTRUM OF PESTICIDE POISONING –PAST AND PRESENT - IN THE CONTEXT OF POLICY CHANGES RELATED TO PESTICIDE BANS

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT OF THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI FOR THE DEGREE OF M.D. BRANCH- GENERAL MEDICINE EXAMINATION TO BE HELD IN MAY 2022

REGISTRATION NUMBER: 201811451

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

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CERTIFICATE I

This is to certify that "CHANGING SPECTRUM OF PESTICIDE POISONING – PAST AND PRESENT - IN THE CONTEXT OF POLICY CHANGES RELATED TO PESTICIDE BANS" is a bona fide work of Dr. Angel Subramani, with registration number 201811451 in partial fulfilment of the requirements for the M.D. Internal Medicine Examination of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, to be held in May 2022.

Dr. Anna B Pulimood ,

Principal ,

Christian Medical College,

Vellore

CERTIFICATE II

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Dr. Thambu David,

Professor and Head of Department of Medicine,

Christian Medical College, Vellore

CERTIFICATE III

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Dr. Anand Zachariah,

Professor and Guide,

Head of Department of Medicine I

Christian Medical College, Vellore

DECLARATION

This is to certify that "CHANGING SPECTRUM OF PESTICIDE POISONING – PAST AND PRESENT - IN THE CONTEXT OF POLICY CHANGES RELATED TO PESTICIDE BANS" is a bona fide work done by me, under the guidance of Dr Anand Zachariah and Dr Punitha J.V., in partial
fulfilment of the rules and regulations for the MD Branch General Medicine Degree examination of the Tamil Nadu Dr M.G.R. Medical University, Chennai, to be held in May 2022. I have independently reviewed the literature, collected the data, and carried out the analysis and evaluation towards the completion of my thesis.

Dr Angel Subramani

Post Graduate Student

Department of General Medicine

Christian Medical College

Vellore-632002

CERTIFICATE – III

This is to certify that this dissertation titled, “CHANGING SPECTRUM OF PESTICIDE POISONING –PAST AND PRESENT - IN THE CONTEXT OF POLICY CHANGES RELATED TO PESTICIDE BANS ” is a bona fide work of the candidate Angel S with registration number 201811451 for the award of the degree of M.D. in the branch of Internal Medicine. I have personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains pages from introduction to conclusion, and the result shows zero percentage of plagiarism in the dissertation.

Dr. Anand Zachariah (MD)

Professor and Guide

Head of Department of Medicine I,

Christian Medical College,

Vellore

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Submitted by	Angel Subramani
Submitter email	angelelcid47@gmail.com
Similarity	0%
Analysis address	angelelcid47.mgrmu@analysis.urkund.com

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"Come and see what the Lord has done, His faithfulness knows no bounds."

First, I would acknowledge and thank God Almighty, without whom I would not have been able to undertake or complete this study.

I thank my guide Dr. Anand Zachariah, Head of Department of Medicine I, for his constant patience, wisdom, kindness and constant encouragement in helping me to do this study. I would not be here if it were not for him, constantly supporting me and encouraging me to do the impossible. His constant patience and ability to calm me in the most crucial of times during this study and his understanding is the sole reason that I have successfully completed this study. His quick mindedness and analysis on my study has taught me humbleness and every endeavor to be like him in the future.

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I would like to thank all my patients for giving me a part of their valuable time and allowing me to be in their lives.

LIST OF COMMON ABBREVIATIONS USED

OP Organophosphate compound

BP Bipyridylium derivative

C Carbamate, HG – Mercury compound

NP Nitro phenol derivative

OC Organochlorine

PAA Phenoxy acetic acid derivative

PY Pyrethroid

T Triazine derivative

TC Thiocarbamate.

ICU Intensive Care Unit

PCC Poison Control Centre

PHC Primary Health Centre

SHC Sub Health Centre

CHC Community Health Centre

CMC Christian Medical College

ARDS Acute Respiratory Distress syndrome

CS Cholinergic crisis

IS Intermediate syndrome

OPD Outpatient department

GI Gastrointestinal

ABSTRACT

TITLE: Changing spectrum of Pesticide poisoning -Past and present in the context of Policy changes related to pesticide bans.

DEPARTMENT: General Medicine

NAME OF THE CANDIDATE: Dr Angel Subramani

DEGREE AND SUBJECT: MD in General Medicine

NAME OF THE GUIDE: Dr Anand Zachariah, Dr Punitha J V

OBJECTIVES: To document changes in the spectrum of pesticide compounds in patients with self-poisoning, before and after the pesticide ban in 2016 and to observe the resultant changes in the profile of compounds, clinical manifestations and morbidity, ICU care, ventilator days and mortality.

METHODOLOGY:

This study includes prospective data collection from the year 2019 to 2021 on all patients who are admitted with a diagnosis of pesticide poisoning, either self or accidental. Retrospective data was collected from Medical records in an unlinked anonymized manner from 2015 to 2016 before the ban. The data were analyzed with SPSS software and changing trends with regards to spectrum of pesticide compounds, the number of admissions into critical care unit, ventilator days and mortality was assessed.

This study included both retrospective and prospective arms, with a comparative analysis aimed at studying the spectrum and outcomes of pesticide poisoning, in the context of a ban on certain pesticides.

RESULTS:

There were 240 patients in the retrospective arm (24 months) and 74 patients in the prospective arm (13 months). Both the arms were compared and the number of patients requiring ICU stay, with the outcome on mortality was assessed.

The overall number of patients in the ***pre ban*** period was ***240*** with ***48.3%*** requiring ICU admission, ventilation and intensive care. Of these patients, the mortality rate was ***11.6%***.

In the ***post ban*** period, the total number of patients was ***74*** with ***35.1%*** requiring ICU care and mortality of ***10.8%***.

There was significant decline in patients requiring ICU care, 49.2% in pre-ban period to 32.4% in the post- ban period (odds ratio of 0.4 with a CI of 0.2 to 0.85 with a P-value of 0.011).

There has been a non-significant reduction in mortality by 0.8 % with an odds ratio of 1.08 and a confidence interval of 0.4-2.5 with a P-value of 0.83%.

Class I compound poisoning showed a declining trend following the ban (33% pre-ban vs. 20.3% post-ban). The odds ratio is 0.51 with a confidence interval of 0.27 -0.97 and a P-value of 0.03. Class II compounds showed a non-significant increase following the ban (19.6% pre-ban to 20.3% post-ban) and Class III compounds disappeared following

the ban (2.5% preban to 0% post-ban). Organophosphate compounds with pyrethroid increased from 20.4% pre-ban to 24.3% post ban (non-significant).

There was a decrease in ICU admission and mortality due to Class I compounds (Mortality due to Class I a pre-ban 2.7% to 0.8% post ban and Mortality due to Class I b pre-ban 2.5% to 1.4 % post ban) . There was increase in mortality due to OP+ pyrethroids from pre-ban of 2.9% to post-ban of 6.7%.

Other compounds contributing to the mortality in the post- ban period were yellow phosphorus, zinc phosphide and paraquat poisoning.

CONCLUSION:

Following the ban being imposed by the Anupam Verma committee with the gradual phasing of pesticides in 2016, and a recent phased ban in 2018 and 2020, the following changes were noted in the spectrum of agrochemical poisoning:

There has been a shift away from Class I and Class III organophosphates to OP/pyrethroid combination poisonings. There is also an increase in herbicide, fungicide and rodenticide poisoning.

The mortality due to Class I organophosphates has reduced but the mortality due to OP/pyrethroid poisoning has increased. There is also mortality due to rodenticide and herbicide poisoning.

There has been a significant decrease in need for ICU care and mechanical ventilation in pesticide poisoning, but there has been no overall change in mortality following the ban.

The agrochemical poisoning spectrum from our centre shows the benefit of regulation of pesticides. Banned compounds, compounds under restriction and compounds listed for phasing out have showed elimination or marked reduction. However they have been replaced by combination pesticides with organophosphate and pyrethroids. These results suggest the need for on-going monitoring of the spectrum and mortality due to pesticide poisoning towards on-going regulation.

TABLE OF CONTENTS

CHANGING SPECTRUM OF PESTICIDE POISONING –PAST AND PRESENT - IN THE CONTEXT OF POLICY CHANGES RELATED TO PESTICIDE BANS

I. AIM-

To document changes in the number and spectrum of pesticide compounds in patients with pesticide poisoning, before and after the pesticide ban in 2016 and to observe resultant changes in the profile of compounds consumed, the clinical manifestations , ICU care and mortality.

The main purpose of this study includes:

- Profile of pesticide compounds and their classification, i.e. the number of cases per compound with a comparative analysis including the pre-ban and post-ban period.
- Profile of classes of pesticides (Organophosphate compound as per WHO classification or pyrethroid/carbamates).
- The overall mortality of compounds consumed and their correlation, with class specific mortality.
- Compound specific mortality as per each class of pesticide compound
- The number of cases requiring ventilation or ICU care, and their correlation with individual compounds (ventilation rate for each class of compound).

II. OBJECTIVE OF STUDY:

Primary objectives: -

- To document change in the number, spectrum and mortality of pesticide compounds over time – including a comparison of pesticides seen before and after 2016 (from 2015 -2016), with comparison to the post-ban period (2019-2021).
- To compare and document changes in outcome among patients requiring ICU stay.
- In-hospital mortality of patients admitted with pesticide poisoning.

III. INTRODUCTION:

A. Definition:

Pesticides are compounds composed of main chemicals which are commonly used for agriculture. They are defined as "Any substance used to kill, repel or control certain forms of animal life that are considered to be pests."(Ref: National Institute of Environmental Health Sciences)

B. Justification for this study:

Pesticides are used to improve the quality of vegetation and its growth and prevent crop destruction.

However, there are health-related risks associated with exposure to these compounds, i.e., the modes of poisoning can be either through inhalation, ingestion of the

compound or transmission via cutaneous route, the latter which is usually accidental with subsequent exposure. (Damalas & Koutroubas, 2016) (1).

In pesticide poisoning which includes all insecticides, deliberate self-harm accounts for 14-20% of total suicide rates globally (Mew EJ, Padmanathan P, Konradsen F, Eddleston,2006 M(2).

The incidence of suicide rates is higher in Asian countries, where a wide spectrum of easily available pesticides are available from local shops, with easy accessibility (3) and as it is commonly used in agricultural work and the fields for crop production.

The problem of deliberate self-harm is most severe in rural Asian Communities, where a wide range of agricultural highly hazardous pesticides (HHPs) are easily available within the home and from shops: Bose A et al., 2009(4).

Studies show that accessibility of less toxic compounds available for consumption reduces mortality when compared to consumption of type I pesticide compounds (Eddleston M., et al:2007(5). Because of this, the Anupam Verma committee was formed in 2015, where they implemented a phased ban of certain toxic pesticides in December 2015, which was implemented in year 2016.

There were 13 pesticides banned in 2016, with 18 pesticides banned or restricted for use in the country. However, this was out of the 66 pesticides which have been banned all over the globe, and are still available for use in India.

Hence, the purpose of this study was undertaken to observe patients with deliberate self-harm and to do a comparative analysis of the changes in the spectrum of pesticide poisoning, within the two-time frame: Pre-ban and post-ban periods.

IV. LITERATURE REVIEW:

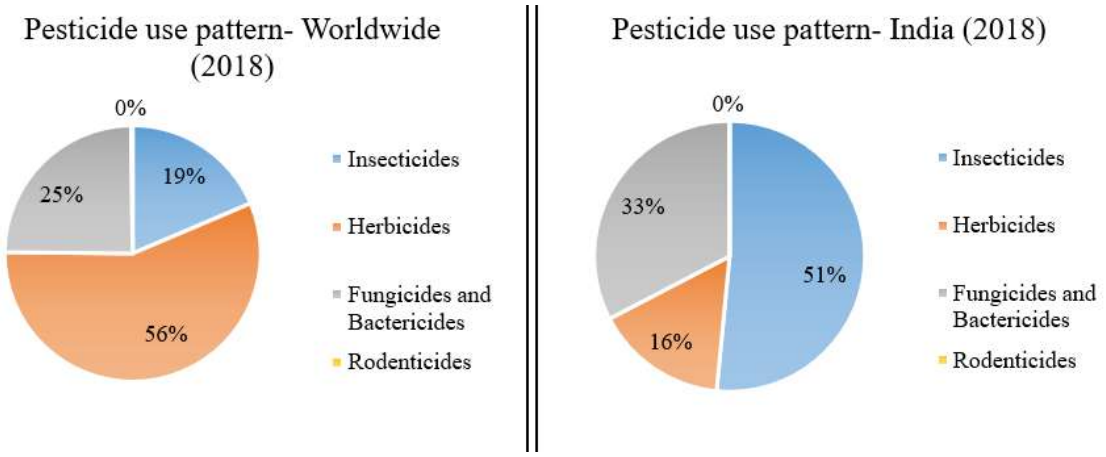
The Anupam Verma committee was formed in the year 2013 and there was a ban implemented in the year 2015, implemented in the year 2016, for certain pesticide compounds which were found to be toxic. The following year in 2018, there was another ban phasing out certain pesticide compounds, including type I compounds. This research aims to study the effects of pesticide poisoning before (2015-2016) and after the ban (2019-2021). This is done to see the change in the spectrum of compounds with a focus on mortality, according to the compound consumed.

A. Statistical data on Pesticides:

Pesticides are regulated under the Insecticides Act, 1968 in India. This body and authority are concerned with the regulation, import and distribution of these compounds and further safety concerns. The usage of pesticides in India is vast, with states relying heavily on pesticides for crop production.

India is the third leading country in pesticide production in Asia with increasing pesticide consumption. The overall amount of pesticide consumed in India is currently 53,453 tons as compared to 5275 in the year 2015-16(Government of India, Min. of Agriculture and Farmers welfare). There has been increasing use of pesticides in India, with an increase of 46% from 1996 to 2016(WHO, 2019). Currently, as per data in 2020, there are 273 pesticides, which have been registered for use in our country. Vineet Kumar, in the Down to Earth article, released in 2020, commented on the total pesticide consumption, which is noted to be the highest in Maharashtra(11,665 in 2015-16 as compared to 2400 tons in 2008-2009), followed by Punjab and Haryana.

Pesticide use data in 2018, showed India to be relying heavily on Insecticides, followed by herbicides and fungicides, as compared to other countries as shown below:

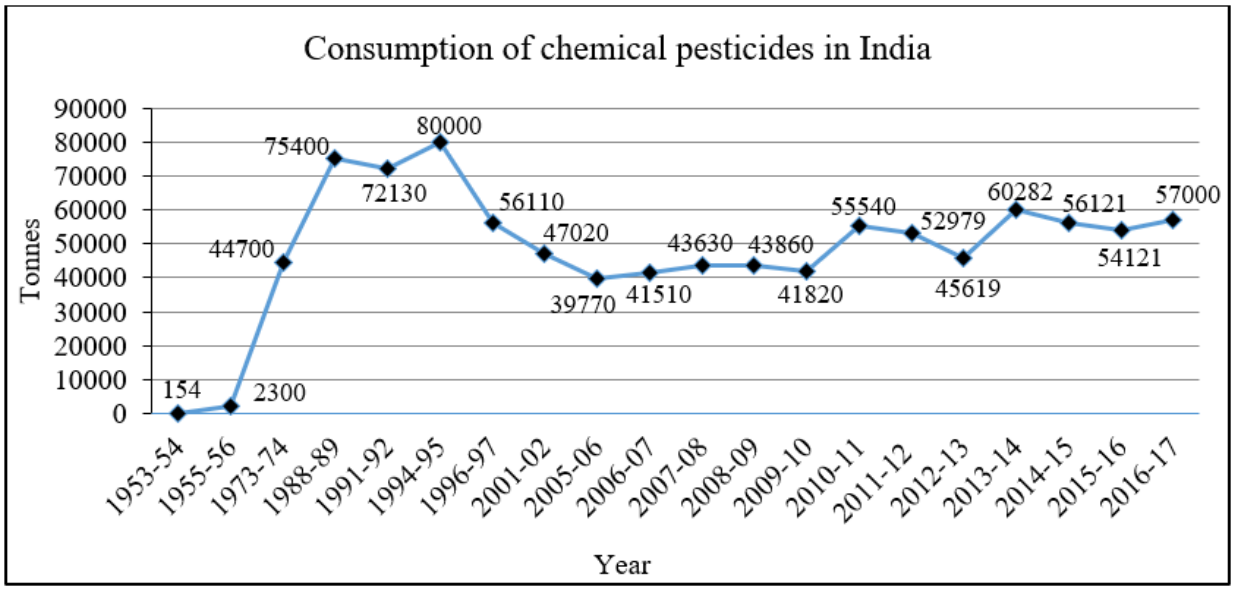


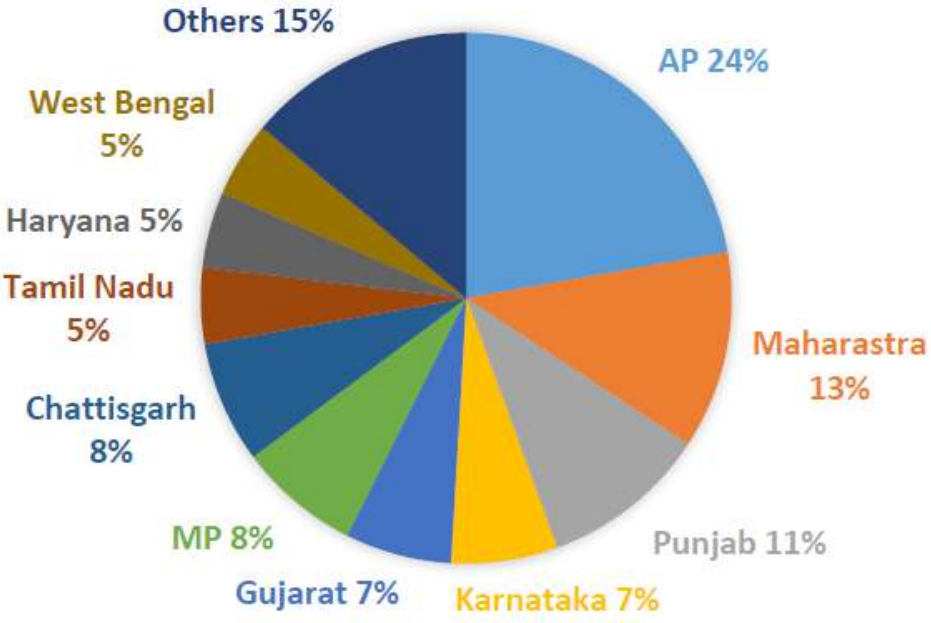
Pesticide use pattern- Worldwide and India (Source: http://www.fao.org/faostat/en/#data)

The increasing number of pesticide consumption across India is shown below:

The usage of pesticides, more commonly insecticides is steadily on the rise with pesticide pattern use of 51% in India as per 2018 statistics.

Tamil Nadu consumes 5 % of these pesticide compounds, with highest state consumption being Maharashtra (13%).





Source:http://www.fao.org/faostat/en/#data

B. Pesticide poisoning:

Ingestion of pesticides is a common mode of suicide in India with disastrous effects due to the compound ingested.

Pesticides are the most common compounds used for poisoning due to easy access and availability. There are a large number of pesticides sold in the market, varying in

chemical composition. M. Eddleston, in 2000(6), wrote an article that surveys the poisoning literature to recognize the most commonly used poisons for self-harm in these areas.

Michael Eddleston et al., 2002 in his article commented that poisoning with pesticides kills more people than infectious diseases in several parts of the developing world. India's under-reporting of suicides has led to a rise in pesticide self-poisoning death estimates of 1,68,000 per year, or 19.7% of global suicides (Gunnell, D et al:2007)(7). According to the WHO, pesticide self-poisoning is the most important reason for suicide in low- and middle-income nations globally, apart from other causes. Given the extensive use of pesticides in agriculture and their ease of availability, these various pesticides and their manifestations following consumption of these compounds are being studied.

Even farmers, when working in the fields, are inadvertently exposed during spraying of the fields, or in cases of deliberate self-harm, these pesticides pose a serious threat to human health because of their high biological activity. Farmers may come into contact with the pesticide in the form of spills, splashes, or direct spray contact due to defective or missing Personal Protective Equipment (PPE).

Long term exposure to pesticides also can have long term complications such as hematopoietic malignancies which have been mentioned by Merhi M, Raynal H et al, Epub 2007(8) and other complications of peripheral neuropathy (Hu R, Huang X, Huang J, et al., 2015(9).

Studies done recently by Bonvoisin et al., 2020(10) examines the possible link between India's high suicide incidence and the regulation of hazardous pesticides at

the national and state levels. There has been a considerable decrease in the number of people taking their own lives in South Asian countries where restrictions on pesticide use have been implemented. Between 1995 and 2015, a total of 441,918 suicides in India were related to pesticide use, with 90.3 per cent occurring in just 11 of the country's 29 states (11).

Pesticide suicide is still a major public health issue in India, where hazardous pesticides are in use. It appears, however, that a few pesticide restrictions may have affected prior patterns in the number of suicides involving pesticides and all suicides combined over the years. Over the previous 20 years, there have been targeted pesticide limitations in Sri Lanka which have decreased pesticide mortality by half with no reduction in agricultural productivity. The storage of these compounds has not had any effect on the outcome or mortality.

It was noted that Sri Lanka reduced its rate of pesticide poisoning (12, 13) and suicide rate by prohibiting Class I compounds, which are organophosphates, followed by endosulfan (organochlorine). In an article published by Darren M. Roberts, people with endosulfan poisoning were noted to have increased mortality with cases of status epilepticus being reported. The mortality rate was noted to significantly fall after this compound was restricted for use.

Reduction or non-availability of highly hazardous pesticides showed effectiveness in preventing suicides due to self-poisoning. (12, 13).

In spite of the ban implementation on target pesticides, studies done by Manuwera G and Eddleston et al in 2008 showed that there was no decrease in the agricultural output, despite these bans (14)

There was also a reduction in the number of hospitalizations as noted by Eddleston M et al., 2012. (15)Knipe, Duleeka W et al. in an article (2017), mentioned the decrease in the total rate of suicides, with a RR of 0.86–1.05.

In 2015, decreased incidence of suicide rates was observed, however, the total number of suicides was noted to be overall the same.

However, this included a larger timeline from the year 2008, when the phased ban was started. Hence the changing trends were captured over a larger time period.

A study was done by Chowdhury FR et al, (Bans of WHO Class I Pesticides in Bangladesh-suicide prevention 2018) (16), showed fewer pesticide suicides. As pesticide self-poisoning (PSP) was a significant issue in Bangladesh, according to legislation passed by the government, a restriction on the use of highly toxic pesticides has been in place in Bangladesh for the past 20 years. Pesticide use and agricultural output in Bangladesh were tracked from 1996 to 2014 to see how the change over time in terms of suicide rates and mortality. Comparing the years 2001 to 2014 with the years 1996 to 2000, there were 35, 071 fewer pesticide suicides. Although pesticide use increased and the number of pesticide poisoning hospitalizations remained unchanged, the rate of pesticide suicides fell.

To put it another way, there was a significant reduction noted in both deaths and hospitalization rates in Bangladesh as a result of this. Hence, the removal of highly toxic and hazardous pesticides from agriculture, according to this study, has been shown to reduce and lower suicide rates quickly without implementing a significant financial burden on farmers.

In 2007, a study done by D. Gunnell et al. (17), showed clinical data from Sri Lanka, which showed time trends of suicide and risk factors from 1975 to 2005. Men's and women's suicide rates had dropped significantly after limitations on WHO Class I hazardous pesticide import and sale were implemented in 1995 and 1998. There were 19,769 fewer suicides in the 1996-2005 period than there were in the 1986-95 period. No correlation could be found between these declines and secular trends in illiteracy, underage drinking, divorce, pesticide use, or the years surrounding Sri Lanka's civil conflict. As a result of these findings, import limitations on the most dangerous pesticides may have a positive influence in nations where self-poisoning is frequent. The intention of consuming pesticides as a means of deliberate self-harm is often seen as impulsive, hence there may be a benefit in considering and restricting access to and selling highly toxic pesticides (Gunnell, David et al., 2017).

Sivanandan A et al, (18) in 2020, did a study involving 1802 patients. The most common pesticides observed for consumption was insecticides which was noted at 91%, followed by the rest.

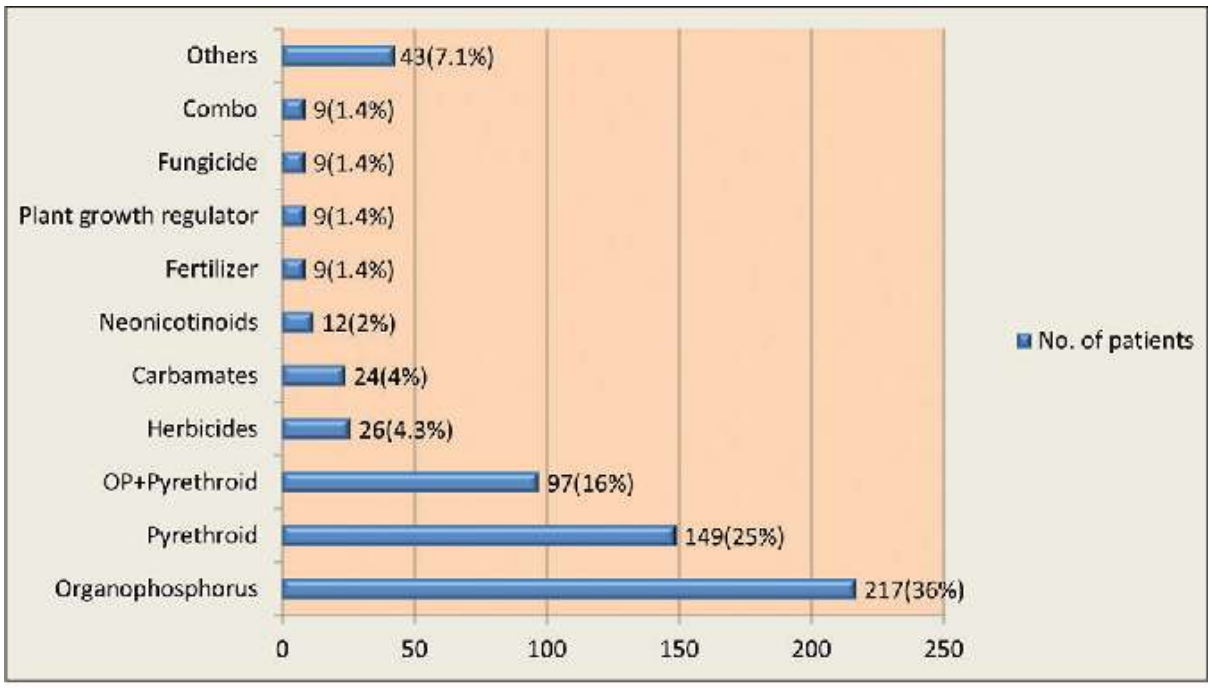


Figure 2: Spectrum of Agrochemicals

The requirement for agricultural products are being constantly evaluated by the Government and alternative pesticides , such as biopesticides are used to replace the more toxic compounds, to reduce deaths secondary to pesticide consumption.

WHO (World Health Organization) states that organophosphate compounds with the highest toxicity compounds that include classes Ia, Ib and II and paraquat, have been claimed to be the culprit and reason for most of the suicide rates since the previous 5 decades. (World Health Organization classification of pesticides)(19).

Eddleston M. et al. (20) mentions that an international effort to reduce poisoning by focusing simply on fatalities is hindered. This is because of non-fatal poisonings, notably on farmers which are unnoticed. The burden of pesticide poisoning may be greatly reduced if the worldwide suggestions to phase out highly toxic pesticides are implemented.

V. CLASSIFICATION OF COMPOUNDS AND CLINICAL MANIFESTATIONS:

There are various classification entities for pesticides, these are classified on:

I.

1. Toxicity:

This toxicity of the compound depends on the dosage ingested or inhaled and the duration of exposure to the compound. It can be divided into acute or chronic toxicity.

2. Chemical composition:

Compounds are divided into insecticides, herbicides, rodenticides and fungicides. They are classified based on the contents of their chemical composition and their formulae.

3. Based on the organism they target
4. Based on mode of entry :

-Via skin contact (Example: Paraquat and other organophosphate compounds)

-Inhalational route (Example: Fumigants)

I. Classification of pesticide, which depends on the mode of action-

1. Physical poison
2. Respiratory poison
3. Protoplasmic poison

II. Based on origin

1. Biopesticides, other compounds from natural sources, such as plants, fungi and other compounds such as herbicides, fungicides.
2. Chemical pesticides: these include organophosphate compounds, pyrethroids which have similar action to OP compounds and carbamates.

III. Most pesticides fall into herbicides, fungicides, and insecticides based on their chemical composition. (Pesticides Classification: Anil Kumar et al., 2017)(21).

Classification:

Pesticides are divided into four classes, which have side effects of main neurotoxicity and respiratory distress warranting immediate medical attention. They are different classes which include 1) Organophosphates, 2) Pyrethroids, 3) Organochlorines, 4) Rodenticides, 5) Carbamates, 6) Biopesticides, 7) herbicides.

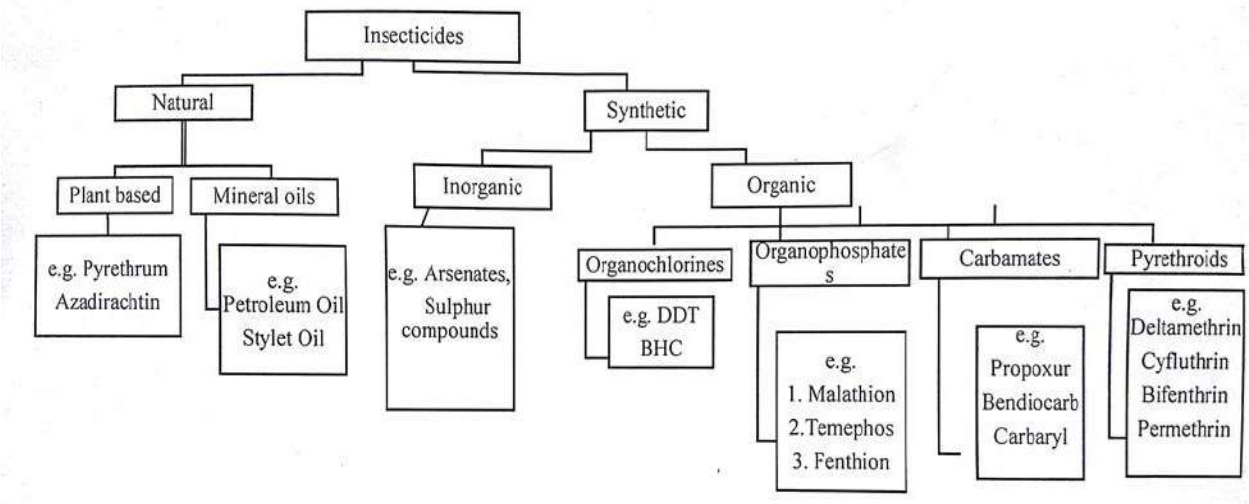


Fig.1: Classification of Insecticides

These compounds are used in a large proportion in India as our country is one of the major leading manufacturers of pesticides. Senanayake & Karalliedde, 1987(22) in their article, mentioned the side effects of consuming these compounds. Most individuals showed immediate neurotoxic effects in the cholinergic phase, while the long-term neurotoxic effects usually took up to two weeks to manifest with intermediate syndrome, necessitating prolonged ICU stay.

Pesticide Poisoning Registry recommends and emphasizes (23), the need for a timely diagnosis to prevent complications and lower mortality rates in pesticide consumption. It was common to see acute complications, which were linked to higher rates of morbidity and possibly mortality.

Research shows that death and outcome are linked to lag time in pesticide poisoning (Banday TH et al.)(24), the amount of pesticide compound consumed, the levels of pseudocholinesterase (in organophosphate pesticides), and the duration of ventilator assistance: which is usually based on the compound consumed.

WHO (World Health Organization) has classified pesticides based on their potential. An understanding of the classification of pesticides allows for understanding the compounds better in terms of toxicity and the need for immediate medical attention.

I. Organophosphorus compounds:

This pesticide is one of the most common pesticides consumed. The severity of clinical manifestations depend on the mode of exposure, compound consumed and the amount of quantity consumed.

Around 3 million people are exposed to these compounds every year. The main mode of action is inhibition of enzyme acetylcholinesterase, thereby causing the

accumulation of acetylcholine at the neuromuscular junction, which causes nicotinic and muscarinic symptoms by stimulating the respective receptors.

Patients present with Muscarinic symptoms and nicotinic symptoms. Muscarinic symptoms include SLUDGE symptoms, which usually present within the first 4 hours following consumption of the compound. These symptoms include:

1. Salivation
2. Lacrimation
3. Urination
4. Defecation
5. Emesis.

Cholinergic symptoms usually manifest within the first 24 to 48 hours after consumption of the compound and are characterized by muscle weakness(predominantly neck muscle, leading to respiratory fatigue followed by arrest)(25), drowsiness, fasciculation's and obtunded state if no medical intervention is sought.

Confirmation of Organophosphate consumption is via pseudocholinesterase level, which is normally in the range of 3000 to 8000 U/.

Clinical history and low serum pseudocholinesterase levels are used to diagnose organophosphate poisoning. This enzyme is inhibited in organophosphate compounds, reducing the cholinesterase levels to <1000 U/L. (Michael Eddleston et al., 2005).

Pseudocholinesterase levels have been told to indicate the severity of pesticide poisoning and the requirement for ICU stay. (Hiremath, Pradeep Kumar et al)(26). In organophosphate compounds, the patients will require atropine as targeted therapy.

The following table gives a severity score based on clinical parameters at the time of presentation. The higher the score, the more severe are the clinical manifestations, making a score of 8-11 as severe poisoning.

Other clinical manifestations present in individuals with pesticide poisoning would include bradycardia at the time of presentation, respiratory distress shortly thereafter and intermediate syndrome, often presenting with type I respiratory failure (hypoxia) or type II respiratory failure(carbon dioxide narcosis).

Table 1: Peradeniya organophosphorus poisoning (POP) scale

Parameter	Criteria	Score
Pupil size	≥2 mm	0
	<2 mm	1
	pinpoint	2
Respiratory rate	<20/min	0
	≥20/min	1
	≥20/min with central cyanosis	2
Heart rate	>60/min	0
	41-60/min	1
	<40/min	2
Fasciculation	None	0
	Present, generalized/ continuous	1
	Both generalized and continuous	2
Level of consciousness	Conscious and rationale	0
	Impaired response to verbal command	1
	No response to verbal command	2
Seizures	Absent	0
	present	1
0-3: mild poisoning, 4-7: moderate poisoning, 8-11: severe poisoning		

These manifestations are known to occur, especially in Type I organophosphate compounds, which are more toxic, necessitating mechanical ventilation (Ref: CMC toxicology website) (27).

Organophosphate compounds are classified into three classes, based on their efficacy and toxicity into classes I, II and III.

These pesticides are grouped according to the toxicity (WHO classification):

1a: Classified as *extremely hazardous*

1b: Classified as *highly hazardous*

II: Classified as *moderately hazardous*

III: Classified as *slightly hazardous*

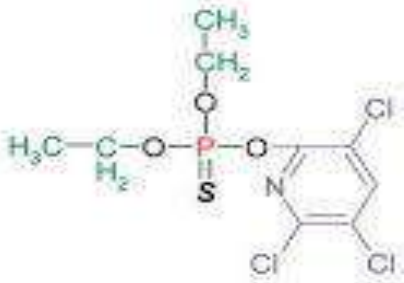
U: *Unlikely* to cause a hazard

The table below lists the organophosphate compounds and their classification, which is classified based on the structure of the alkyl groups attached.

WHO COMPOUNDS: Classification	Name of the compound
Class IA	Methyl parathion, Phosphamidon, Phorate
Class IB	Monocrotophos, Dichlorvos, Triazophos
Class II	Quinalphos,Fenthion,Chlorpyrifos,Dimethoate,Profenofos,Ethion,Phenthoate
Class III	Acephate, Malathion

Chemical composition of Organophosphate compound, to the right: Chlorpyrifos (Type II compound)

organophosphate (general structure)



chlorpyrifos

Below is a picture of Monocrotophos, a type I b organophosphate compound, which is a commonly used compound for agriculture.

II. Carbamates:

These are similar to organophosphate compounds and have a similar mode of action to them. They interfere with nerve signal transmission at the neuromuscular junction. These are derivatives of N-methyl carbamates, which cause carbamylation at the neuromuscular junction. These compounds bind to acetylcholinesterase reversibly, hence have similar clinical manifestations to organophosphate compounds (NCBI Stat pearls Jason Silberman, Alan Taylor).These are toxic chemicals that inhibit acetylcholinesterase, hence similar clinical manifestations but milder (28).

These compounds are from carbamic acid. They are considered safer than OP pesticides. The following are some of the compounds of carbamates:

1. Aldicarb
2. Carbaryl
3. Carbofuran
4. Methomyl
5. Propoxur

These compounds are similar to OP compounds, that they inhibit AchE (acetylcholinesterase).However, the binding is reversible, and thus clinical symptoms are mild .These include SLUDGE symptoms similar to OP compound described previously. Convulsions are noted to occur and death occurs due to respiratory failure.

Diagnosis: This is based on cholinergic signs, and low levels of acetylcholine esterase in the blood.

Treatment: This is similar to OP poisoning, with antidote of choice being Atropine, which can be given as boluses or as infusion if high doses are required.

III. Pyrethroids

These compounds are neurotoxic, with direct action on voltage-gated sodium channels (B.P.S. Khambay et al., 2005) (29, 30). These chemicals after binding to these channels over the pore-forming subunits, create open channels, which remain persistently open in the Central nervous system, termed as depolarization. (30)Clinical manifestations were similar to organophosphate compounds which included tremors, seizures, and cholinergic symptoms (Ref: CMC toxicology website). These compounds break down in the presence of light, most commonly used are the compounds Permethrin and cypermethrin.

These compounds are used commonly as house sprays.

It is known to have slow absorption through skin, and has rapid breakdown into nontoxic metabolites. Synthetic pyrethroids are produced by the addition of a cyano group into the compound to prevent its breakdown by the light.

These compounds are classified into:

Type I: These do not have an alpha cyano group

Type II: Presence for cyano group at the carbon atom, thus making these compounds more potent and toxic.

Mode of action:

These compounds act on the sodium and chloride channels, with a target action on mainly nerves and muscles. Type II compounds cause a longer action potential by prolonged sodium influx, thus blocking any other action potential from being generated. This could be the reason for arrhythmias.

Type II compounds at very high concentrations, act on GABA channels in CNS, thus lowering the threshold for seizures.

As pyrethroids administration is causing increasing resistance among crops, these compounds have been modified as synergists. They are mixed with organophosphate compounds or piperonyl butoxide.OP compounds have a synergistic effect when mixed along with pyrethroids, as it inhibits it’s detoxification by carboxylesterases. This increases the half-life of pyrethroids, thereby increasing its potency and toxicity.

Exposure to pyrethroid occurs via inhalational or consumption.

There are 2 toxidromes explained below (30):

Type I syndrome: Reflex hyper excitability with tremors

Type II syndrome: Characterized by choreoathetosis

TYPE I COMPOUNDS	TYPE II COMPOUNDS
PERMETHRIN	CYPERMETHRIN
PHENOTHRIN	CYFLUTHRIN
ALLOTHRIN	DELTAMETHRIN
BIFENTHRIN	TRALOMETHRIN
PRALLETHRIN	CYHALOTHRIN
TEFLUTHRIN	FENPROPATHRIN
RESMETHRIN	

IV. Organochlorines

These compounds are chlorinated hydrocarbons, attached to chlorine. They affect the central nervous system, predisposing patients to seizures. Some of the used compounds include DDT, Endosulfan and lindane. DDT is still in use in India for malaria control with endosulfan banned from use in India.

V. Combination pesticides

In order to prevent resistance from using a single pesticide, there are formulations of pesticides that are combined. They are sold in the market as a combination of organophosphate compounds with organochlorines or pyrethroids. (Bhavna Gupta, Sukhyanti Kerai, Izan Khan).Indian J Anaesth. 2018 (31).

These compounds, which are in combination, have been reported previously to cause higher toxicity due to the combined effect.

Iyyadurai R, Peter JV et al in 2014 (32), mentioned increased toxicity in the combination pesticides, as the organophosphate compound inhibits the pyrethroid, thus increasing the half-life of both the compounds, causing more toxicity than single pesticides alone. In this study, the number of patients recruited was 1177, which was over two years. Combination mixtures were studied and it was noted that ventilator free days was lower in patients who consumed ($p < 0.006$) in single pesticide, (20.9 ± 9.3 days), as compared to those with combination pesticides.

This was a study done which compared clinical profile and outcome in patients who had either Chlorpyrifos alone (Number: 20), or cypermethrin poisoning (Number: 32) and compared it to those who had consumed combination compounds, including cypermethrin-pyrethroid and other combination compounds. Mortality was not changed, however symptoms of organophosphate poisoning were higher in patients with combination compound poisoning. Another study done by Tripathi et al (33), showed that patients who had consumed combination of methylparathion (OP) with cyhalothrin (pyrethroid) showed predominantly symptoms exhibited in pyrethroid poisoning. This could be a postulate that the symptomatology of the patient and

clinical manifestations exhibited could be secondary to the proportion or amount of OP and pyrethroid compound in the pesticide combination.

V. Fungicides

These are derived from fungi and have a good safety profile. Fungicides are known as ergosterol biosynthesis and mitochondrial respiration inhibitors for herbicidal use.

VI. Herbicides

Herbicides have different mechanism of action with high toxicity .Toxicity differs in amphibians due to diversity of the compound used, the concentration, and other compounds present in it ,such as surfactants , silicon containing compounds(Encyclopedia of food sciences and Nutrition).

Herbicides are classified into:

- Contact Herbicides (Examples: Paraquat, glufosinate)

These compounds are used along with weed killers

- Systemic Herbicides (Fluazifop, Sethoxydim, Glyphosate)

These compounds can sometimes be sprayed directly on the plants and have very little soil activity (Homer M.LeBaron).

VII. Rodenticides

These are inorganic compounds (34) (Zinc, aluminum phosphide) or coumarin derivatives (1st generation compounds). These are commonly used for rats .These are chemical compounds, for rats, gophers and squirrels. These compounds are available as powders, paste and cake /block bait.

There are super warfarin compounds available, which include: Bromadiolone, Brodifacoum.

They are classified into toxicity compounds based on their LD50.

- Highly toxic: Median lethal dose (LD 50) ranges from 0 to 50 mg/kg body weight, examples include phosphorous, metal phosphides, arsenic, and sodium fluoroacetate.
- Moderately toxic: LD 50 ranges from 50 to 500 mg/kg
- Less toxic: LD 50 ≥ 500 mg/kg , example :Warfarin

Some of these compounds deserve mention and are explained below:

1. Yellow/white phosphorous

This is commonly used for rodenticides. RATOL is a very popular brand, and this formulation contains yellow phosphorous as paste. This paste contains 2-5% of yellow phosphorous.

Mode of action: This compound is gradually absorbed after consumption and affects ribosomal function of all cells with impaired fat metabolism and glucose homeostasis. This leads to liver damage. Due to the excess of phosphorous, hypocalcemia is present. The lethal dose is 1 mg/kg.

There are three clinical stages after consumption of this compound:

Day 1(24 hours): Gastrointestinal symptoms such as nausea and vomiting.

Day 2(From 24 hours to 72 hours):

Patients have no symptoms, however there is gradual derangement of liver function test characterized by elevated bilirubin levels and transaminitis. They go on to develop coagulopathy with deranged liver function tests and cardiac arrhythmias.

Central nervous system manifestations occur as confusion, encephalopathy and coma. Case reports of gastrointestinal symptoms such as hollow viscus perforation have also been reported. They develop fulminant liver failure with progression to death. Cardiovascular collapse or liver injury usually causes death.

There is no specific treatment for the compound consumed, except conservative management. N-Acetyl cysteine has been administered to patients who present with poisoning. Steroids and plasma exchange transfusions are still in trial phase.

2. Aluminium phosphide and zinc phosphide

- These are the most common agents implicated in poisoning in India which include Aluminium phosphide(metal phosphide).This contributed to 26.1% study of all cases with pesticide poisoning .This study was done in PGI ,Chandigarh. Poisoning with this compound is highly toxic, and gastric lavage should not be done as it may lead to further formation of phosphine gas .Clinical symptoms manifest after 48 hours of ingestion /poisoning with this compound.

Mortality with these compounds is significant with zinc consumption and mortality ranging from 37-100%.

Mode: These compounds mix with HCL in stomach and phosphine is released. This inhibits mitochondrial oxidative phosphorylation. Hence, hydroxyl radical is formed which causes oxidative damage to cell membranes.

Phosphine, is absorbed from the GI tract (a corrosive nature) and distributes rapidly to the brain, kidney and liver. It causes methemoglobinemia by binding to hemoglobin .Patients with aluminium poisoning present with GI symptoms with epigastric pain .This is accompanied by shock, myocarditis ,with pulmonary edema and multiorgan dysfunction in terms of arrhythmias with liver injury and disseminated intravascular coagulation. Shock with CNS manifestations of convulsions occur ,eventually leading to death of the patient. There is no effective anti-dote for this compound, except supportive management. N-acetyl cysteine is tried as part of a treatment in acute liver injury.

Aluminium phosphide, studies are needed to study its benefit in humans (34) D.Silva et al.

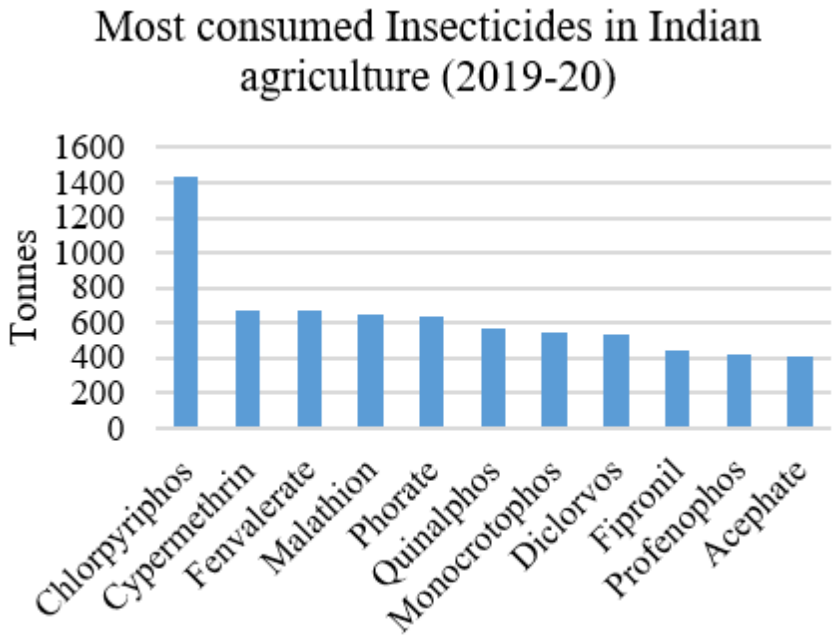
VI. BAN OF PESTICIDES

If national and international standards are followed, pesticide limits could have an important influence on the number of suicide fatalities in the region.

In 2019, a total of 318 pesticides were registered for use in India.

Of these, 18 of the same are class I compounds. In Kerala in 2005, Endosulfan was banned and in 2011, there were 14 other pesticides were banned. This was followed by the national banning of Endosulfan in the year 2011. Following the ban, there was a decrease in the rate of suicide cases and total suicides by 2014, RR of 0.90(0.87-0.93) after the 2011 Endosulfan ban. The ban implemented towards Endosulfan in 2005 ban, showed less suicide rates of pesticide poisoning (0.79, 0.64-0.99). (Boinvosin et al)(35).

Due to increased suicide rates from pesticide consumption and pesticide exposure via inhalational route or skin route, thereby causing toxicity, there has been a review of pesticides consumed with a ban imposed by the Anupam Verma committee. This ban was imposed in the year 2016. In India, the Anupam Verma committee was formed in the year 2013 and banned the sale of certain pesticide compounds in 2016. Following this, there has been a spectrum of change in classes of pesticides being sold in the markets. This study is concerned with assessing the changing spectrum of pesticide poisoning –Past and present - In the context of policy changes related to pesticide ban.



The spectrum of pesticide compounds sold over the market has changed as class III compounds were banned with more recent use of a mixture of compounds and herbicides.

To analyze the chronology of pesticide legislation in India, and the effects of the ban, the following table explains the banned pesticides in 2016, in a phased manner.
In 2015, the Anupam Verma (former professor, IARI) committee was formed. This is an expert committee that reviewed the safety of pesticides and their compounds.
In 2016, the Committee reviewed a total of 66 pesticides, which were registered and used in India, however, these were banned on a global scale. They recommended 13 pesticides banned in 2016. The following is the list of pesticides advised by the committee panel.

The following tables list the pesticides that were considered in 2016 by the Anupam Verma Committee. The table has included the type of chemical compound, and the WHO category and class respectively.

VI A. Banning of 13 pesticides

Table 1: Anupam Verma committee banned 13 pesticides in 2016

LIST OF COMPOUNDS BANNED SINCE 2016			
#	**COMPOUND**	**CHEMICAL***	**WHO class**
1	Benomyl^^	Benzimidazole fungicide	U
2	Carbaryl^^	C	II
3	DDT	OC	II
4	Diazinon^^	OP	II
5	Fenarimol^^	pyrimidine	III
6	Fenthion^^	OP	II

7	Linuron^^	phenyuria	III
8	MEMC^^	HG	Ia
9	Methyl Parathion^^	OP	Ia
10	Sodium Cyanide	-	Ib
11	Thiometon^^	OP	Ib
12	Tridemorph^^	-	II
13	Trifluralin	OP	II
Ban continued			
1	Fenitrothion	OP	II

DDT – dichlorodiphenyltrichloroethane; MEMC – Methoxy Ethyl Mercuric Chloride

^^ - In the Central Insecticide Board and Registration Committee (CIBRC) website, these have been listed as banned since August 2018.

VI B. Review of Pesticides: The Expert Committee, after reviewing the compounds and their toxicity, planned a review of 27 pesticides in order to consider banishing them in the year 2018 after further studies.

LIST OF COMPOUNDS TO BE REVIEWED IN 2018			
#	**COMPOUND**	**CHEMICAL***	**WHO class**
1	Acephate	OP	II
2	Atrazine	T	III
3	Benfuracarb	C	II
4	Butachlor	-	III
5	Captan	-	U
6	Carbendazim	-	U
7	Carbofuran	C	Ib
8	Chlorpyrifos	OP	II

9	Deltamethrin	PY	II
10	Dicofol	OC	II
11	Dimethoate	OP	II
12	Dinocap	NP	II
13	Diuron	-	III
14	2,4-D	PAA	III
15	Malathion	OP	II
16	Mancozeb	-	U
17	Methomyl	C	Ib
18	Monocrotophos	OP	Ib
19	Oxyfluorfen	-	U
20	Pendimethalin	-	II
21	Quinalphos	OP	II

22	Sulfosulfuron	Sulphonylurea	Not listed
23	Thiodicarb	C	II
24	Thiophanate Methyl	-	U
25	Thiram	-	II
26	Zineb	-	U
27	Ziram	-	II

Key: Chemical Type: BP – Bipyridylium derivative, C – Carbamate, HG – Mercury compound

NP – Nitrophenol derivative, OC – Organochlorine, OP – Organophosphorus, PAA – Phenoxy acetic acid derivative, PY – Pyrethroid, T – Triazine derivative, TC - Thiocarbamate.

VI C. Ban of Pesticides in 2018:

In 2018, 18 pesticides were banned with some of these compounds restricted

Benomyl	Trifluralin(immediate effect)
Carbaryl	Alachlor
Diazinon	Dichlorvos
Fenarimol	Phorate
Fenthion	Phosphamidon
Linuron	Triazophos
Methoxy Ethyl Mercury Chloride	Trichlorfon
Methyl Parathion	
Sodium Cyanide	
Thiometon	
Tridemorph	

2020: The Anupam Verma committee recommended banning /phasing of the following pesticides by 2020.

VI D. List of compounds to be phased by 2020:

LIST OF COMPOUNDS TO BE PHASED OUT BY 2020			
#	**COMPOUND**	**CHEMICAL***	**WHO class**
1	Alachlor	-	II
2	Dichlorvos	OP	Ib
3	Phorate	OP	Ia
4	Phosphamidon	OP	Ia
5	Triazophos	OP	Ib
6	Trichlorfos	OP	II

To summarize, the Anupam Verma committee had recommended ban of 13 pesticides in 2016, and in the following year, i.e. there were18 pesticides banned.

There has been another phased ban implemented in the year 2020, which includes 6 more compounds, mainly involving class I and II compounds, bringing the total number of banned compounds to 24 compounds, with the remaining 42 compounds accessible to the general population(Source: Government of India, Ministry of Agriculture and Farmers welfare).

Compounds, including type I compounds like Phorate, have been suggested for ban in a phased manner, however, more dangerous compounds such as Monocrotophos or Paraquat dichloride(1,1'-dimethyl-4,4'-bipyridinium)have not been taken off the market or banned. These compounds, however, have already been banned in Kerala, but it's still in use in other parts of the country.

These pesticides banned have been restricted for use in other countries because of safety concerns.

VI E. Summary of all pesticides banned:

The following compounds (36) were enlisted in 2015, where the minutes of Registration Committee were held in December 2015. A few of the compounds mentioned in the meeting are discussed below:

1. Acephate: This is a Class III type of organophosphate compound, the use of this compound was to be reviewed in 2018. The degraded product of acephate, called Methamidophos is more toxic than the parent compound. This compound is PERMITTED FOR USE.

2. Alachlor: This is a herbicide compound. This was planned for phasing out in 2020. This compound was noted to cause retinal degeneration in rodents with a likelihood of carcinogen at high doses.
3. Aluminium phosphide: Certain formulations, if undertaken by the Government (a Government body), can be used with restrictions. Tablets of aluminium phosphide with 3 gm strength are banned. This compound is RESTRICTED FOR USE.
4. Benomyl: This is banned because of suspected human carcinogen and damage to soil-dwelling organisms. This leads to foetal eye defects and brain malformation.
5. DDT: This compound is banned for use, except in cases of an outbreak of very exceptional requirements, where this can be purchased directly from the company. This compound is RESTRICTED FOR USE.
6. Dichlorvos: High or repeated exposure was found to cause peripheral neuropathy with depression, anxiety. This was planned to be phased out in 5 years, as recently implemented in 2020.
7. Diazinon: This is an organophosphate compound. This is carcinogenic, banned in agricultural use, but allowed for domestic uses. It is highly toxic if heated, with combustible properties.
8. Dazomet: This has been banned for use in India.

9. Enthion: This was found to be carcinogenic, with the potential for causing mutations and genetic aberrations. This is banned for use.
10. Fenitrothion: This compound is banned for use, cases of Reye's syndrome and encephalitis have been reported, with molar pregnancies. (37)
11. Methyl bromide: This compound is restricted for use and not banned. This can be sold to Government organisations, to be used under the supervision of Government experts. This is RESTRICTED FOR USE.
12. Methyl parathion: Banned in certain vegetables, however, allowed to be used in other crops: RESTRICTED FOR USE
13. Monocrotophos: During the use of this compound, residues in excess were noted in vegetables. This is banned for use in certain vegetables, however, allowed to be continued in other crops: RESTRICTED FOR USE.
14. Paraquat: This is an herbicide, replacing the organophosphate compounds. This compound is known to cause acute respiratory distress syndrome with lung fibrosis, oesophageal strictures secondary to a corrosive like action, acute kidney injury with multi-organ dysfunction. When consumed the mortality reported is as high as 70-90 %.(38,39). *Use of this compound is to be continued; as advised by the committee.*

15. Phorate: they produce toxic products: sulfoxide and sulfone compound –more persistent in the soil. There was a decision made to phase this compound in the ban imposed in 2020.
16. Sodium cyanide: This is banned for use in India.
17. Phosphamidon: Exposure to this compound causes marked suppression of humoral and cell-mediated immunity, hence a ban was recommended in 2020 for this product.
18. Methoxy ethyl mercuric chloride: This compound causes neurological dysfunction, peripheral neuropathy and kidney damage in long term exposure. This is banned in agricultural use, except in potato seeds and sugarcane: RESTRICTED FOR USE
19. Captafol: Banned except for exportation of this compound. Used as seed dresser.
20. Cypermethrin: Restricted for use: Can be used by pest operators only. However, combination pesticides with cypermethrin are allowed and approved formulation for use in the country.

- A further ban on 27 pesticides has been proposed by the Pesticide Action Network (PAN), including 2, 4-D, acephate, atrazine, benfuracarb, captan, carbofuran, chlorpyrifos, deltamethrin, dimethoate, monocrotophos, quinalphos. This has been put forward for consideration.

Eddlestone in 2012, did a study that showed decreasing hospital admissions following the ban of certain pesticides. (40)

VII. COMBINATION PESTICIDES:

Below are the combination compound pesticides allowed and approved for use in the country as in the Insecticide Regulation act in 2019:

Acephate + Cypermethrin	Buprofezin+ Fipronil
Acephate + Bifenthrin	Cartrap+ Bufprofezin
Acephate + Fenvalerate	Bifenthrin + Chlorpyrifos
Acephate + Imidacloprid	Buprofezin + Acephate
Acephate + Chlorpyrifos	Chloranthranilioprole+abamectin
Acetamiprid + Chlorpyrifos	Chlorantraniloprole+ lambda cyhalothrin
Beta Cyfluthrin + Imidacloprid	Chlorpyriphos+cypermethrin
Buprofezin+Acephate	Chlorpyrifos+alphacypermethrin
Chlorpyriphos+ fipronil	

Combination pesticides approved for use in the country have been listed. Of these, to note are type II and type III organophosphate compounds, which are sold as a combination. In the face of multiple bans being implemented, other combination compounds are also available in the market.

Below are pictures of certain combination compounds available in the market:

This is a picture of profenophos and cypermethrin available for agricultural use. Profenophos is a Class II organophosphate compound mixed with cypermethrin.

A study was done by Weerasinghe et al., in 2014(41), to look into the role of pesticide dealers in reducing self-poisoning in rural Sri Lankan communities. This was a large

observational study done to see the source of pesticides, and in those patients who were admitted with a diagnosis of pesticide poisoning. They were interviewed after admission. There were a total of 669 patients included in the analysis, in which in 511 (76%) cases, the compounds were stored within reach of the individual, either in the house or nearby the fields. The reason noted for poisoning with that particular compound, was secondary to the compound being the most commonly available agent and that they were within easy reach and accessible. This showed the importance of restricting the availability of highly hazardous pesticides to the common population. Pesticide distributors' interactions with consumers who were in danger of self-poisoning were examined in order to develop strategies for preventing it. Pesticides should only be sold to farmers who have identification cards or to clients who have 'prescriptions' for pesticides in their possession. In this study, people at danger of self-poisoning were identified by vendors, although it was difficult to separate them from legal consumers; suppliers also said that they wanted to help improve the process of identifying these people. Vendors were not held responsible by the community for selling pesticides that were afterwards used for self-poisoning. Selling low-toxic items, providing client counselling, and encouraging customers to return the next day, all fall under these tactics. However, the planned interventions of 'identification cards' and 'prescriptions' received little support. Complementing this strategy will necessitate the implementation of new public health measures. A similar approach could be attempted by the Government, at contacting the vendors in order to find if there is an over the counter, random distribution of pesticide compounds in shops without producing identification cards.

VIII. RESEARCH METHODOLOGY:

This study includes prospective data from 2019 to 2020 and relevant parameters which were collected after informed verbal and signed consent. If the patients were too sick for consent, the same was obtained from close relatives. Retrospective data was also collected from previous discharge summaries dated in the years 2015 and 2016(pre-ban period), in an unlinked anonymized manner. The data would be analyzed and described to present the changing trends with regards to changes in the number, frequency of compounds consumed and spectrum of pesticide compounds used for self-poisoning. The resultant changes in the profile of clinical manifestations and morbidity, duration of hospital stay, ICU care and ventilator days and mortality would be calculated for each year and compared in both the time period.

This study, with a comparison of both retrospective and prospective arms, is aimed at studying the clinical spectrum and outcomes of pesticide poisoning, in the context of the ban on certain pesticides since 2016(Ban proposed in 2015, however, implemented in 2016) by the Anupam Verma panel. This is done to see if the ban has an effect on the poisoning and the types of compounds consumed.

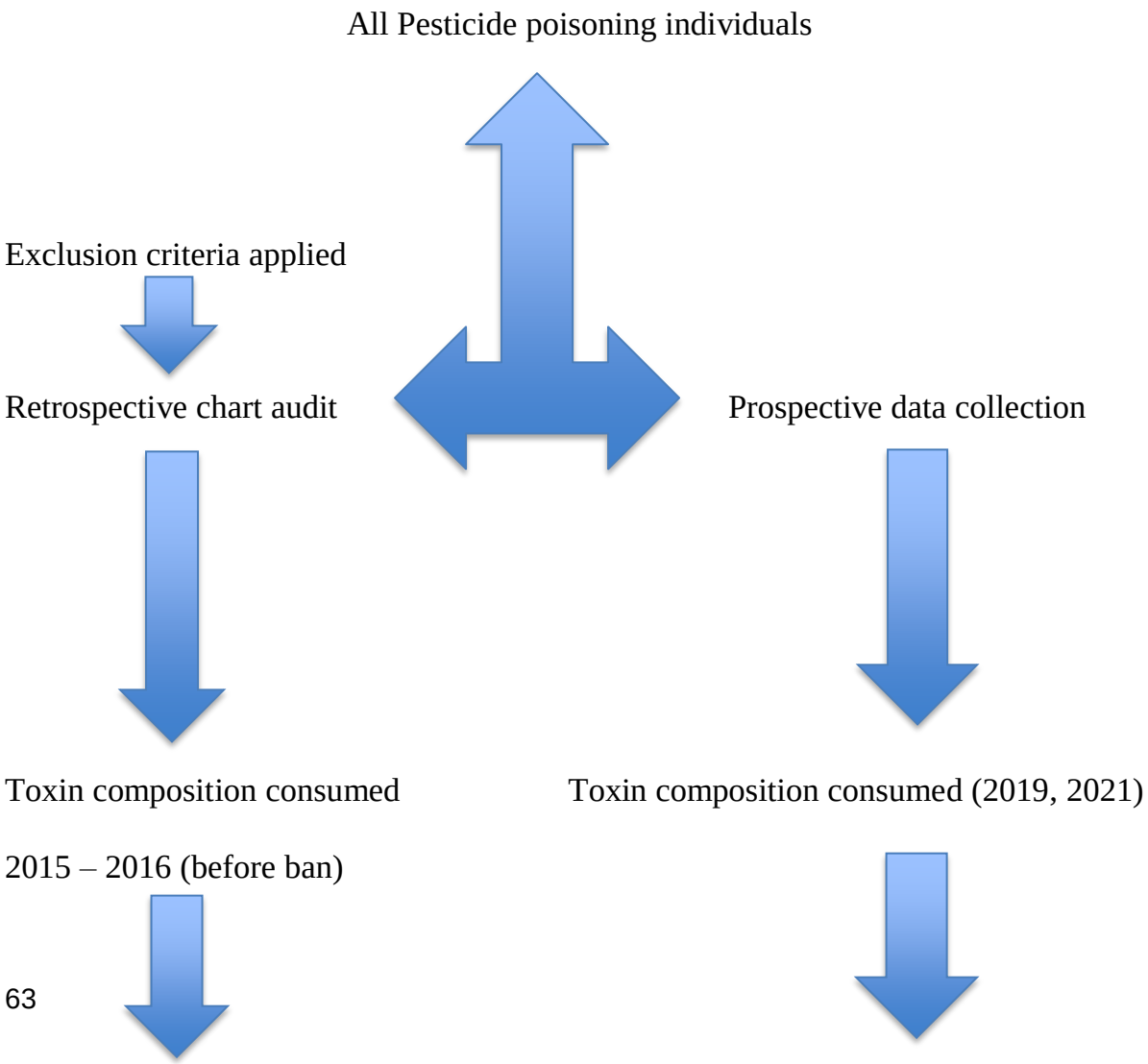
Data was collected in the year 2015 and 2016- with two years data being collected prospectively, from 2019 to 2020. However, because of the recent COVID 19 infection, individuals who presented with pesticide poisoning in the year 2021 were also included. Details on the compound ingested, WHO toxicity as per the classification, clinical manifestations and outcomes were collected. The ranges of pesticides that would be studied in this research include agrochemical compounds including organochlorines, organophosphates, rodenticides, herbicides and a mixture of compounds.

Retrospective data was collected from details in the patient charts and discharge summaries. The prospective arm of the study includes data collection obtained from the charts and patients after consent among those admitted with a diagnosis of deliberate self-harm with pesticide consumption in the medical wards and the medical intensive care or high dependency units at Christian Medical College, Vellore from April 2019 till March 2021, with the exception of 2020 in view of recent COVID-19 pandemic.

In this study, we will analyze if the pesticide spectrum has changed, following the ban and the clinical outcomes in terms of morbidity and mortality, with respect to these compounds.

This proposed study intends to capture these changing trends.

IX .ALGORITHM OF THE STUDY



Number, Key clinical manifestations

& Mortality rate

2015-2016 Detailed retrospective analysis on

clinical manifestations, ICU stay and mortality.

Clinical manifestations, ICU stay, and mortality rate

The study was done in Christian Medical College Vellore, a tertiary care center and Hospital. This study has both a prospective and a retrospective arm. The prospective arm of the study would include data collection obtained from the charts and patients after consent among those admitted with a diagnosis of deliberate self-harm with pesticide consumption in the medical wards and the medical intensive care or high dependency units at Christian Medical College, Vellore from April 2019 till March 2021. The compound consumed was confirmed on arrival of patient to the Emergency department. The container was brought along with the patient, which was assessed to confirm pesticide consumption and the type of compound ingested. The retrospective arm focused mainly on the number of pesticide poisonings, the spectrum of compounds and its outcomes with special attention to mortality from 2015 till 2016.

Participants:

Sample: Included all patients admitted with pesticide poisoning at Christian Medical College, Vellore.

Eligibility criteria-

All patients with Pesticide poisoning admitted to medical wards or intensive care unit.

Exclusion criteria-

Those who do not consent to participate and children <16 years of age.

Participant enrollment:

Every patient who gets admitted into Christian Medical College, Vellore with a diagnosis of pesticide poisoning which includes insecticides, fungicides, herbicides, rodenticides, fumigants and insect repellants will be enrolled and the collective data will be plotted against a time graph with comparison of the retrospective data and current prospective data. This will be a time series analysis with comparison of both retrospective and prospective data.

Sample size:

Since this is an observational study based on the primary objective of clinical manifestations and observation of changing trends, a time series analysis will be performed negating the need for a sample size.

However, for the prospective data collection, a sample size for mortality is calculated based on previous mortality data that has been mentioned as 4 %, which is available based on a pilot study done in a Government college. The study proposes to describe mortality trends along with other clinical features over time and a different spectrum of compounds.

The sample size was determined based on a pilot study in which the prevalence of death among organophosphorus poisoning patients was measured at 4%. A minimum sample size of 61 patients was calculated hence, assuming a type 1 error (two-tailed) of 0.05 with a margin of error of 10%. Hence, the final sample selected is n= 60.

$n = t^2 \times p\ (1\text{-}p)\ m^2$

Description

n = needed sample size

t = confidence level at 95% (with standard value - 1.96)

p = estimated prevalence of organophosphate poisoning in study area

m = margin of error at 10% (standard value of 0.05)

$$n = \frac{(1.96)^2 \times 0.\ 04(1\text{-}0865)}{(0.05)^2}$$

$$n = \frac{3.8146 \times 0.0384}{0.0025}$$

= 61 in the study group

This study was cleared by IRB number 11922, dated 06/03/2019.

X.RESULTS:

The total number of patients in the study:

I. The number of patients based on criteria:

- Retrospective study:

PRE BAN PERIOD

2015-2016	240 cases

- Prospective study:

POST BAN PERIOD

2019-2021	74 cases

X.RESULTS:

The total number of patients in the study:

II. The number of patients based on criteria:

Retrospective study:

PRE BAN PERIOD (2015,2016)

2015-2016	240 cases

POST BAN PERIOD (2019,2021)

2019-2021	74 cases

Table X A

Table of Baseline characteristics of Pre-ban and post-ban period with ICU stay and mortality

CHARACTERISTICS	PRE-BAN(2015-2016)	POST BAN(2019-2021)		
Total number of patients	240	74		
Age	Mean age=32 Range 15-79	Mean age=36 Range:17-67		
Sex	Males: 162(67.5%) Females:78 (32.5%)	Males: 53 (71.5%) Females: 21 (28.4%)		
No. of individuals with Compound consumed	PRE-BAN	POST-BAN	ODDS RATIO	P VALUE
Class I	79 (33%)	15(20.3%)	0.51 CI:0.27-0.97	***0.03***
Class II	47(19.6%)	15(20.3%)	1.04 CI:0.5-2.0	0.89
Class III	6 (2.5%)	0		
OP mix:OP+Pyrethroid	49(20.4%)	18(24.3%)	1.25 CI:0.6-2.3	0.47
OP mixtures: OP+OP	8(3.3%)	0		
ICU stay	118(49.2%)	24(32.4%)	0.4 CI:0.2-0.85	***0.011***
Number of days of IP stay(including ICU)	Median :6 days	Median:7 days		
Number of patients requiring ventilation	V:116(48.3%) No V:124(58.7%)	24 (32.4%) requiring ventilation 50(67.6%) not req.ventilation	0.51 CI:0.2-0.81	***0.016***

No. requiring Tracheostomy	34(15%)	11(14.8%)	1.05 CI:0.50-2.20	0.88
Mortality	11.6 %	10.8%	1.089 CI:0.4-2.5	P value: 0.83%

IX 1

Explanation:

The pre-ban period included a total sample size of 240 individuals with post-ban period of 74 individuals, who were admitted with a diagnosis of pesticide poisoning. The post-ban sample size was low –with a total sample size of only 74. There is a large possibility of cases missed during the COVID 19 pandemic as the prospective data was from July 2019 till December 2019 (6 months) ,with no cases included in 2020 in view of the pandemic. There was recruitment of cases occurring after the COVID pandemic, which was from October 2020 to April 2021 (7 months). The total duration of prospective data collection of 13 months.

The mean age in both the groups was 32 -36 years of age, with a wide range aged 15 to 79 years of age in both groups. Males had a higher incidence of suicide rates as compared to females, with 67-71.5% of males having consumed pesticide in both the groups as compared to the females, with 28.4-32.5 %.

In pesticides consumed, when comparing both the groups, the proportion of pure ***type I compounds have shown a declining trend following the ban. The odds ratio is 0.51 with Confidence interval of 0.27 -0.97 and P value of 0.03***. The proportion of pure ***Class II compounds have shown a marginal increase in post ban*** with 20.3% as

compared to pre-ban period which shows incidence of 19.6%. However, the odds ratio observed is 1.04 with P value of 0.89, which was not significant.

In Pre ban period, 6/240(2.5%) patients were noted with consumption of class III compounds, and in the post-ban period, no cases of poisoning with Type III compounds were seen.

There was a marginal rise in proportion of mixture compounds, which include organophosphate compounds with pyrethroid, in pre-ban period incidence of 20.4% and post-ban period of 24.3%. However, the P value was not significant (0.47).

There were other compound mixtures noted in pre-ban period, which were not approved by the Insecticides Regulation act, which included 2 compounds of organophosphate compounds mixed together and sold as a combination. There were 8 such compounds seen in the pre-ban phase, which is not present in the post-ban period.

The proportion of poisoning cases requiring ICU care has shown a declining trend.

In the pre-ban period, there were ***49.2%*** of individuals who required ICU stay and in the post ban period, there is a reduction noted in ICU admissions, with 32.4% requiring ICU stay. This is statistically significant with odds ratio of 0.4 with CI of 0.2 to 0.85 with P value of 0.011.

The proportion of patients requiring ventilation was also noted to be in declining trend, with CI of 0.51 and P value of 0.016. This analysis shows that the proportion of ICU admissions could be declining due to most of the hazardous compounds being banned. Although, the phased ban was implemented in 2020 December, there already seems to be a reduction in type I compounds prior to the ban.

The mortality in pre-ban period was 11.6%, with post-ban period having mortality of 10.8%. This did not show any significant change in trend. The lack of decline in mortality could be due to the marginal increase in type II compounds and combination pesticides.

IX B. CLASS OF COMPOUNDS

(Compounds Pre- Ban and Post- Ban) :

Incidence of compounds consumed	NO.OF ADMISSIONS		ICU CARE		MORTALITY (Class specific)	
Class I	PRE-BAN	POST-BAN	PRE-BAN	POST-BAN	PRE-BAN	POST-BAN
Class I a	34 (14.2%)	4 (5.4%)	18 (7.5%)	2 (2.7%)	2 (0.8%)	0
Class I b	45 (18.8%)	11 (14.9%)	24 (10%)	5 (2%)	6 (2.5%)	1 (1.4%)
Class II	47 (19.6%)	15 (20.3%)	19 (7.9%)	3 (1.3%)	4 (1.7%)	0
Class III	6 (2.5%)	0 (0%)	3 (1.25%)	0	1 (0.4%)	0
Compound mixtures	49 (20.4%)	18 (24.3%)	23 (9.6%)	9 (3.8%)	7 (2.9%)	5 (6.7%)

(OP + pyrethroid combination)						
Compound Mixtures:	OP+OP :2 (1.3%) OP+triazobenzene: 1	3(1 each from one class)	2 (0.8%)	0	3 (1.3%)	1 (1.4%)
Pyrethroids(single)	2 (0.8%)	5 (6.7%)	1 (0.4%)	0	0	0
Carbamates	1 (0.4%)	2 (2.7%)	0	1 (1.4%)	0%	0
Organo bromine	1 (0.4%)	0 (0%)	0	0	0	0
Herbicides	1 (0.4%)	4 (5.4%)	0	1 (1.4%)	0	0
Fungicides(mixed+ single)	6 (2.5%)	4 (5.4%)	1 (0.4%)	0	3 (1.3%)	0
Rodenticides	0%	2 (2.7%)	0	0	0	2.7%
Organochloride	1	0 %	1	0	0%	0%

	(0.4%)		(0.4%)			

B 2. EXPLANATION: The table above explains the total number of admissions for each compound with the respective percentages.

In individuals who have consumed class Ia organophosphate compounds, noted as highly hazardous, compose 14.2% in the pre-ban period, compared to only 4 % in the post ban period.

The number of ICU admissions in the pre-ban period in class Ia compound is 7.5% as compared to 2.7% in the post ban period. The mortality for this compound is 0.8% as compared to no mortality noted in the post ban period.

Individuals admitted with class Ib compound are 18.8% in the pre-ban period as compared to 14.9% in the post ban period, with 10% of patients requiring ICU stay in the pre-ban period and only 2% in post-ban period. There was a decline of mortality rate from 2.5% in the pre-ban period to 1.4% in the post ban period.

These data show the decrease in the proportion of type I compounds, the ICU admission and mortality following the ban.

In type II compounds, only 1.3% of patients required ICU stay in the post ban period as compared to the pre-ban period which was 7.9%. There is no mortality noted in the post ban period.

In class III compounds, 6 compounds were observed in the pre-ban period , with no individuals having consumed type III compounds in the post-ban period.

Compound mixtures:

In the pre-ban period, there were 49 (20.4%) mixtures of OP + pyrethroid compounds ,with 18 compounds in the post-ban period. There is a slight increase in the number of compounds (24%),in the post ban period ,with increase in mortality rate from 2.9% in the pre-ban period to 6.7% in the post-ban period. These data show the increase in the proportion of OP + pyrethroid compounds and mortality that have occurred post-ban.

There have been other compound mixtures noted in the pre-ban period, with combination of 2 organophosphate compound mixtures noted (combination of class I and class II) and one combination of organophosphate compound with nitrobenzene.

In the post-ban period, there were 3 compounds, which included

1) Yellow phosphorous+ deltamethrin

2)Quinalphos+ dimethylbenzene

3) Gamma cyalothrin+ Prallithrin

While 2/3 patients in the pre-ban period (0.8%) of patients required ICU stay, none of the patients in the post ban were admitted in ICU. However, there was mortality noted with yellow phosphorous compound. This trend is expected to change in the future as deltamethrin has been considered for ban in 2020.

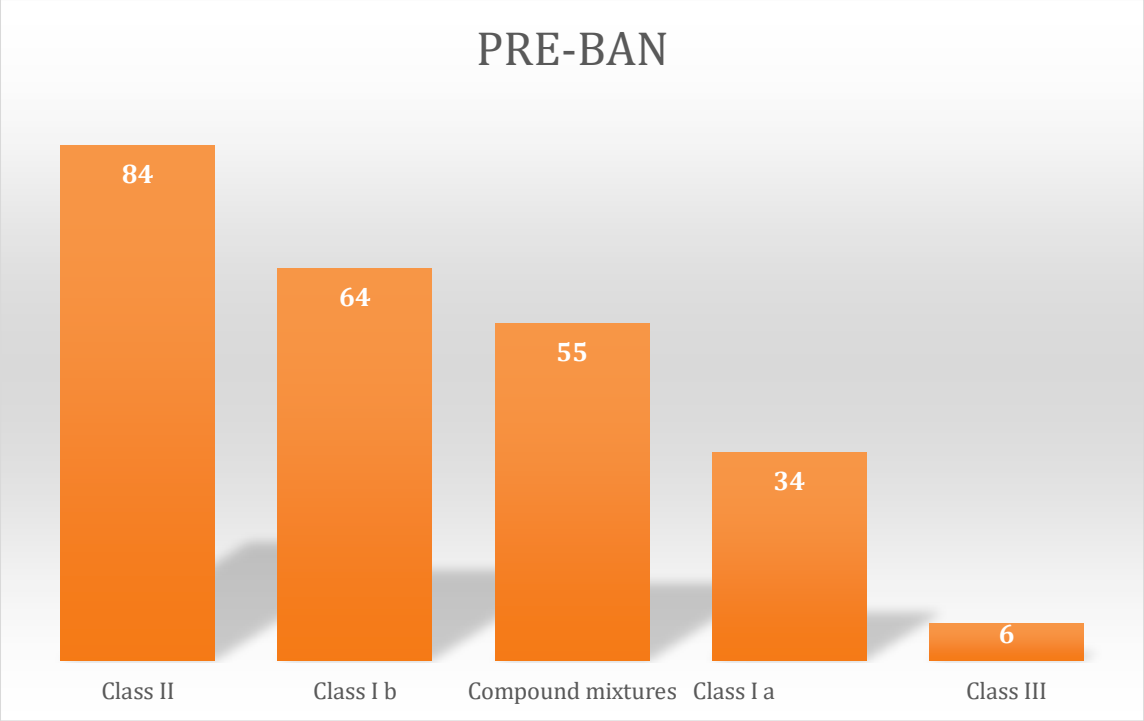
Pyrethroid compounds showed a serial rise from 0.8% in the pre-ban period to 6.7% in the post-ban period. There was no mortality noted in the pre-ban or post-ban period. There were herbicides noted in the pre-ban period with only one patient having consumed (0.4%),as compared to 4 patients who had consumed in the post-ban period(5.4%).This shows increasing use of herbicides in the post –ban period ,as compared to the pre –ban .

Fungicides noted in the pre–ban period, included combination mixtures of monocrotophos with copper ferric oxychloride (Type Ib compound with herbicide) ,which included 5 out of 6 patients, with 1.3% mortality(3%) secondary to consumption of this compound. There were no combination mixture compounds involving fungicides in the post ban period. The proportion of fungicide poisoning increased from 2.5% in the pre-ban period to 5.4% in the post- ban period, the compounds including tebuconazole, nitrobenzene, propiconazole. There was no mortality in the post ban phase with no patients requiring ICU stay ,indicating the possibility of low toxicity .

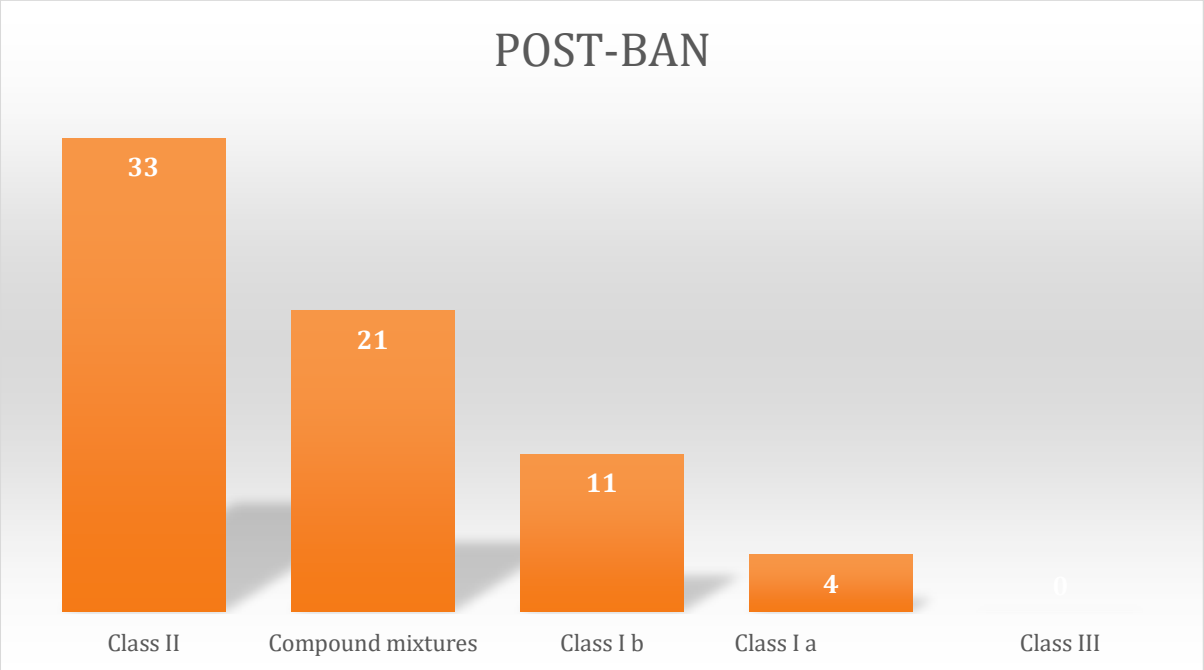
There were only 2 rodenticides noted in the post-ban period, which could be due to number of cases missed during recruitment, hence giving a falsely low number. From this table, it can be inferred that type I compounds have been in the declining trend with less usage. In the post- ban period, there is a wide variety of pesticide compounds observed which include bisypyribac sodium, quiazalofop, which compose herbicides consumed. Other compounds include pure pyrethroid mixtures, thiomethoxam (neonicotinoid) and Cartrap.

The possible side effects of these compounds, in individuals exposed to them in the future will have to be observed with further studies in the future.

GRAPH X 2.1: PROFILE OF COMPOUNDS PRE-BAN PERIOD



GRAPH 2.2: PROFILE OF COMPOUNDS IN POST-BAN PERIOD



The above graphical representation shows: 1. Decline in proportion of Class I and III compounds 2. Increase in proportion of Class II and compound mixtures

X C. PRE BAN PERIOD (2015-2016)

: INDIVIDUAL COMPOUNDS CONSUMED (IN ASCENDING ORDER)

	PRE BAN(2015-2016)					
Compound	Patients		ICU		Deaths	
	Number	%	Number	%	Number	%
UNKNOWN (Rank 1 in number consumed)	43	17.8%	20	46.5%	4	9.3%
PHORATE	27	11.2%	14	51.8%	2	7.4%
MONOCROTOPHOS (Rank 1 in highest mortality in post ban period)	26	10.8%	16	61.5%	4	15.4%
CHLORPYRIFOS	21	8.7%	8	38.1%	1	4.8%

PROFENOFOS+CYPERMETHRIN	17	7.0%	6	35.3%	2	1.2%
CHLORPYRIFOS+CYPERMETHRIN	14	5.8%	7	50%	1	7.1%
TRIAZOPHOS	13	5.4%	7	53.8%	2	15.4%
DIMETHOATE	10	4.1%	6	60%	2	20%
TRIAZOPHOS+DELTAMETHRIN	9	3.7%	6	66.7%	2	22.2%
PROFENOFOS	7	2.9%	3	42.9%	1	14.2%
DICHLOROVAS	6	2.5%	3	50%	0	0

QUINALPHOS	6	2.5%	3	50%	1	16.7%
MONOCROTOPHOS & CU OXYCHLORIDE	5	2.1%	1	20%	3	60%
MALATHION	4	1.7%	2	50%	0	0%
ETHION +CYPERMETHRIN	3	1.2%	2	66.7%	2	66.7%
METHYL PARATHION	5	2.1%	0	0%	0	0%
PHENTHOATE	3	1.2%	0	0%	0	0%
ACEPHATE	2	0.8%	1	50%	0	0%

PHOSPHAMIDON	2	0.8%	1	50%	0	0%
TRIAZOPHOS +CYPERMETHRIN	2	0.8%	1	50%	0	0%
ALPHAMETHRIN	1	0.4%	1	100%	1	100%
BORATE	1	0.4%	1	100%	0	0%
CHLORPYRIFOS+CYPERMETHRIN+CYALOTHRIN	1	0.4%	0	0%	0	0%
CHLORPYRIFOS+PYRETHRUM	1	0.4%	0	0%	0	0%

DELTAMETHRIN+TRIAZOPHOS	1	0.4%	1	100%	0	0%
DIELDRIN	1	0.4%	1	100%	0	0%
IPROBENOFOS	1	0.4%	0	0%	0	0%
LAMDA CYHALOTHRIN	1	0.4%	1	100%	0	0%
MONOCROTOPHOS+DIMETHOATE	1	0.4%	1	100%	0	0%
MONOCROTPHOS+DIBROMO PROPANE	1	0.4%	0	0%	0	0%
	1	0.4%	1	100%	0	0%

ORGANOCARBAMATE						
PHENTHOATE +CYPERMETHRIN	1	0.4%	0	0%	0	0%
PHOSPHANE	1	0.4%	1	100%	0	0%
TRIAZOPHOS+CHLOR PYRIFOS	1	0.4%	0	0%	0	0%
TRIAZOPHOS+NITROB ENZENE	1	0.4%	1	100%	0	0%
TOTAL	240	100%	116	48.3%	28	11.6%

X B .POST BAN (2019-2021)

	POST BAN(2016-2021)					
Compound	Number of patients		ICU		Deaths	
	Number	%	Number	%	Numbe r	%
MONOCROTOPHOS	10	13.5%	4	40%	0	0%
CHLORPYRIFOS+CYPE RMETHRIN	9	12.2%	5	55.5%	4	44.5%
CHLORPYRIFOS	7	9.5%	1	14.3%	0	0%
PROFENOFOS+CYPER METHRIN	7	9.5%	5	71.4%	1	14.2%
PROFENOFOS	6	8.1%	0	0%	0	0%

UNKNOWN	4	5.4%	2	50%	0	0%
PHORATE	2	2.7%	0	0%	0	0%
ACEPHATE	1	1.4%	0	0%	0	0%
AMITRAZ-TRIAZPENTADINE	1	1.4%	0	0%	0	0%
BISYPYRIBAC SODIUM	1	1.4%	0	0%	0	0%
CARBOFURAN	1	1.4%	0	0%	0	0%
CARTRAP HCL	1	1.4%	0	0%	0	0%

CHLORPYRIFOS+BIFENTHRIN	1	1.4%	0	0%	0	0%
CYPERMETHRIN	1	1.4%	0	0%	0	0%
DELTAMETHRIN	1	1.4%	0	0%	0	0%
DICHLOROVAS	1	1.4%	1	100%	1	100%
EMAMECTIN BENZOATE	1	1.4%	0	0%	0	0%
GAMMA CYALOTHRIN+PRALITRHIN	1	1.4%	0	0%	0	0%
INDOXACARB	1	1.4%	1	100%	0	0%

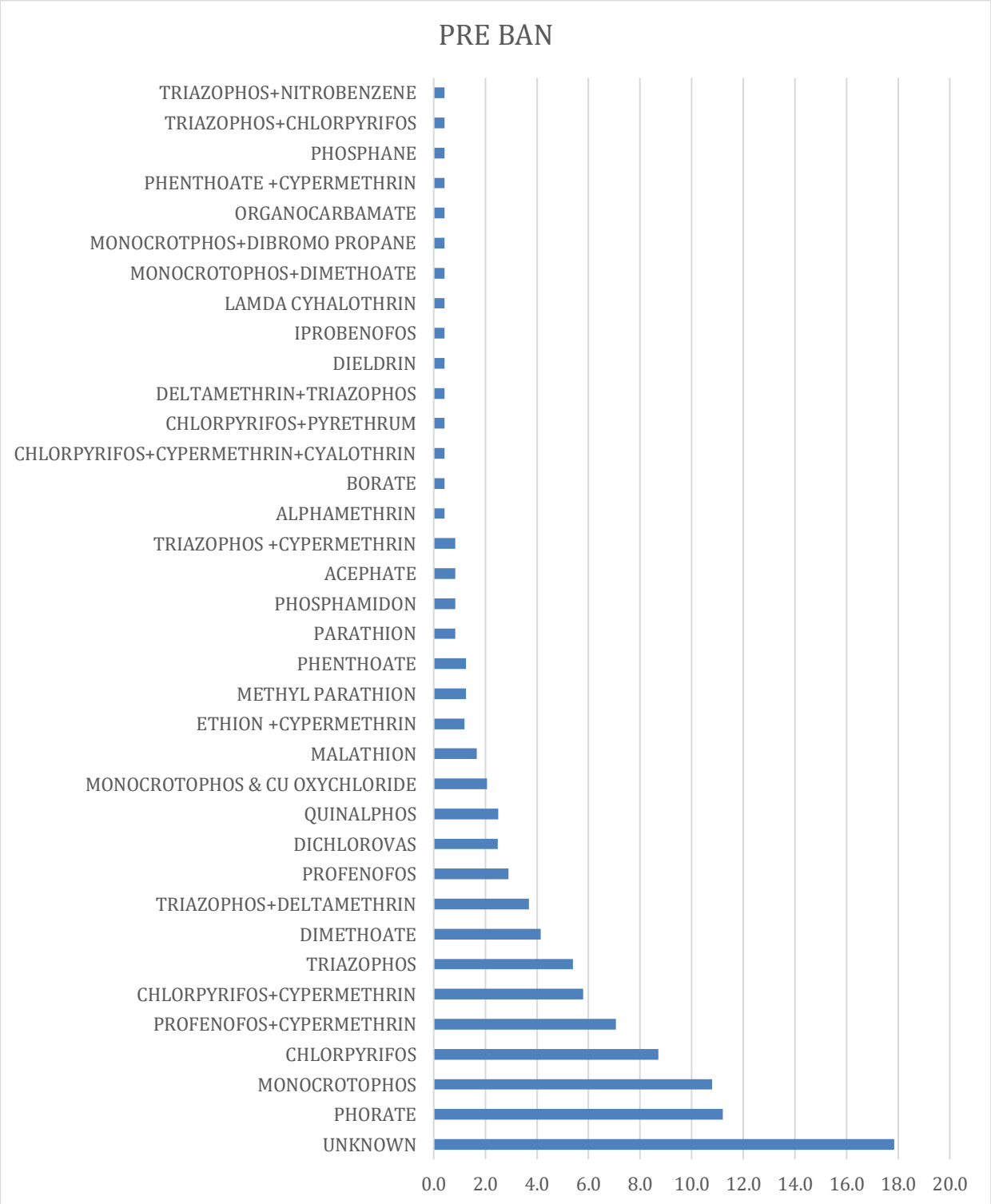
METHYL PARATHION	1	1.4%	1	100%	0	0%
NITROBENZENE	1	1.4%	1	100%	0	0%
PARAQUAT	1	1.4%	0	0%	0	0%
PARATHION	1	1.4%	1	100%	0	0%
PHENTHOATE	1	1.4%	1	100%	0	0%
PHENYLPHENOL	1	1.4%	0	0%	0	0%
PROPIOCONAZOLE	1	1.4%	0	0%	0	0%
	1	1.4%	0	0%	0	0%

PYRETHROID						
QUINALPHOS	1	1.4%	1	100%	0	0%
QUINALPHOS + DIMETHYLBENZENE	1	1.4%	0	0%	0	0%
QUINALPHOS+CYPERMETHRIN	1	1.4%	0	0%	0	0%
QUIZALOFOP	1	1.4%	0	0%	0	0%
TEBUCONAZOLE	1	1.4%	0	0%	0	0%
THIAMETHOXAM	1	1.4%	0	0%	0	0%
TRANSFLUTHRIN	1	1.4%	0	0%	0	0%

YELLOW PHOSPHORUS+DALTE METHRIN	1	1.4%	1	100%	1	100%
ZINC PHOSPHIDE	1	1.4%	1	100%	1	100%
Total	74	100%	26	35.1%	8	10.8%

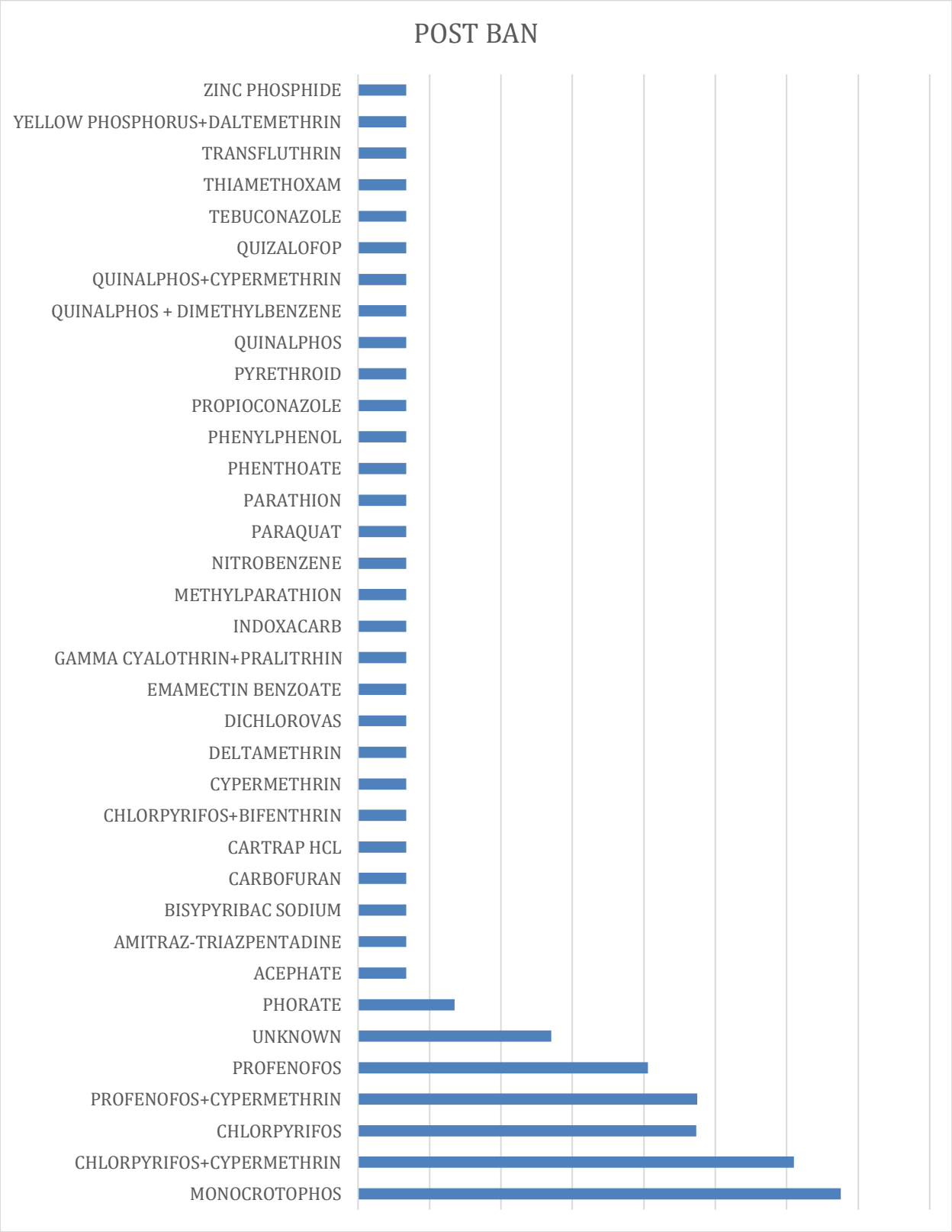
X 3.1 PRE-BAN (2015-2016)

INCIDENCE OF PESTICIDE POISONING IN THE PRE-BAN PERIOD IN ASCENDING ORDER



IX 4. 1POST BAN (2019-2021)

INCIDENCE OF PESTICIDE POISONING IN THE POST-BAN PERIOD IN ASCENDING ORDER (Increase in Monocrotophos and compound mixtures noted).



Results:

Type I A compounds:

(Extremely hazardous)

Phorate:

In the Pre-ban period, the most common compound consumed in this study, second to unknown compounds, was Phorate, which is a class Ia compound(extremely hazardous), with 51.8% (14 cases) requiring intensive care admission, with 7.4% mortality (2 deaths). It was the second most common compound requiring ICU care.

In the Pre-ban period, 11.2% (27 cases) of the poisoning cases had consumed phorate, as opposed to only 2.7% (2 cases) of the poisoning cases after the Ban. ***This effect could be secondary to the Ban imposed on phorate in the year 2018, bringing down the incidence of phorate poisoning by 8.5%*** (reduction of cases from 27 to 2 cases) ***and eliminating mortality.*** No patients in the post ban period required ICU care.

Methyl parathion:

The proportion of consumption of this compound was 1.2% (5 cases) only, with no mortality noted. This compound was later, banned in the year 2018. Although the percentage of cases had not changed the number of cases had reduced in the post-ban period of 1.4% (1 case).

There was no mortality noted in both time periods, however, both groups required intensive care and stay.

Type I B compounds:

(Highly hazardous)

Monocrotophos:

Monocrotophos was the second most commonly ingested compound in the pre-ban period and the most commonly ingested compound in the post ban period. The number of cases declined from 26 to10 cases.

Monocrotophos compound has a total of ***61.5***% of patients requiring intensive care stay with a mortality of 15.4***%.*** This is compared to combination pesticides, which includes: Monocrotophos and copper oxychloride, with ***20%*** requiring ICU stay with ***60%*** mortality.

Monocrotophos with dimethoate is a combination of type I b and type II compounds, requiring ICU stay with no mortality effect.

This is compared to the post-ban effect where only 40% of patients required ICU stay, with ***0% mortality in the post-ban period.*** There were no cases recruited which involved combination compounds.

Monocrotophos is listed for banning and this has also been proposed by Pesticide Action Network.

Diclorovas:

The number of patients admitted in the pre-ban period was 2.5% (6 cases) with 50% requiring ICU stay and ventilator, with no mortality.

This is compared to post Ban period with an incidence rate of 1.4% (1 case) who required ICU care and died. This spectrum of poisoning is expected to change in the near future, considering the ban on this compound imposed since December 2020.

Triazophos:

Triazophos was the 7th most commonly ingested compound, with 13 cases, 7 requiring ICU care and 2 deaths.

The compound is noted to have an ICU stay of ***53.8%*** with a mortality rate of ***15.4%***, as compared to combination compounds, including triazophos with deltamethrin(type II pyrethroid), requiring a ***higher requirement for ICU care of 66.7%*** and ***mortality rate of 22.2%.***

Triazophos with cypermethrin(type II pyrethroid) also has an ICU admission rate of 50%, with no mortality. Triazophos with other combination compounds such as nitrobenzene has been noted. Triazophos has been banned since 2018.

In the post Ban period, there were no subjects with consumption of triazophos. This could be secondary to the Ban which could be deemed successful.

Type II compounds:

Chlorpyrifos:

Chlorpyrifos was the 4th most commonly ingested compound in the pre-ban period and 3rd most in the post ban period. The number of patients admitted with consumption of this compound in the pre-ban period was ***8.7%*** (21 cases) with ***38.1*** % (8 cases) going onto require ICU admission with a mortality rate of ***4.8% (1 death).*** This is compared to combination compounds of chlorpyrifos with cypermethrin, with an incidence of ***5.8%***, ICU admission rates of ***50%*** and mortality rate of ***7.1%***, as compared to a single compound alone.

In the post-ban period, the proportion of poisoning patients ingesting this compound was ***9.5%*** (7 cases) with ICU admission rates of ***14.3%*** (1 case) with ***no mortality***.

Chlorpyrifos cypermethrin combination was the 5th most common compound ingested in the pre ban period (14 cases) and the 2nd most common compound ingested in the post ban period (9 cases). In the preban period the mortality of this combination was 3.6% compared to 44.5% in the post ban period. It was the most lethal compound in the post ban period.

This shows that the incidence of combination compounds such as Chlorpyrifos with cypermethrin is noted to have an incidence of ***12.2%(9 cases), which is higher than the pre-ban period, with ICU admission rates of 55.5%(5 cases) and mortality rate of 44.5%(4 cases) as compared to mortality rate of 7.1 %(1 death) in the Pre-ban period with 50% (7 cases) of patients requiring ICU care.***

Other compound combinations such as Chlorpyrifos with bifenthrin are noted during the post-ban period.

Chlorpyrifos has been recommended for ban by the Pesticide Action network. The banning of chlorpyrifos combination with cypermethrin should be considered.

Dimethoate:

Dimethoate was the 8th most compound ingested in the pre-ban period. The proportion of poisoning patients who had consumed this Class II compound in the pre-ban period was 4.1% (10 cases), with 60% of patients requiring ICU stay (6 cases), with 20% mortality (2 cases).

Post ban period, there were no cases of this compound noted.

This pesticide has been recommended for banning by the Pesticide Action Network.

Quinalphos:

There were 6 cases of Quinalphos poisoning (Class II compound) in pre-ban period with mortality of 16.7% (1 case). This was sold as a single compound in the pre-ban period but is noted to be in combination compound as Quinalphos with dimethyl benzene/cypermethrin. However, none of the patients who consumed these compounds required ICU stay. There was only one case of this poisoning and one of the combination with cypermethrin in the post ban period.

Banning of this compound has been recommended by Pesticide Action Network.

Phenthoate:

The number of patients having consumed this compound seems less, and in comparison with the post-ban period is similar with 1.2-1.4% incidence, one patient requiring ICU care in the post-ban period with no mortality in both the groups.

Profenofos:

Propenofos was the 10 most commonly ingested compound in the pre-ban period (7 cases) and 5th most common in post ban period (6 cases).

In the pre-ban period the ICU admission rates for this compound are ***42.9%*** (3 cases) as observed, with a mortality rate of ***14.2% (1 case).***

There were 17 case of propenofos with cypermethrin in the pre-ban period. Patients who had ingested compound mixtures of profenofos with cypermethrin were noted to have an ICU admission rate of ***35.3% (6 cases)*** (as compared to ***42.9% for a single compound) with a mortality rate of 1.2% only (2 cases).***

This is in comparison to the post-ban period with 7 cases, of which 5 required ICU admission (71.4%) and 1 death (14.2%). Combination compounds including profenofos with cypermethrin were noted to have an ***ICU admission rate of 71.4% with a 14.2% mortality rate.***

The stark differences in these periods could be explained by the rising use of combination compounds.

The ban of propenofos with cypermethrin should be considered.

Ethion:

This is a Class II compound, which is extremely toxic. This has not been banned and is available for use. This was noted to be available as a combination pesticide. There were 3 cases with 2 requiring ICU admission both of whom died.

There were no patients who had ingested this compound in the post-ban period.

Type III compounds:

Acephate:

There were 2 cases of Acephate poisoning in the pre-ban period one who required ICU care and survived. In the post-ban period, there were no ICU admissions with nil mortality. This compound has been listed for banning and this has also been recommended by Pesticide Action Network.

Malathion:

There were 4 cases of Malathion poisoning of whom 2 required ICU care and there were no deaths in the pre-ban period. There were no admissions for this compound in the post-ban period.

Alphamethrin, deltamethrin and cypermethrin were commonly used pyrethroids in combination with organophosphate compounds, with one individual having consumed alphamethrin, followed by death in spite of ICU treatment and stay. There were 4 combinations that were documented: Chlorpyrifos with cypermethrin, Triazophos with deltamethrin, Ethion with cypermethrin.

There were 49 cases of Organophosphate with pyrethroid in the pre-ban period with 7 deaths and 18 cases in the post ban period with 5 deaths. OP pyrethroid combinations contributed to 20.4 % of poisonings and 14.2 % of mortality in the pre-ban period and 24.3 % of poisonings and 17.7 % mortality in the post ban period. Therefore consideration of banning these combinations should be strongly considered.

In this, the combination pesticides seem to have increased morbidity and mortality, this could be secondary to a possible synergistic effect.

The reason for consumption of these particular compounds, when questioned during interviews, was told to be secondary to easy availability at home or near the fields. The ease of availability of these compounds could contribute to these specific compounds being consumed.

There was one case of Dieldrin poisoning noted in the pre-ban period who survived. This is an organochlorine that has been banned in India since 2003, however still seems to be available for the population.

The overall mortality of pesticide poisoning in the pre-ban period was ***11.6%*** (28/240 cases) as compared to the post-ban period, which has a mortality rate of ***10.8% (8/74***

cases). This shows that the overall mortality has reduced by only ***0.2%.*** However the actual number of deaths has fallen from 28 (over 24 months) to 8 deaths (over 13 months). This has been due to decline in the total number of pesticide poisonings from 10 per month in the pre-ban period to 6 per month in the post-ban period. In the pre ban period the majority of deaths were due to organophosphate poisonings (phorate (2), monocrotophos (4), chorpyrifos (1) triazophos (2), dimethoate (2), propenofos (1), and quinalphos (1). In contrast in the post ban period only one death was due to single organophosphate (dichorvos). The other deaths were due to OP combination with pyrethroid (chlorpyrifos with cypermethrin (4), propenofos with cypermethrin (1) and rodenticide poisoning (zinc phosphide (1) and yellow phosphorus poisoning (1).

The other compounds contributing to the ***mortality in the post Ban included yellow phosphorus with a combination of pyrethroids (deltamethrin) and zinc phosphide. Two patients, with rodenticides, were recruited with both patients requiring ICU stay with 100 % mortality.***

The usage of monocrotophos has been restricted in the country and not banned, hence we have patients presenting in Pre-ban and post-ban with consumption of this Class I B compound.

Although there has been a relative decrease in type I compounds, there has been a steady rise in type II compounds, which has shown a marginal increase from 35% to 44.6%, with no class III compounds in the post ban period.

The compound mixtures noted in the pre-ban period are 22.9%, with a significant increase in the post-ban period of 28.3%, which could negate the effects of mortality.

In the table below are mentioned the number of patients requiring tracheostomy for prolonged ventilation, in the pre-ban and post-ban period.

Pre-Ban	34/240= 15% of patients required tracheostomy
Post-Ban	11/74= 14.8% of patients required tracheostomy

Summary of findings:

1. There were 240 cases of pesticide poisoning in the pre-ban period (24 months) and 74 cases in post -ban period (13 months).
2. There was significant decline in patients requiring ICU care, 49.2% in pre-ban period to 32.4% in the post- ban period (odds ratio of 0.4 with CI of 0.2 to 0.85 with P value of 0.011).
3. There was significant reduction in proportion of patients requiring ventilation was also noted to be in declining trend (48.3% pre-ban compared to 32.4% post ban), with CI of 0.51 and P value of 0.016.
4. There was no difference in the mortality in the pre-ban and post-ban period, pre-ban 11.6% and post-ban 10.8%.
5. Class I compound poisoning showed a declining trend following the ban (33% pre-ban vs. 20.3% postban). The odds ratio is 0.51 with Confidence interval of 0.27 -0.97 and P value of 0.03. Class II compounds showed a non-significant increase following the ban (19.6% pre-ban to 20.3% post-ban) and Class III compounds disappeared following the ban (2.5% preban to 0% post-

ban). Organophosphate compounds with pyrethroid increased from 20.4% pre-ban to 24.3% post ban (non-significant).

6. The changes in profile of individual compounds were as follows:

a. Class I organophosphates: There was decline in Phorate compound, Methylparathion, Dichorvos poisoning and disappearance of Triazophos. There is no decline in Monocrotophos and evidence of poisoning with monocrotophos combinations.
b. Class II compounds: There was disappearance of Dimethoate poisoning and decline of Quinalfos poisoning. There is no change in Chlorpyrifos, Phentothate, Propenofos poisoning. There was increase Chlorpyrifos+ cypermethrin with increase mortality with this combination pesticide. There was appearance of Quinalfos + pyrethroid and Propenofos + pyrethroid combination poisonings.
c. Class III compounds: There was disappearance of Acephate and Malathion poisoning.
d. Pyrethroid poisonings showed increase.
e. Herbicide poisoning showed increase.
f. Fungicide compound poisoning showed increase.
g. Many new compounds appeared in the post-ban period: Amitraz, Bispyribac, Carbofuran, Cartrap, Cypermethrin, Deltamethrin, Emanectin, Gammacyalothrin+pralithrin, Indoxacarb, Nitrobenzene, Paraquat, Phenyphenol, Propioconazole.

7. **Mortality:** There was a decrease in ICU admission and mortality due to Class I compounds (Mortality due to Class I a pre-ban 2.7% to 0.8% post ban and Mortality due to Class I b pre-ban 2.5% to 1.4 % post ban) . There was increase in mortality due to OP+ pyrethroids from pre-ban of 2.9% to post-ban of 6.7%.

In the pre ban period the ***majority of deaths were due to organophosphate poisonings:*** Phorate (2), Monocrotophos (4), Chorpyrifos (1) Triazophos (2), Dimethoate (2), Propenofos (1), Quinalphos (1).

In contrast in the post ban period, only one death was due to single organophosphate (dichorvos) compound. The other deaths were due to OP combination with pyrethroid (chlorpyrifos with cypermethrin (4), propenofos with cypermethrin (1) and rodenticide poisoning (zinc phosphide (1) and yellow phosphorus poisoning (1).

XI. **DISCUSSION**

There were a total of 240 cases recruited in the retrospective arm (pre-ban) and 74 cases in the prospective arm (post-ban period). The number of cases recruited were all patients who presented with a history of poisoning, either self or accidental, with pesticides, requiring admission. Patients requiring admission inwards and the Intensive care unit were recruited.

A questionnaire was used, which pertained to age, sex, type of compound consumed, the requirement for ICU stay, associated complications noted during admission, including cardiovascular, renal, central nervous system manifestations including cholinergic crisis and intermediate syndrome, leading to ventilator requirements.

The discussion will focus on three aspects:

1. Changing spectrum of pesticide compounds and their clinical outcome
2. The impact of regulation on spectrum of pesticide poisoning
3. Implications of the study

Section 1 - Changing spectrum of compounds and their clinical outcome

The main changes in profile of poisonings and outcomes following the ban were:

1. Decline in Class I Organophosphate compounds- decrease in need for ICU care and mechanical ventilation

There was decline in phorate compound, methylparathion, Dichorvos poisoning and disappearance of Triazophos. There is no decline in Monocrotophos poisoning and evidence of poisoning with monocrotophos combinations.

2. Increase in Class II Organophosphate compounds- decrease in need for ICU care and mechanical ventilation

There was disappearance of Dimethoate poisoning and decline of Quinalfos poisoning.

There is no change in Chlorpyrifos, Phentothate, Propenofos poisoning.
There was increase Chlorpyrifos+ cypermethrin with increase mortality with this combination pesticide. There was appearance of Quinalfos + pyrethroid and Propenofos + pyrethroid combination poisonings.

3. Elimination of Class III Organophosphate compounds

There was disappearance of Acephate and Malathion poisoning.

4. Increase in Organophosphate compounds +pyrethroid mixtures- with higher mortality (as above under 2)
5. Increase in Pyrethroid poisonings- with low mortality
6. Increase in herbicide consumption- associated with low mortality
7. Increase in fungicide compounds - with low mortality
8. Rodenticides- The actual number of Rodenticides are being underrepresented in the current sample. This may contribute to falsely low incidence of these compounds and mortality.
9. There has been the appearance of many new compounds in the post-ban period: Amitraz, Bispyribac, Carbofuran, Cartrap, Cypermethrin, Deltamethrin, Emanectin, Gammacyalothrin+pralithrin, Indoxacarb, Nitrobenzene, Paraquat, Phenyphenol, Propioconazole.
10. In the pre ban period the ***majority of deaths were due to organophosphate poisonings:*** (1), phorate (2), monocrotophos (4), chorpyrifos (1) triazophos (2), dimethoate (2), propenofos (1), quinalphos (1).

In contrast in the post ban period, only one death was due to single organophosphate (dichorvos) compound. The other deaths were due to OP combination with pyrethroid (chlorpyrifos with cypermethrin (4), propenofos with cypermethrin (1) and rodenticide poisoning (zinc phosphide (1) and yellow phosphorus poisoning (1).

The other compounds contributing to the mortality in the post- Ban period included yellow phosphorus with a combination of pyrethroids (deltamethrin) and zinc phosphide.

There was a decline in ***rate of ICU admissions and rates of mechanical ventilation*** probably secondary to the decrease in the Class I organophosphate poisonings.

In the pre ban period the ***majority of deaths were due to organophosphate poisonings*** (1), phorate (2), monocrotophos (4), chorpyrifos (1) triazophos (2), dimethoate (2), propenofos (1), quinalphos (1).

In contrast in the post ban period, only one death was due to single organophosphate (dichorvos) compound. The other deaths were due to OP combination with pyrethroid (chlorpyrifos with cypermethrin (4), propenofos with cypermethrin (1) and rodenticide poisoning (zinc phosphide (1) and yellow phosphorus poisoning (1).

The other compounds contributing to the mortality in the post- Ban period included yellow phosphorus with a combination of pyrethroids (deltamethrin) and zinc phosphide. Two patients, with rodenticides, were recruited with both patients requiring ICU stay with 100 % mortality.

OP+ pyrethroid combinations contributed to ***20.4 % of poisonings and 14.2 % of mortality in the pre-ban period*** and ***24.3 % of poisonings and 17.7 % mortality in the post ban period***.

The overall mortality has not declined despite the decline in Class I OP poisonings. What has been the reason for this?

The most toxic /hazardous pesticides have been removed, they have been replaced by other toxic compounds. The declining number of deaths is clearly due to a declining ingestion of the toxic organophosphate (Phorate, Monocrotophos, Dimethoate, Triazophos, Dichlorvos, and Quinalphos) compounds and replacement of these with a

wide range of newer pesticides. There has been a shift away from the Class I organophosphates to Class II compounds and combinations which is evident in the study.

Section 2- The impact of regulation on pesticide poisoning

The focus of this study has been on the impact of regulation of pesticides on the spectrum of agrochemical poisonings. From this study we can note the following beneficial effects of regulation:

1. Banned compounds: Methylparathion has disappeared and Phorate and methylparathion have reduced.
2. Compounds which are under restriction: Phorate, Dichlorvos, Phosphamidon have reduced. Triazophos has disappeared.
3. Compounds which have been listed for phasing out: Phorate has reduced

The compounds that were noted to have ***completely disappeared*** in the post-ban period are Triazophos, Dimethoate, Triazophos+Deltamethrin, Dichlorvos, Quinalphos, Malathion, Ethion+ Cypermethrin, methylparathion, malathion,
The compounds that have ***reduced are*** Phorate, Propenofos+ cypermethrin, Chlorpyrifos+cypermethrin, Dichlorvos

The compounds that were ***earlier causing deaths which caused no deaths*** were Monocrotophos, Phorate, Triazophos, Dimethoate

The result of our study suggest that regulation in India has resulted in a change in agrochemical poisoning with shift from highly toxic class I OP to another spectrum of

highly toxic pesticides (OP + pyrethroid combinations, rodenticides, herbicides). This may account for lack of fallen mortality in our study.

These results are noted to be similar to the study done in Sri Lanka following the ban of pesticides. (40).Certain pesticides, including Chlorpyrifos, Paraquat, Dimethoate, were banned in period frame from 2008-2014. Admissions noted for these compounds reduced by 43% following this ban in Polonnarauwa, where the ban was imposed. The case fatality reduced from 14.4% to 9%, with an odds ratio of 0.59. There was a 50% fall in the suicide rate, however it has been observed that poisoning with class II pesticides, and paraquat contributed to the major mortality. The case fatality was noted to be 20.6% with dimethoate, with 42.7% case fatality with paraquat poisoning.
However, other pesticides, which were less toxic including Carbosulfan and Profenofos were used. These pesticides were noted to have a higher case fatality, rather than the previous compounds.
(41)Choudary et al., in Bangladesh in 2018 did a study which showed the effect of ban of class I compound. In this, the mortality in the hospital in individuals with pesticide poisoning decreased from 15.1% vs 9.5%, with RR of 37.1%, with confidence interval of 35.4 to 38.8 after the 2000 ban. There were fewer suicides noted.

How has the banning and restrictions led to changes in the profile of agrochemical poisoning?
Companies appears to be anticipating and responding to proposed regulation policies by withdrawing Class I and III organophosphates, and expanding Class II

organophosphates and combinations. Also they appear to be widening the basket of pesticides, herbicides and fungicides available.

People in the community are shifting to the most toxic agrochemical available. In the absence of lethal organophosphates they are choosing lethal combination pesticides, rodenticides and herbicides.

In the light of this regulation policies also need to anticipate the changes in use of pesticides. Following the ban, *there will be change in pattern of occupational, accidental and suicidal exposures.* The human consequences of these should be monitored, and regulation has to adapt to the new set of poisonings.

The ***main cause of death in the post ban*** period were the following compounds: Chlorpyrifos+Cypermethrin (4), Propenofos+ Cypermethrin and rodenticides

Data shows that the spectrum of mortality of pesticide in post-ban period indicate need for regulation of the following classes of pesticides.

Based on the results of the study it is suggested that further pesticides needs to be banned including: Monocrotophos, Chlorpyrifos, Dimethoate, Quinalphos, Acephate, Organophosphate pyrethroid combinations (such as Chlorpyrifos+ cypermethrin, Propenofos + Pyrethroid combination, Ethion+ Cypermethrin (Triazophos+Deltamethrin) and Organophosphate combinations. In addition, we suggest that Yellow phosphorus, Zinc phosphide and Paraquat poisoning need to be banned.

Lethal poisonings underestimated in the current study

This study underestimates paraquat poisoning, as cases may have been possibly missed in this study.

In a recent analysis in cases with Paraquat poisoning, a retrospective chart data review was done in Christian Medical College, Vellore from the year 2015 to 2021. All patients presenting with paraquat poisoning were included. A total of 36 patients were included. The mortality noted was 80.6% with 29 /36 patients dying, and those with cardiovascular instability had 100% mortality. Hepatic involvement showed 96% mortality, with ARDS showing 95.5% mortality. Individuals with renal involvement had 87.5% mortality with CNS manifestations having 80% mortality. GI corrosive effects showed 75% mortality effect. Most common toxidromes were acute kidney injury, hepatitis and acute respiratory distress syndrome. The predictors for poor clinical outcomes involved the amount ingested, Apache score at presentation, and presence of multi-organ involvement (Adarsh et.al. conference presentation).

A similar underestimation of poisoning with yellow phosphorous compound may be present, as those who presented with acute liver failure were treated under Hepatology department.

Eapen CE, Venkataraman J. in 2021, reported on Yellow phosphorus poison (rodenticide) induced Hepatotoxicity .This was a survey done across 6 districts, between the month of January and June, 2019

There were 131 patients (31%) who died and 28 patients (6%) who had moribund state at the time of discharge. During the 6 month study period, there were 1584 cases

of yellow phosphorus induced hepatotoxicity, with estimate of 554 patients having a poor outcome.

This poisoning seems to be equal to paracetamol overdose in causing acute liver injury with liver necrosis.

Part 3- Implications of the study

In view of bans implemented, there has been a change in the spectrum with new combination pesticides available in the market. These spectrum of compounds would need analysis in order to understand the various clinical manifestations that accompany it. Further studies will have to be done, in order to analyze the effects of the new compounds on individuals exposed to these newer spectrum of pesticides.

Need for Poison Control Centres

Poison control centres from all the states need to have surveillance systems for environmental exposure, occupational poisoning and vigilance on newer pesticide compounds. There should be surveillance on the possible complications that can occur with newer compounds with wide spectrum of toxicity and manifestations.

There was a recent analysis of PCC in Christian Medical College, Vellore. In an audit done for referral of patients, following poisoning, at least 88% of individuals presented to one regional hospital before presenting to CMC. Most of these patients either discharged against medical advice or referred in view of worsening clinical deterioration. The reasons for clinical deterioration noted was due to delayed access to anti dotes, with suboptimal stabilization and resuscitation prior to transfer. There were 3639 calls made from 2019 to 2021. 93% of these compounds were from doctors related to information on compounds consumed by patients, as most of these were not

labelled. It was noted that at least 48% of containers were not labelled with information on compounds or antidotes. In this analysis, most common compounds consumed were agrochemicals: pyrethroids (23.8%) followed by rodenticides and organophosphate compounds.

There are less than 10 poison centers in a country with 1.3 billion population. Hence, the urgent need for opening more PCCs across the country with a large population.

There should be Poison control centres with 24 hour contact numbers which should be available for physicians in primary health care centres, to contact for management of various poisonings. This will also help decide if patient is to be referred to higher centre. The PCC helpline needs trained physicians who can advise on management of these poisonings.

Training of doctors in new spectrum of pesticides

Doctors will have to be educated on the newer profile of pesticide compounds, and expected clinical manifestations. This will be beneficial for treatment of individuals admitted with poisoning.

For example, in this study, Indoxacarb which is a carbamate and nitrobenzene ,which is a herbicide are noted to have produced methemoglobinemia .With increasing use of pyrethroid in compound mixtures, pyrethroids (Cypermethrin and deltamethrin) can produce seizures in patients. For example, gastric lavage and it's contraindication in aluminium phosphide poisoning.

However, this information may not be available easily in rural setup. This is due to the reason that the trend of pesticide poisoning is changing with more recent use of

herbicides, fungicides and pyrethroid combinations. Hence treating physicians or health care workers who come in first contact with the patient, in various health set ups need to be aware of these complications pesticide of poisoning and their management. Hence, patients who present with pyrethroid poisoning may require ICU stay based on compound consumed.

Traditionally training modules for poisoning focus on OP poisoning and plant poisonings. Training modules for management of poisoning in India today need to refocus on the wide variety of common poisonings as documented in this study (combination pesticides, herbicides, rodenticides). State government needs to ensure training of doctors in PHC, CHC and District hospitals on poisoning management.

Feedback of profiles of pesticide poisonings from Poison Control Centres to Regulators and agrochemical companies

The current agrochemical poisoning profiles, ICU admission, ventilation rate and mortality from Poison control centres and hospital based information needs to be compiled and sent to the government for initiating regulation. It is likely that the agrochemical companies will respond to such clinical data by changing their production and marketing.

For example, in individuals with manifestations, such as ARDS and multiorgan dysfunction in Paraquat poisoning, a the information regarding the high death rate due to this compound needs to be shared with the Government and the Company to inform them of the toxicity profile of these compounds. So that the compound can be withdrawn from the market.

Strategies for regulation of pesticides

The impact of the regulation has shown decreasing trend in poisoning with type I compounds. The most frequently consumed pesticide available is compound mixtures. These compounds by single compound, for example acephate is mildly toxic. However, when combined with other compounds such as pyrethroids, there is a synergistic effect with pesticide and pyrethroid toxicity, thus contributing to increased morbidity.

In view of this, proposed phasing out may not have any effect as there is already a decline in type I pesticides. In view of this ban and in order to increase efficacy of pesticides and prevent resistance by pests, there are new combinations of compound mixtures, introduced. These have been permitted by the Government.

There has to be a ban on compound pesticide mixtures by the Government. All pesticides which are introduced, should be registered under the Pesticide act. Pesticides should be labelled, and should not be used unless there are directions for use of the compound with appropriate antidotes mentioned on the label.

All adverse effects of pesticide use should be reported with incidents such as accidental spill or inhalation to the company.

Long term exposure is known to cause neurotoxicity with carcinogenic potential which will require monitoring on long term basis, which will need to be studied further. Hence, the Government needs to ban new mixture of compounds, in order to avoid another vast array of clinical features.

Strict restrictions in terms of pesticide availability should be enforced, especially to the common population, and warning labels with names of the compounds should be included on the containers of pesticides prior to sale.

XII. CONCLUSION:

1. Spectrum of poisoning

   Following the ban, there has been a shift away from Class I and Class III organophosphates to OP/pyrethroid combination poisonings. There are also increase in herbicide, fungicide and rodenticide poisoning. There are many new compounds that are causing pesticide poisoning.

   The mortality due to Class I organophosphates has reduced but the mortality due to OP/pyrethroid poisoning has increased. There is also mortality due to rodenticide and herbicide poisoning.

   There has been a significant decrease in need for ICU care and mechanical ventilation in pesticide poisoning, but there has been no overall change in mortality following the ban.

2. Impact of regulation

   The agrochemical poisoning spectrum from our centre shows the benefit of regulation of pesticides. Banned compounds (Methylparathion, Phorate and methylparathion), compounds under restriction (Phorate, Dichlorvos, Phosphamidon, Triazophos) and compounds listed for phasing out (Phorate) have showed elimination or marked reduction.

Class I organophosphates have reduced. However there have been replaced by combination pesticides with organophosphate and pyrethroids. When one class of highly toxic pesticides are banned, they are replaced by other toxic chemical overdoses.

The results suggest the need for on-going monitoring of the spectrum and mortality due to pesticide poisoning towards on-going regulation.

XIII. RECOMMENDATIONS:

There is need for Poison control centres

1. To document the changing profile of pesticide poisoning
2. Provide telephonic help line support for doctors working in primary and secondary level on poisoning management.
3. Share the information on pesticide poisoning with regulators and companies.
4. Conduct training for doctors on management of newer pesticide poisonings.

There is need to determine the poisons causing mortality following the ban to identify further compounds that need banning and restriction.

XIV. LIMITATIONS:

There are certain limitations to the study noted which have been mentioned below.

1. The post-ban sample size is low –with a total sample size of only 74. There is a large possibility of cases missed during the COVID 19 pandemic as the prospective data was from July 2019 till December 2019, with no cases included in 2020 in view of the pandemic. There was recruitment of cases occurring after the COVID pandemic, which was from October 2020 to April 2021.

2. Since this study is done in a tertiary care center, the actual number of individuals consuming pesticides and the mortality related to it /outcomes may be different. This does not include individuals admitted to other hospitals, who may have a different outcome.

3. This does not include patients who are brought dead to casualty with consumption of pesticides.

4. Only those accessible to the health center, could have presented in time, considering the possibility of further deterioration or death en route or at home after consumption of more toxic compounds

4. Mild cases of poisoning, for example, individuals who have attempted poisoning self or accidental contact with pyrethroids may have not been admitted for mild symptoms and treated on OPD basis. Hence, these individuals who do not warrant admission were not included in the IP list making the number of pesticide poisonings lower and the mortality possibly higher than the actual data.

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XVI. ANNEXURE

1.1 Questionnaire

Study Title : To compare the spectrum and number of pesticide poisonings before and after the 2016 policy changes in pesticide related bans and its effect on the clinical presentation and outcomes.

Dr.Angel.S, Medicine Post-graduate Thesis
Christian Medical College, Vellore - 632004

Informed Consent Sheet

(i) I confirm that I understand the information provided to me about the study dated _____and have had the opportunity to ask questions. [ ]

(ii) I understand that participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or rights being affected. [ ]

(iii) I understand that I /my relative will not directly benefit by participating in the study, but will help the researcher understand the pesticides in current use and the effects due to poisoning from the same. [ ]

(iv) I give permission to the researcher to access the chart and medical records to obtain details that are relevant for the study. [ ]

(v) I understand that the information will be kept safe and would be kept confidential [ ]

(vi) I understand that information collected could be used for future publication, but ensuring that personal identification is protected. [ ]

(vii) I agree to take part in the above study. [ ]

---------Name of Participant: Date:

Signature (or Thumb impression) of the Subject/Legally Acceptable

---

Name of Relative: Date:
(If participant is unable to consent)
Relationship to the patient:

Signature (or Thumb impression) of the Relative/ Legally acceptable:

Name of Researcher: Date:

Signature:

_____

Patient Information Sheet :

Pesticide poisoning is a major cause suicide and suicidal attempts. Ingestion of pesticides can cause various effects on the body. Depending on the type of pesticide ingested, it can cause mild or severe symptoms. Some effects could be very severe and may require prolonged ICU care and sometimes could even result in death.

In other countries, by banning very toxic pesticides, they have noticed that deaths due to pesticides had come down quite a lot. In India, the government has banned certain pesticides in 2016. Has this ban caused changes in the type of pesticides that are currently available in the pesticide shops? More importantly, when someone consumes these any of these pesticides, is there a different effect on the body? Are these pesticides less toxic or more toxic? How does it make a difference in the outcome for the patient? These are some of the things that we would like to look at.

We know that you have been admitted for treatment following ingestion of pesticide.

We would like to ask you some details about the pesticide that you had consumed. We would also like to collect some details from your medical records. This would include information about the pesticide and how it has affected the body and its effects on hospitalization, ICU care, ventilator supports and outcomes. These could be used for publication in the future, but we will assure you that all data is completed unlinked from any personal identification.

Participation in the study is fully voluntary and does not involve any cost to you. You could choose to not participate or withdraw from the study at any time without providing any explanations and it will not affect your medical care.

We would be happy to explain or clarify any questions that you may have about the study.

Thank you

Dr. Angel. S

Principal Investigator

Consent form:

QUESTIONNAIRE

1. NAME
2. AGE

3. SEX

   A-MALE B-FEMALE

4. EDUCATION- a.-Up to 6^{Th} grade
   a. B-Up to 12^{Th} grade
   b. C-Up to College
5. EMPLOYMENT- a)DAILY WAGE LABOURER b) AGRICULTURAL WORK c)OTHERS

6. MARRIED - a)YES b) NO

7. CONCOMITTANT ALCOHOL USE-A-no B –yes

8. POISON CONSUMED-

9. NAME OF THE POISON

10. TYPE OF COMPOUND-

    IF OP ,THEN
11. CLASSIFICATION OF THE COMPOUND ON SEVERITY-

    a. WHO CLASS I/II/III
    b. PERINDIYA SCALE-

12. TIME OF CONSUMPTION

13. DATE OF CONSUMPTION

14. REASON OF CONSUMPTION OF PARTICULAR COMPOUND-

    -CHEAP/COMMONLY AVAILABLE

15. INCOME OF THE AFFECTED PARTICIPANT-
    a. LOW CLASS
    b. MIDDLE CLASS-UPPER/LOWER
    c. HIGH CLASS

16. HOW WAS THE POISON CONSUMED?-MIXED/PLAIN

17. SEVERITY OF THE COMPLAINT-

18. CLINICAL MANIFESTATIONS-

19. GCS AT ARRIVAL-

20. PUPILS AT ARRIVAL-

21. WAS GASTRIC LAVAGE GIVEN OUTSIDE/INSIDE WITHIN FOUR HOURS OF CONSUMPTION ?

22. CLINICAL MANIFESTATIONS-

i) NEUROLOGICAL-EARLY/LATE-
   a. INTERMEDIATE SYNDROME
   b. DOPE
   c. SEIZURES WITH HIE
   d. EXTRA PYRAMIDAL SYMPTOMS
   e. CRITICAL ILLNESS POLYNEUROPATHY

ii) CARDIOVASCULAR- ARRHYTHMIAS/BLOCKS/BRADYCARDIA

iii) LIVER TOXICITY-HEPATIC FAILURE/TRANSAMINITIS

iv) NEPHROTOXICITY

23. DID THE PATIENT REQUIRE ICU STAY?-YES/NO

24. VENTILATORY REQUIREMENTS?-YES/NO

25. INVASIVE/NON-INVASIVE-A/B

26. NUMBER OF DAYS IN ICU STAY-

a) <3 days b) 3-7 days c)7-14 days d) >14 days

27. NUMBER OF DAYS OF VENTILATORY REQUIREMENTS

a) <3 days b) 3-7 days c)7-14 days d) >14 days

28. TRACHEOSTOMY REQUIRED –
YES-A
NO-B

29. ANY OTHER INFECTIONS ACQUIRED DURING THE COURSE OF STAY-

a. CRBSI-Y/N
b. VAP-Y/N
c. DVT-Y/N

30. ANY OTHER COMPLICATIONS DEVELOPED DURING STAY-

a. -ACUTE CORONARY EVENT
b. -PULMONARY EMBOLISM
c. -SEPSIS WITH/WITHOUT SHOCK
d. -HYPOXIC ENCEPHALOPATHY

31. ANY OTHER CO-MORBID FACTORS-

a) DIABETES b) HTN c)HIV /HbSAg

32. LONG TERM COMPLICATIONS-

a. -NEUROLOGICAL SEQUELAE-EPS
b. -DYSPHONIA/DYSPHAGIA
c. -CORD PALSY

33. CHOLINESTERASE LEVELS-
A-NORMAL
B-LOW

34. MORTALITY-
A)ALIVE B) DEAD

1.3 Data sheet

PRE BAN PERIOD

Y151	26	2	OP +pyrethroid	Profenofos 40% + Cypermethrin 4%
Y152	34	2	OP +pyrethroid	Profenofos 40% + Cypermethrin 4%
Y153	19	1	O P	TRIAZPHOS
Y154	32	2	O P	Methyl parathion
Y155	20	1	O P CLASS I + OP CLASS II	Monocrotophos+Dimethoate
Y156	27	2	O P	Phorate 1%
Y157	21	1	O P	UNKNOWN
Y158	57	1	O P +nitrobenzene	Triazophos +Nitrobenzene
Y159	27	2	O P	Dimethoate 30%
Y160	22	1	O P	Phorate 1%
Y161	29	2	O P+ pyrethroid	Chlorpyrifos+Cypermethrin
Y162	32	2	O P	Phorate 1%
Y163	26	2	O P	Chlorpyriphos
Y165	35	1	O P	Triazophos40%
Y166	55	1	O P	Quinalphos
Y167	24	2	O P	Prophenophos 40%+cypermethrin 4%
Y168	21	1	O P	Triazophos
Y169	38	1	O P	Acephate
Y170	26	2	OP	Acephate
Y171	28	1	OP I+OPII	Triazophos 40%+Chlorpyriphos20%
Y172	27	1	O P	UNKNOWN
Y173	20	2	O P	phorate
Y174	36	1	O P	Monocrotophos 10%
Y175	19	1	O P	Dichlorvas
Y176	35	1	O P	Profenophos
Y177	37	1	OP +PYRETHROID	UNKNOWN
Y178	22	1	O P	CHLORPYRIFOS
Y179	31	1	O P	monocrotophos-INHALATION
Y180	32	1	O P	Quinalphos25%
Y181	37	1	OP	Phorate
Y182	19	2	OP+PYRETHROID	999
Y183	35	1	O P	Triazophos35% & deltamethrin1%
Y184	27	1	O P	Parathion
Y185	77	1	OC	Organo carbamate
Y186	46	1	PYRETHROID	Lambda cyhalothrin

Y187	30	2	OP+PYRETHROID	Triazophos35% & deltamethrin1%
Y188	36	1	OP+PYRETHROID	Triazophos35% & deltamethrin1%
Y189	59	1	OP	UNKNOWN
Y190	17	1	O P	UNKNOWN
Y191	29	2	O P	UNKNOWN
Y192	44	1	O P	monocrotophos 1%
Y194	30	2	O P	UNKNOWN
Y195	23	1	O P	Triazophos 40%
Y196	21	1	O P	Chlorpyriphos 1.5%
Y197	34	1	ORGANOCHLORIDE+OP	DIELDRIN
Y198	23	1	OP	UNKNOWN
Y199	35	2	O P	Dimethoate 30%
Y200	20	1	O P	Chlorpyrifos
Y201	50	1	O P+ Pyrethroid	-chlorpyrifos+cypermethrin
Y202	20	1	O P-monocrotophos	Monocrotophos 36%
Y203	50	1	O P	monochrotophos
Y204	25	1	O P+Pyrethroid	Deltametherin 1% + Triazophos 35%
Y205	20	2	O P	DICHLOVOS
Y206	34	2	O P	Phorate
Y207	34	1	O P	QUINALPHOS
Y208	24	2	OP	METHYLPARATHION
Y209	26	1	O P propaferos & cypermethrin	PROFENOPHOS+CYPERMETHRIN
Y210	19	2	O P	UNKNOWN
Y211	27	1	O P-dimethoate	DIMETHOATE
Y212	27	1	OP	Monocrotophos 36%
Y213	17	2	OP	Monocrotophos 36%
Y214	24	2	OP	DIMETHOATE
Y215	19	2	O P-quinalphos	QUINALPHOS
Y216	70	1	OP	UNKNOWN
Y218	17	2	O P	PROFENOPHOS+CYPERMETHRIN
Y220	19	1	OP	DIMETHOATE
Y221	39	1	OP	UNKNOWN
Y222	30	2	O P	UNKNOWN
Y223	54	1	O P	UNKNOWN
Y224	18	2	O P-parathion	PARATHION
Y225	25	2	OP+PYRETHROID	CLORPYRIPHOS+CYPERMETHRIN
Y226	45	1	O P	UNKNOWN
Y227	27	2	OP	CHLOPYRIPHOS 20%
Y229	23	1	OP	PHORATE 10%
Y230	22	1	O P	UNKNOWN
Y231	28	1	OP	MONOCROTOPHUS 30%
Y233	24	1	O P-chlorpyrifos	CHLOPYRIPHOS
Y234	25	1	OP	MALATHION
Y235	20	1	OP + PYRETHROID	CHLOPYRIPHOS+ CYPERMETHRIN

Y236	24		2	O P	UNKNOWN
Y237	22		1	OP	MONOPHOS
Y238	25		1	OP	DIMETHOATE
Y239	24		1	OP	PROPHENOPHOS
Y240	34		1	O P	UNKNOWN
Y241	29		2	OP	MONOCROTOPHOS
Y242	28		1	OP	PROFENOFOS
Y243	37		1	OP	IPROBENOFOS
Y244	30		1	O P	UNKNOWN
Y255	27		1	OP	TRIAZOPHOS
Y256	35		2	OP	PHORATE
Y257	55		2	OP	CHLORPYRIFOS
Y258	24		1	OP	CHLORPYRIFOS
Y259	45		1	OP	MONOCROTOPHOS
Y260	64		1	OP	BORATE
Y261	24		2	OP	TRIPAZOPHOS
Y262	19		2	OP	METHYLPARATHION
Y263	34		1	OP+PYRETHROID	TRIAZOPHOS +DELTAMETHRIN
Y264	33		2	OP	MALATHION
Y266	33		1	OP	PHORATE
Y267	27		1	OP	TRIAZOPHOS
Y268	35		2	OP+PYRETHROID	CHLORPYRIFOS+CYPERMETHRIN
Y269	21		2	OP	PHORATE
Y270	32		2	O P	MONOCROTOPHOS
Y271	28		1	OP	MONOCROTOPHOS
Y272	19		2	O P	UNKNOWN
Y273	22		1	OP	CHLORPYRIFOS
Y276	34		1	OP	TRIAZOPHOS
Y277	25		1	OP+PYRETHROID	ETHION +CYPERMETHRIN
Y278	36		2	OP	CHLORPYRIFOS
Y279	27		1	OP	MONOCROTOPHOS
Y280	32		1	OP	MONOCROTOPHOS
Y282	55		1	O P	UNKNOWN
Y283	60		1	OP+PYRETHROID	PROFENOFOS +CYPERMETHRIN
Y286	35		1	OP	CHLORPYRIFOS
Y287	52		1	OP	CHLORPYRIFOS
Y288	45		1	O P	UNKNOWN
Z100	18		M	OP	CHLOPYRIFOS
Z101	30		M	OP	MONOCROTOPHUS
Z105	24	M		O P & OXYCHLORIDE	MONOCROTOPHOS & CU OXYCHLORIDE
Z106	18	M		O P & OXYCHLORIDE	MONOCROTOPHOS & CU OXYCHLORIDE
Z107	58	M		OP	chlorpyriphos & cypermethrin
Z109	45	M		OP	PHOSPHAMIDON
Z110	19	M		OP	MONOCROTOPHUS

Z111	68	M	OP	MONOCROTOPHUS
Z113	27	F	O P	O P
Z114	22	M	OP	TRIAZOPHOS +CYPERMETHRIN
Z115	22	F	OP	TRIAZOPHOS +CYPERMETHRIN
Z117	21	F	OP	PROFENOFOS+CYPERMETHRIN
Z118	41	M	ACCIDENTAL EXPOSURE TO O P COMPOUND	UNKNOWN
Z119	45	M	OP	MALATHION
Z120	27	F	OP	CHLORPYRIPHOS 20%
Z122	20	F	OP	CHLORPYRIFOS
Z123	30	F	O P	UNKNOWN
Z124	21	F	OP	TRIAZOPHOS
Z125	53	F	OP	DICHLOROPHOS
Z126	15	F	OP	PHORATE
Z127	27	M	OP	PHORATE
Z128	30	F	OP	PHORATE
Z129	25	F	O P	UNKNOWN
Z130	18	M	OP	PHORATE
Z132	22	M	OP	DIMETHOATE
Z133	27	F	OP	PHORATE
Z134	50	M	OP	DIMETHOATE
Z135	20	F	OP	CHLORPYRIFOS 20%
Z136	27	F	OP+PYRETHROID	TRIAZOPHOS+DELTAMETHRIN
Z137	65	M	OP	CHLORPYRIFOS
Z138	25	M	OP+PYRETHROID	CHLORPYRIFOS+CYPERMETHRIN
Z139	45	M	OP	MONOCROTPHOS+DINITRODIBROMO PROPANE
Z141	28	F	OP+PYRETHROID	chlorpyriphos & cypermethrin
Z143	35	M	O P	O P
Z144	25	M	OP	O P-chlorpyriphos & cypermethrin
Z146	23	M	OP	PHENTHOATE
Z147	29	M	OP	TRIAZOPHOS
Z148	55	M	OP	CHLORPYRIPHOS+CYPERMETHRIN
Z149	40	M	OP	PHENTHOATE +CYPERMETHRIN
Z150	58	M	OP	O P-glycopyriphos & pyrithrium
Z151	23	M	OP	DICHLORVAS
Z153	44	M	O P-malathion	MALATHION
Z154	17	F	OP+PYRETHROID	PROFENOFOS+CYPERMETHRIN
Z155	21	M	OP	PHOARATE
Z156	24	F	OP	MONOCROTOPHOS
Z157	19	M	O P-profenophos & cypermethrin	PROFENOFOS+CYPERMETHRIN
Z158	18	M	OP	PROFENOFOS
Z159	53	M	O P-profenophos & cypermethrin	O P-profenophos & cypermethrin

Z160	25	F	OP	TRIAZOPHOS
Z162	31	M	O P	PHORATE
Z163	20	M	O P-profenophos & cypermethrin	O P-profenophos & cypermethrin
Z164	20	M	O P	O P
Z165	33	M	O P-monocrotophos	MONOCROTOPHOS
Z1666	27	F	O P-phenthoate	PHENTHOATE
Z167	20	M	O P-monocrotophos	MONOCROTOPHOS
Z168	41	M	OP	QUINALPHOS
Z169	28	M	O P	0
Z170	57	F	OP	CHLOPYRIPHOS
Z171	27	F	OP+ PYRETHROID	TRIAZOPHOS+DELTAMETHRIN
Z172	28	F	OP	CHLOPYRIPHOS
Z173	57	M	OP+PYRETHROID	TRIAZOPHOS+DELTAMETHRIN
Z174	22	F	OP	PROFENOFOS
Z175	20	M	O P	0
Z176	18	M	OP	PHORATE
Z177	17	M	OP+PYRETHROID	CHLORPYRIPHOS+CYPERMETHRIN
Z178	41	F	O P	CHLORPYRIPHOS+CYPERMETHRIN+CYALOTHRIN
Z179	28	M	OP+PYRETHROID	PROFENOFOS+CYPERMETHRIN
Z180	29	F	O P-entrin	0
Z181	30	M	O P-entrin	0
Z182	17	M	O P	0
Z184	22	M	OP+ PYRETHROID	PROFENOPHOS+ cypermethrin
Z185	35	M	OP+ PYRETHROID	PHORATE
Z186	33	M	OP+PYRETHROID	PROFENOPHOS+CYPERMETHRIN
Z187	36	F	OP	DICHLORVOS
Z188	22	F	OP+PYRETHROID	CHLORPYRIPHOS+CYPERMETHRIN
Z190	21	M	OP+PYRETHROID	CHLORPYRIPHOS+CYPERMETHRIN
Z191	54	M	OP+PYRETHROID	PROFENOPHOS+CYPERMETHRIN
Z192	26	M	O P	PHORATE
Z194	20	M	OP	PHORATE
Z195	25	M	O P	999
Z196	26	M	OP	DICHLORVOS
Z197	19	M	O P	999
Z198	46	M	OP	PHORATE
Z199	32	M	OP	PHORATE
Z200	18	M	OP	PHORATE
Z201	24	M	OP	999
Z202	16	F	OP	PHOSPHAMIDON
Z203	36	M	OP	CHLORPYRIPHOS
Z204	31	M	O P	999
Z205	38	M	OP	PROFENOFOS
Z206	27	M	OP	MONOCROTOPHOS

Z207	33	M		O P							999
Z208	22	F		OP							PHORATE
Z209	55	F		OP							PHENTHOATE
Z210	17	F		O P							999
Z211	18	F		OP							PHOSTANE
Y164	67		1	O P+ pyrethroid							Chlorpyrifos+Cypermethrin
Y193	28		1	O P							UNKNOWN
Y217	25		2	OP							PROFENOFOS
Y219	21		2	OP							MONOCROTOPHUS
Y228	70		1	PYRETHROID							Alphamethrin
Y232	64		2	OP							UNKNOWN
Y265	55		1	OP							QUINALPHOS
Y274	71		1	OP							DIMETHOATE
Y275	29		1	OP							ETHION +CYPERMETHRIN
Y281	34		1	OP+PYRETHROID							TRIAZOPHOS +DELTAMETHRIN
Y284	60		1	OP							TRIAZOPHOS
Y285	65		1	OP							CHLORPYRIFOS
Z102	22	F		O P & OXYCHLORIDE							MONOCROTOPHOS & CU OXYCHLORIDE
Z103	45	F		O P & OXYCHLORIDE							MONOCROTOPHOS & CU OXYCHLORIDE
Z104	54	M		O P & OXYCHLORIDE							MONOCROTOPHOS & CU OXYCHLORIDE
Z108	54	M		OP							PHORATE
Z112	16	M		OP							MONOCROTOPHUS
Z116	24	M		OP							MONOCROTOPHUS
Z121	38	M		OP							ETHION+CYPERMETHRIN
Z131	35	M		OP							UNKNOWN
Z140	60	M		O P							UNKNOWN
Z142	53	M		OP+ PYRETHROID							profenophos & cypermethrin
Z145	55	M		OP							DIMETHOATE
Z152	30	M		O P-profinophos & cypermethrin							PROFENOFOS+CYPERMETHRIN
Z161	79	M		O P-triazophos							O P-triazophos
Z183	54	M		OP+ PYRETHROID							TRIAZOPHOS+DELTAMETHRIN
Z189	60	M		O P							PHORATE
Z193	20	F		OP							MONOCROTOPHUS
NO.	AGE	SEX		OP/Non OP-pyrethroid	OP +-						Name of compound
NO.	AGE	SEX		OP/Non OP-pyrethroid	OP +-						Name of compound
		2	II		2	1	> 2MM	1-OUTSIDE			2
		1	II		2	3	> 2MM	1-OUTSIDE			2
		1	III		1	0					2

	2	Ia		1	1	2
	1	Ia+class II		3	3	1
	1	Ia		1	2	1
	1		999	1	3	1
	1	Ib		2	2	1
	1	II		1	2	2
	1	Ia		2	0	1
	1	II		1	0	2
	1	Ia		1	1	2
	1	II		1	0	2
	1	Ib		0	2	1
	1	II		1	2	2
	1	II		0	1	2
	1	Ib		1	2	2
	1	III		1	2	2
	1	III		1	2	2
	1	I and II		1	1	2
	1		999	0	1	2
	1	Ia		2	3	1
	1	Ia	6(post CPR)		4	1
	2	Ib		4	3	2
	1	II		2	2	1
	1		999	2	2	1
	1	II		2	2	2
2		IB		1	1	2
	2	II		2	2	1
	1	Ia		1	2	2
	1		999	6	3	1
	1	Ib		1	2	2
	1	Ia		4	3	2
	1		999	2	2	2
	1		999	3	3	2
	1	Ib		1	1	2
	1	Ib		4	3	2
	1		999	1	1	2
	1		999	4	3	2
	1		999	2	2	2
	1	Ib		4	3	2
	1		999	1	2	1
	1	II		0	1	2
	1	II		0	0	2
	1	ORGANOCHLORINE		3	3	2
	1		999	0	1	2
	1	II		0	1	2
	1	II		0	0	1

2	II			2	2			1	
1	IB			1	1			2	
1	IB			2	1			2	
1	IB			4	3			1	
1	IB			0	0			2	
1	IA			1	0			1	
1	II			2	2			1	
1	IA			0	0			2	
1	II			0	0			2	
1		999		0	0			2	
1	II			0	0			2	
1	IB			5	3			1	
1	IB			10	4			1	
1	II			2	1			1	
1	II			2	2			1	
1		999		0	0			2	
1	II			3	4			1	
1	II			2	2			1	
1		999		2	2			1	
1		999		2	1			1	
1		999		1	1			2	
1	IA			0	0			2	
1	II			3	3			1	
1		999		1	1			2	3
1	II			1	1			2	
1	IB			0	0			2	
1		999		4	5			1	
1	IB							2	
1	II			0	0			2	
1	III			0	0			2	
1	II			2	1			2	
1		999		2	1	N	N	2	
1	IB			3	3			1	
1	II			1	1			2	
1	II			0	0			2	
1		999		2	2			2	
1	IB			4	4			1	
1	II			0	0			2	
1	FUNGICIDE			0	0			2	
1		999		2	3			1	
1	IB			2	3			1	
1	1A			0	0			2	
1	II			0	0			2	
1	II			0	0			2	

	1	IB		0	0	2	
	1		999	2	1	1	
	1	IB		0	0	2	
	1	IA		0	0	2	
	1	IB		1	2	1	
	1	III		0	0	2	
	1	IA		0	0	2	
	1	IB		0	0	2	
	1	II		0	3	1	2
	1	IA		0	2	2	
	1	IB		3	4	1	
	1	IB		1	3	1	
	1		999	2	4	1	
	1	II		0	0	2	
	1	IB		1	1	1	
	1	II		0	0	1	
	1	II		0	1	2	
	1	IB		2	2	1	
	1	IB		0	0	2	
	1		999	4	6	1	
	1	II		3	5	1	
	1	II		1	1	2	
	1	II		0	0	2	
	1		999	0	0	2	
	1	II		0	0	2	
	1	1B		0	0	1	
	1	IB+CU		0	0	2	
	1	IB+CU		0	0	2	
	1	II		1	1	2	
	1	IA		1	0	2	
	1	IB		0	0	2	
	1	IB		0	0	2	
	1		999	1	0	2	
	1	IB		1	2	1	
	1	IB		1	2	1	
	1	II		2	3	2	
NO			999	3	5	2	
	1	III		0	0	2	
	1	II		0	0	1	
	1	II		3	5	1	
	1		999	2	4	1	
	1	IB		3	5	1	
	1	IB		2	4	2	
	1	IA		3	5	1	

1	IA		0	0	2
1	IA		0	0	2
1		999	3	5	1
1	IA		3	5	1
1	II		3	7	1
1	IA		1	3	1
1	II		3	5	1
1	IB		0	0	2
1	IB		3	5	1
1	II		3	6	1
1	II		1	2	2
1	IB		0	0	2
1	II		0	0	2
1		999	0	0	2
1	II		2	3	2
1	II		1	1	2
1	IB		1	1	2
2	II		3	5	2
1	II		1	1	2
1	II		1	1	2
1	IB		3	5	1
1	III		3	5	1
1	II		0	0	2
1	IA		3	5	1
1	IB		3	5	1
1	II		1	3	1
1	II		0	0	1
1	II				
1	IB		0	0	2
1	IA		0	0	2
1	II		0	0	2
1		999	0	0	2
1	IB		0	0	2
1	II		2	2	2
1	IB		4	3	1
1	II		0	0	2
1		999	0	0	2
1	II		1	0	1
1	IB		5	4	1
1	II		4	4	1
1	IB		1	1	2
1	II		0	0	2
1		999	0	0	2
1	IB		0	0	2

1	II		3	4	1	
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1	II		0	0	2	
1		999	0	1	2	
1		999	1	0	2	
1		999	0	0	2	
1	II		2	2	2	
1	IA		0	0	2	
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1	IB		2	2	2	
1	II		4	5	1	
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1	II		1	0	2	
1	IA		3	3	1	
1	IA		2	2	1	
1		999	1	1	2	
1	IB		4	5	1	
1		999	5	6	1	
1	IA		1	1	2	
1	IA		4	5	1	
1	IA		5	6	1	
1		999	4	5	1	
1	IA		4	5	2	
1	II		1	0	2	
1		999	1	1	2	
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1	IB		1	1	2	
1		999	1	1	2	
1	IA		8	12	1	
1	II		3	4	2	
1		999	3	4	1	
1		999	5	7	1	
2	II		4	4	1	
2		999	5	4	1	
1	II		3	5	1	
1	IB		4	5	1	
1	PYRETHROID		3	3	1	
1		999	4	5	1	
1	III		0	0	1	2
1	II		3	5	1	
1	II		1	1	2	
1	IB		4	6	1	
1	IB		2	2	1	
1	II		0	2	1	

1	IB+CU		0	0				2
1	IB+CU		7	10				1
1	IB+CU		0	0				1
1	IA		2	4				2
1	IB		2	5				1
1	IB		3	5				1
1	II		3	5				1
2		999	0	0				2
1		999	3	5				1
1	II		5	8				1
1	II		4	6				1
1	II		0	0				2
1	IB		3	3				1
1	IB		4	6				1
1	IA		4	5				1
1	IB		5	8				1

Gastric lavage given	Classification WHO	Perindiya scale	PSI	Pupils at arrival	Gastric lavage	Clinical manifestations	N 2 N C C 5
Gastric lavage Y/N 11 /NO 2	Classification WHO	Perindiya scale	PSI	Pupils at arrival	Gastric lavage	Respiratory-1:1,2 :2	
2	2	2	2	2	2		
2	2	2	1	1	1		
2	2	2	2	2	2		
2	2	2	2	2	2		
2	2	2	1	1	2		
2	2	2	1	1	2		
2	2	2	1	1	2		
2	2	2	1	1	2		
2	2	2	2	2	2		
2	2	2	1	1	2		
2	2	2	2	2	2		
2	2	2	2	2	2		
2	2	2	2	2	2		
2	2	2	1	1	2		
2	2	2	2	2	2		

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2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	2	2	2
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2	2	2	1	1	1
2	2	2	1	1	2
1	2	2	1	1	2
2	2	2	1	1	2
2	2	2	1	1	2
2	2	2	1	1	1
2	2	2	2	2	2
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2	2	2	2	2	2
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2	2	2	1	1	1
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	2	2	2
1	1	2	1	1	trach
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	1	1	Tracheostomy
2	2	2	2	2	2
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1	2	2	1	1	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	1	1	1
2	2	2	1	1	1
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	1	1	1
2	2	2	1	1	2
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2	2	2	1	1	1
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	1	1	1
2	2	2	2	2	2

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2	2	2	1	1	2
2	2	2	2	2	2
2	1	2	1	1	1
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	1	1	2
2	2	2	1	1	1
2	2	2	2	2	2
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2	2	2	2	2	2
2	2	2	2	2	2
2	1	1	1	1	1
2	2	2	2	2	2
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2	2	2	1	1	2
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2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	1	1	1
2	2	2	1	1	2
2	2	2	1	1	2
2	2	2	1	1	1
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2	2	2	1	1	2
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	1	1	2
2	2	2	1	1	1

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2	2	2	1	1	1
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2	2	2	1	2	2
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2	2	2	2	2	2
2	2	2	1	1	2
2	2	2	1	1	2
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2	2	2	2	2	2
2	2	2	1	1	2
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2	2	2	2	2	2
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2	2	2	1	1	2
2	2	2	2	2	2

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2	2	2	2	2	2
2	2	2	1	1	2
2	2	2	1	1	1
2	2	2	1	2	2
2	2	2	1	1	2
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	1 ICU STAY	1	1
2	1	2	1	1	2
2	2	2	1	1	2
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	2	2	2
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2	2	2	2	2	2
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1	2	2	1	1	2
2	2	2	2	2	2
2	2	2	1	1	1
2	2	2	1	1	2
1	2		1	1	2
1	1	1	1	1	no tracheostomy
2	2	2	1	1	2
1	2	2	1	1	2
2	2	2	1	1	2
2	2	2	2	2	2
2	2	2	1	1	2
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2	2	2	1	1	1
2	2	2	1	1	2
1	1	1	1	1	1
2	2	2	2	2	2
2	2	2	1	1	2

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2	2	2	1	1	1
2	2	2	2	2	2
2	2	2	1	2	2
2	2	2	1	1	2
1	2	1	1	1	1
1	2	2	1	1	2

Cardiovascular CARDIAC ARREST :1,SHOCK 2 2 :3 Cardiovascular:1 1 ,no :2	Hepatoxicity Y1 n2 Hepatoxicity	Nephrotoxicity Y:1 N:2 Nephrotoxicity	ICU stay -1 /No ICU stay -1 /No	Ventilation - 1:YES , 2:NO Ventilation - 1/NO	Tracheostomy Tracheostomy 1:1, NO: 2	
	0	2	2	4		3
26+trach -on day 2		1	2	4		3
	0	2	2	4		3
	0	2	2	4		3
3 days		1	2	4		3
10 days		1	1	4		3
5 days		1	1	4		3
4 days		1	2	4		3
	0	2	2	4		3
6 days		1	2	4		3
	0	2	2	4		3
	0	2	2	4		3
	0	2	2	4		3
5 days		1	2	4		3
	0	2	2	4		3
	0	2	2	4		3
2 days		1	2	4		3
2 days		1	2	4		3
	0	2	2	4		3
	0	2	2	4		3
	0	2	2	4		3
	0	1	1	4		1
10 days		1	1	4		3
4 days		1	2	4		1
6 days		1	2	1		3
5 days		1	2	1		3
19 days+trach		1	2	4		1
	0	2	2	4		3
24 days+trach on day 8		1	1	1		1
	0	2	2	4		3
7 days		1	2	4		3
	0	2	2	1		3

5 days		1	2		4	3
6 days		1	2	1+3		3
8 days		1	2		1	3
	0	2	2		4	3
2 days		1	2		1	3
	0	2	2		1	3
4 days		1	2		4	1
	0	2	2		4	3
14 days+trach		1	2		4	3
14 days -Trach on day3		1	2		4	1
	0	2	2		4	3
	0	2	2		4	3
4 days		1	1		4	3
	0	2	2		4	3
	0	2	2		4	3
ventilated days-0		1	1		2	3
8 days		1	2		4	3
	0	2	2		4	3
2o		2	2		4	3
24 days		1	1		4	1
	0	1	2		4	3
5 DAYS		1	1		4	3
5 DAYS		1	1		4	3
	0	2	2		4	3
	0	2	2		4	3
	0	2	2		4	3
	0	2	2		4	3
4 DAYS		1	2		4	3
5 DAYS		1	2		4	3
2 DAYS		1	2		4	3
3 DAYS		1	2		4	3
	0	2	2		4	3
25 DAYS		1	2		4	1
7 DAYS		1	2		4	3
25 DAYS		1	1		4	1
5 DAYS		1	2		4	3
3 DAYS		2	2		4	3
	0	2	2		4	3
7 DAYS		2	2		4	3
	0	2	2		4	3
	0	2	2		4	3
	0	2	2		4	3
48 HOURS		1	2		4	3
	0	2	2		4	3

	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
7 DAYS		2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
6 DAYS		2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
10 DAYS		2	1	4	1
3 WEEKS		1	1	4	1
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
7 DAYS		1	2	4	1
7 DAYS		1	2	4	3
	0	2	1	4	3
	0	2	2	4	3
12 DAYS		1	1	4	3
	0	2	2	4	3
	0	2	2	4	2
	0	2	2	4	3
20 DAYS		1	1	4	1
	0	2	2	4	3
10 DAYS		1	2	4	3
14 DAYS		1	1	4	1
6 DAYS		1	2	4	3
	0	2	2	4	3
6 DAYS		1	2	4	1
48 HOURS		1	2	4	3
	0	2	2	4	3
48 HOURS		2	2	4	3
	0	2	2	4	3
6 DAYS		1	1	4	3
14 DAYS		1	2	2+3	1
	0	2	2	4	3
4 DAYS		1	1	4	3
	0	2	2	4	3
	0	2	2	4	3
21 DAYS		1	1	4	1
	0	2	2	4	3
	0	2	2	4	3

	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	1+2+3	3
	0	2	2	4	3
	0	2	2	4	3
4 DAYS		1	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	2	3
7 DAYS		1	1	4	3
7 DAYS		1	1	4	3
5 DAYS		1	1	4	1
20 DAYS		1	1	4	3
	0	2	2	3	3
8 DAYS		1	2	4	3
	0	2	2	4	3
	0	2	2	4	3
8 DAYS		1	1	4	3
8 DAYS		1	2	4	3
6 DAYS		1	1	4	3
48 HOURS		1	2	4	3
10+7 DAYS		1	1	4	3
	0	2	2	4	3
5 DAYS		1	2	4	3
25 DAYS		1	1	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
10 DAYS		1	2	4	3
	0	2	2	1	3
	0	2	2	4	3
12 DAYS		2	2	4	3
4 DAYS		1	1	4	3
	0	2	2	4	3
4 DAYS		1	1	4	3
24 DAYS		1	1	4	3
24 DAYS		1	1	4	3
5 DAYS		1	2	4	3
	0	2	2	4	3

	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
10 DAYS		2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
5 DAYS		1	2	4	3
5 DAYS ICU		1	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
7 DAYS		1	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
	0	2	2	4	3
7 DAYS		1	2	4	3
	0	2	2	4	3
20 DAYS		1	2	4	1
	0	2	2	4	3
	0	2	2	4	3
	0	1	2	4	3
5 DAYS IN ICU		1	1	4	3
	0	2	2	4	3
5 DAYS IN ICU		2	1	4	3
7 DAYS		1	1	4	3
	0	2	2	4	3
15 DAYS		1	1	4	1
12 DAYS		1	1	4	1
8 DAYS		1	2	4	3
8 DAYS		1	2	4	3
	0	2	2	4	3
	0	2	2	4	3
3 DAYS		1	1	4	3
	0	2	2	4	3
	0	2	2	4	3

5 DAYS		1	1		4	3
	0	2	2		4	3
20 DAYS		1	1		4	1
4 DAYS		1	2		4	3
4 days		1	1		4	3
20 days		1	1		4	3
10 DAYS		1	1		4	3
4 DAYS		1	1		4	3
6 DAYS		2	1		4	3
	0	2	2		4	3
	5	1	1		4	3
24 HOURS		2	2		2	3
	0	2	2		4	3
48 HOURS		1	2		4	3
8 DAYS		1	1		4	3
24 HOURS		1	1		2	3
	0	2	2		4	3
3DAYS		1	2		4	3
	1	1	1		2	3
4 DAYS		1	2		4	3
20 DAYS		1	1		4	3
4 DAYS		1	2		4	1
25 DAYS		1	1	2+3		3
	0	2	2		4	3
12 DAYS		1	1		4	3
23 DAYS		1	1		4	3
24 DAYS		1	2		4	3
	0	2	2		4	3
7 DAYS		1	2		4	3
1 DAY ICU STAY		1	2		4	3
10 DAYS		1	2		4	1
	0	1	2		4	3

No.of days of ventilation	oxygen	VAP/DVT	Co -morbid factors	Long term complications
No.of days of ventilation	oxygen yes 1,NO :2	VAP/DVT y:1,NO :2	Co -morbid factors ACOHOL 1,DM 2,HTN 3 NIL4	Long term complicationsVOCAL CORD PALSY/TRACH /STENOSIS:1, LIVER :2, NIL:3
149	1			
207	1			
312	1			
6754	1			
100	1			

	49	1
	64	1
	125	1
	558	1
	132	1
	148	1
	247	1
	182	1
	401	1
	47	1
	123	1
	113	1
	1599	1
	352	1
	4262	1
	66	1
	90	1
	993	1
	131	1
	126	1
	86	1
X		1
	847	1
	90	1
	8490	1
	274	1
	198	1
	91	1
	7491	1
	9206	1
	125	1
	156	1
	108	1
	165	1
	79	1
	95	1
	74	1
	165	1
X		1
	421	1
	240	1
	1512	1
	7512	1
	89	1
	159	1

169	1
133	1
328	1
159	1
6850	1
4208	1
1200	1
4251	1
2361	1
76	1
4405	1
728	1
83	1
6947	1
80	1
621	1
71	1
57	1
2018	1
5493	1
64	1
144	1
66	1
7326	1
115	1
4540	1
7191	1
116	1
371	1
158	1
15	1
2330	1
257	1
5012	1
173	1
692	1
192	1
815	1
120	1
6596	1
259	1
75	1
156	1
601	1

156	1
101	1
129	1
7101	1
135	1
452	1
128	1
1957	1
90	1
164	1
580	1
107	1
213	1
110	1
103	1
106	1
290	1
107	1
124	1
100	1
91	1
110	1
94	1
1270	1
188	1
188	1
92	1
247	1
9928	1
123	1
66	1
73	1
139	1
936	1
76	1
1176	1
639	1
71	1
115	1
118	1
	1
159	1
1187	1
77	1

186	1
150	1
1143	1
116	1
915	1
103	1
139	1
131	1
123	1
333	1
109	1
331	1
405	1
3814	1
461	1
67	1
95	1
47	1
297	1
125	1
244	1
64	1
58	1
68	1
96	1
80	1
1129	1
373	1
58	1
64	1
649	1
2995	1
79	1
103	1
174	1
153	1
900	1
900	1
141	1
2944	1
70	1
93	1
102	1
143	1

4228	1
384	1
542	1
234	1
128	1
4142	1
610	1
147	1
68	1
10718	1
88	1
437	1
110	1
253	1
308	1
117	1
7127	1
171	1
93	1
1644	1
32	1
273	1
104	1
5204	1
414	1
552	1
67	1
4442	1
83	1
115	1
134	2
42	2
70	2
44	2
3433	2
1752	2
80	2
815	2
107	2
89	2
2102	2
4092	2
190	2
186	2

214	2
110	2
603	2
481	2
76	2
6884	2
122	2
70	2
1170	2
49	2
128	2
164	2
96	2
66	2

cholinesterase levels Mortality
cholinesterase levels Mortality 1:1 ,1 :2

1.4

POST BAN PERIOD

A1	24	1	prophenophos 40%+cypermethrin4%	OP+ pyrethroid	II	
A2	23	1	Emamectin benzoate 5%	Pesticide		999
A5	24	2	UNKNOWN	OP		999
A6	35	1	Profenofos	OP	II	
A7	30	1	Chlorphyriphos 20%	OP	II	
A8	25	1	UNKNOWN	OP		999
A9	35	1	Quinalphos 20%+cypermethrin3%	OP+ pyrethroid	II	
A10	17	1	BIsypyribac sodium	HERBICIDE		999
A11	30	1	Monocrotophus 36%	OP	IB	
A12	35	2	UNKNOWN	PESTICIDE		999
A13	35	2	quinalphos	OP	II	
A14	59	2	10% PHORATE	OP	IA	
A15	30	1	Profenophos 50%+cypermethrin3%	OP+ pyrethroid	II	
A16	48	2	PROPHENOPHOS 50%	OP	II	
A17	26	2	CHLORPYRIFOS 1.5 %	OP	II	
A18	19	1	chlorphyriphos +cypermethrin	OP + PYRETHROID	II	
A19	50	1	prophenophos	OP	II	
A20	24	1	Monocrotophus 36 % GROUP	OP	IB	
A21	61	1	Monocrotophus 36 %	OP	IB	
A23	31	1	chlorphyriphos 50% +cypermethrin5%	OP+ pyrethroid	II	
A24	42	1	prophenophos 40%+cypermethrin4%	OP+ pyrethroid	II	

A25	32	1	Phenol phenyl 50%	OP		999
A26	29	1	Polydol-parathion	OP	IA	
A27	49	1	chlorphyriphos 50% +cypermethrin5%	OP+ pyrethroid	II	
A28	38	1	prophenophos 40%+cypermethrin4%	OP+ pyrethroid	II	
A29	57	2	gamma cyalothrin-0.005%+prallethrin	pyrethroid		999
A30	27	1	Chlorphyriphos 15%	OP	II	
A31	45	1	Propiconazole 25%	fungicide		999
A32	19	1	prophenophos 40%+cypermethrin4%	OP+ pyrethroid	II	
A33	27	1	Methylparathion 50%	OP	IA	
A34	52	1	chlorphyriphos 50% +cypermethrin5%	OP+ pyrethroid	II	
A35	23	1	Amitraz-triazapentadine	PESTICIDE		999
A37	55	1	Profenofos	OP	II	
A39	30	2	PHORATE 10%	OP	IA	
A40	47	2	QUIZALOFOP	Herbicide		
A41	46	2	Cypermethrin 10%	pyretthroid		999
A42	30	1	pyrethroid	pyrethroid		999
A43	61	2	Nitrobenzene 20 %	herbicide		999
A44	18	2	PROFENOFOS 50%	pesticide	II	
A45	31	2	monocrotophus	OP	IB	
A46	24	1	Bifenthrin 3% + Chlorpyriphos 30% and 100 ml of Lambdacyhalothrin 5%	OP + Pyrethroid	II	
A47	28	1	00 mL of Monocrotophos	OP	IB	
A48	23	2	monocrotophus	OP	IB	
A49	26	1	50% chlorpyrifos	OP	II	
A51	29	1	Phenothoate	OP	II	
A52	48	1	MONOCROTOPHUS	OP	IB	
A53	36	2	MONOCROTOPHUS	OP	IB	
A54	25	2	MONOCROTOPHUS	OP	IB	
A56	56	1	999	999		999
A58	45	1	CHLORPYRIPHOS	OP	II	
A59	41	1	MONOCROTOPHUS	OP	IB	
A60	35	2	CHLORPYRIPHOS	OP	II	
A61	28	1	CHLORPYRIPHOS 50% +CYPERMETHRIN OP+PYRETHROID		II	
A62	26	1	Indoxacarb	CARBAMATE		999
A63	32	1	Thiamethoxam	NEONICOTINOID		999
A64	66	2	TEBUCONAZOLE	FUNGICIDE		999
A65	50	1	Deltamethrin 1.25%	PYRETHROID		999
A66	22	1	PARAQUAT	PARAQUAT		999
A67	26	1	QUINALPHOS + DIMETHYLBENZENE	OP	II	
A68	23	1	Acephate 75%	OP	III	
A69	45	1	PROPENOFOS + CYPERMETHRINE	OP+PYRETHROID	II	
A70	40	1	Cartap hydrochloride 4.1%	PESTICIDE		999
A71	30	1	CHLORPYRIFOS 20%	OP	II	

A72	35	1	PROFENOFOS 50%	OP	II	
A73	19	2	CARBOFURAN 3% POISONING	CARBAMATE		999
A74	25	1	Transfluthrin	PYRETHROID		999
A3	25	1	Yellow phosphorus+daltemethrin	Pesticide+pyrethroid		999
A4	30	1	chlorphyriphos 50% +cypermethrin5%	OP+ pyrethroid	II	
A22	56	1	prophenophos 40%+cypermethrin4%	OP + pyrethroid	II	
A36	60	1	Dichlorvas	OP	IB	
A38	25	2	zinc phsophide 2%	Rat killer compound		999
A50	49	1	250ml of Cypermethrin 50% + Chlorpyrifos 5%	OP +Pyrethroid	II	
A55	67	1	CHLORPYRIPHOS 50% +CYPERMETHRIN 5%	OP+PYRETHROID	II	
A57	53	2	CHLORPYRIPHOS 50% +CYPERMETHRIN	OP+PYRETHROID	II	

NAME	AGE	SEX M:1 F:2	NAME OF COMPOUND	CLASSIFICATION OF PESTICIDES OP VS HERBICIDE VS PYRETHROID VS CARBMATES	WHO
			class ii		
			class i		
			compound mix op+pyrethroid		
			compound mix other		

1	1	1	1	1	
999	1	1	1	1	
2	2	1	2	2	
0	0	1	1	1	
0	1	1	1	1	
1	1	1	1	1	
1	0	2	1	1	
	0	1	1	1	
2	3	1	1	2	
1	1	1	1	1	
4	3	3	1	1	
1	1	2	1	1	
2	0	1	1	1	
1	1	1	1	1	
1	1	2	1	1	
0	1	1	1	1	
0	2	1	1	1	
0	2	1	1	1	
2	3	1	2	1	
2	2	1	2	1	
1	2	1	1	1	
0	0	1	1	1	

7	3		3	2	2
2	3		1	1	2
4	3		3	1	2
1	1		1	1	2
3	2		1	1	1
	0		1	1	2
1	3		3	1	2
3	3		2	1	1
2	2		1	1	2
999	1		1	1	2
1	1		1	1	2
1	1		1	1	1
			1	1	1
0	0		1	1	1
0	0		1	1	1
0	0		1	1	1
1	2		1	1	1
4	6		3	2	1
2	1		2	1	1
3	2		2	2	1
2	1	GCS - 2		1	1
3	3		2	1	1
8	10		3	1	1
3	4		1	1	1
7	6		3	2	1
6	7		3	1	1 1+PNEUMOTHOR
7	10		3	2	1
2	2		1	1	1
2	2		1	1	1
0	0		1	1	1
2	2		1	1	1
999	999		1	1	1
999	999		1	999	1
999	999		1	999	1
999	999		1	999	1
999	999		1	1	1
1	1		1	1	1
1	1		1	1	1
3	5		2	1	1
999	999		1	1	1
1	1		1	1	1
1	1		1	1	1
999	999		1	1	1
999	999		1	1	1

999		2	1	1	1	
4		4	3	2	1	
4		4	3	2	2	
5		3	3	2	2	
0		0	1	1	2	
9		12	3	1	1	
8		10	3	2	1	
6		7	2	1	1	

Perindiya scale 0-3 MILD,4-7 MODERATE,8-11 SEVERE	PSI:POISON SEVERITY INDEX	A.GCS at arrival;GLASCOW COMA SCALE -3 :< OR =8, 2 :9-14, 3:15/15	B.PUPILS AT ARRIVAL >2 MM:1 <2MM:2	C.GASTRIC LAVAGE GIVEN YES1 /NO 2	D.RESPIRATORY COMPLICATIONS YES:1,2 :2
				GIVEN LAVAGE:1/NOT GIVEN :2	
			PUPILS >2MM: 1 AND <2 MM :2		TYPE I RESPIRATO FAILURE

	3	3	2	2	
	3	3	2	2	
	1	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	3	2	2	
	3	2	2	2	
	3	3	2	2	

3	3	2	2	
2	2	1	2	
2	3	2	1	
2	3	1	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
2	3	2	2	
2	3	1	2	
1	3	2	2	
3	2	2	2	
5	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
METHAEMOGLOBINEMIA		2	2	1
3	3	2	2	
3	3	2	2	
3	3	2	2	
1+3		3	2	2
3	3	2	2	
2	3	2	2	
2	3	2	2	
3	3	2	2	
1+EPS		3	2	2
1+2		1	2	2
1+2+6		3	2	2
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
METHAEMOGLOBINEMIA		3	2	2
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	
3	3	2	2	

		3		3		2		2		
		1		3		1		2		
		4		3		2		2		
		3		2		2		2		
		4		2		2		1		
		3		2		1		2		
1+2+4				3		2		2		
6+HIE				1		1		1		
		3		3		2		2		
E:NEUROLOGICAL COMPLICAITONS:IS:1,CHOLINERGIC CRISIS 2 /2 3 /DOPE:4,EPS 5,SEIZURES 6			f:CARDIOVASCULAR CARDIAC ARREST :1,SHOCK 2 2 :3		G.HEPATOXICITY-Y1 n2		H.NEPHROTOXICITY y:1 N:2		I. ICU stay -Ye /No2	
	0	2	2				4		3	
	0	2	2				4		3	
25 days +trach		1	1				4		1	
	0	2	2				4		3	
	0	2	2				4		3	
	0	2	2				4		3	
	0	2	2	1+2					3	
	0	2	2				4		3	
18 days -trach day3		1	1				4		1	
	0	2	2				4		3	
7 days		1	1				4		3	
	0	2	2				4		3	
14 -trach day 7		1	1				1		1	
	0	2	2	1+2					3	
	0	2	2				4		3	
	0	2	2				4		3	
	0	2	2				1		3	
	0	2	2				1		3	
	0	2	2	1+2+3					3	
	0	2	2				4		3	
	0	2	2				1		3	
	0	2	2				1		3	
11 days		1	1				4		1	
5 days		1	1				4		3	
7+ trach		1	1	1+2					1	
	0	2	2				4		3	
	2	2	2				4		3	
	0	2	2				4		3	
11+trach		1	1				4		1	
26 days +trach		1	1				4		1	

	6	1	1	4	1
	0	2	2	4	3
	0	2	2	1	3
	2	2	2	4	3
	2	2	2	2	3
	2	2	2	4	3
	2	2	2	4	3
7 DAYS		1	1	2	3
	2	2	2	4	3
19 DAYS		1	2	4	1
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
7 days of ventilation		2	2	4	3
5 DAYS		1	2	4	3
	2	2	2	4	3
28 DAYS		1	1	4	1
23 DAYS		1	1	4	1
26 DAYS		1	1	3	1
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
7 DAYS		1	1	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
4 DAYS		1	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	2	2	2	4	3
	0	2	2	4	2
33 days + trach		1	1	1	1
5 days		1	1	4	1
20 days+trach		1	1	2	1
	2	1	1	4	3
10 DAYS		1	2	4	3
33 Days		1	1	3	1
	2	2	2	4	3

No.of days of ventilation	oxygen Y:1 N:2	VAP:Y1,N:2	CO MORBID- ACOHOL 1,DM 2,HTN 3	Long term complications: VOCAL CORD PALSY /STENOSIS:1, LIVER :2,
			24	2:3
251		1		
6459		1		
103		1		
302		1		
138		1		
114		1		
184		1		
6597		1		
256		1		
7161		1		
142		1		
2104		1		
1241		1		
463		1		
6234		1		
277		1		
162		1		
7881		1		
440		1		
141		1		
328		1		
2613		1		
193		1		
155		1		
100		1		
6813		1		
4000		1		
2604		1		
232		1		
591		1		
195		1		
9789		1		
121		1		
7729		1		
8780		1		
7063		1		
11435		1		
3808		1		
1722		1		
262		1		

	155	1
	137	1
	7117	1
	178	1
	2353	1
	6425	1
	140	1
	154	1
	272	1
	1728	1
	5912	1
	185	1
	176	1
	3533	1
X		1
X		1
	5764	1
X		1
	115	1
X		1
	143	1
	8497	1
	138	1
	302	1
	4412	1
	6552	1
X		2
	129	2
	525	2
	226	2
		2
	256	2
	160	2
	150	2

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Anna Benjamin Pulimood, M.B.B.S., MD., Ph.D.,
Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

July 03, 2019

Dr. Angel.S,
PG Registrar
Department of Medicine - I,
Christian Medical College,
Vellore – 632 002

Sub: **Fluid Research Grant:**
Changing spectrum of pesticide poisoning –Past and present - in the context of policy changes related to pesticide bans.
Dr. Angel.S, PG Registrar, Medicine, Dr. Punitha J.V Dr. Anand Zachariah, Medicine, Dr.Binila Chacko MICU, Dr. Alice Nithyananth, Medicine I, Dr. Ravikar Ralph, Medicine I, Dr. Thambu David, Medicine II Dr. Sowmya Satyendra, Medicine III, Dr. O.C.Abraham, Medicine IV Dr. Ramya I, Medicine V, Dr. Alex Reginald, Internal Medicine

Ref: IRB Min. No. 11922 [OBSERVE] dated 06.03.2019

Dear Dr. Angel.S,

The Institutional Review Board (**Blue**, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "Changing spectrum of pesticide poisoning –Past and present - in the context of policy changes related to pesticide bans" on March 06th, 2019.

The Committee reviewed the following documents:

1. IRB application format
2. Patient Information Sheet and Informed Consent Form
3. Data Collection Proforma
4. Signature Page
5. Cvs of Drs. Reginald Alex, Anand Zachariah, Punitha, Ravikar Ralph, Angel E, Alice Joan M, Binila Chacko, OC Abraham, Sowmya S, Ramya and Vignesh.
6. No. of documents 1 – 5.

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on March 06th 2019 in the New IRB Room, Bagayam, Christian Medical College, Vellore 632 004.

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284202 Fax: 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
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Chairperson, Ethics Committee.

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Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Name	Qualification	Designation	Affiliation
Dr. Biju George	MBBS, MD, DM	Professor, Haematology, Research), Additional Vice Principal , Deputy Chairperson (Research Committee), Member Secretary (Ethics Committee), IRB, CMC, Vellore	Internal, Clinician
Dr. B. J. Prashantham	MA(Counseling Psychology), MA(Theology), Dr. Min(Clinical Counselling)	Chairperson, Ethics Committee, IRB. Director, Christian Counseling Centre, Vellore	External, Social Scientist
Mr. C. Sampath	BSc. BL	Advocate, Vellore	External, Legal Expert
Ms. Grace Rebekha	M.Sc., (Biostatistics)	Lecturer, Biostatistics, CMC, Vellore	Internal, Statistician
Mr. Samuel Abraham	MA, PGDBA, PGDPM, M. Phil, BL.	Sr. Legal Officer, CMC, Vellore	Internal, Legal Expert
Dr. John Jude Prakash	MBBS, MD,	Professor, Clinical Virology, CMC, Vellore	Internal, Clinician
Dr. Rekha Pai	BSc, MSc, PhD	Associate Professor, Pathology, CMC, Vellore	Internal, Basic Medical Scientist
Dr. Premila Abraham	M.Sc. Ph.D	Professor, Department of Biochemistry, CMC, Vellore	Internal Clinician
Mrs. Sophia Vijayananthan	MSc Nursing	Addl. Deputy Dean CMC, Vellore	Internal, Nurse
Rev. Joseph Devaraj	BSc, BD	Chaplaincy Department, CMC, Vellore	Internal, Social Scientist
Dr Sneha Varkki	MBBS, DCH, DNB	Professor, Paediatrics, CMC, Vellore	Internal, Clinician
Mrs. Pattabiraman	BSc, DSSA	Social Worker, Vellore	External, Lay Person
Dr. Jayaprakash Muliyil	BSC, MBBS, MD, MPH, Dr PH (Epid), DMHC	Retired Professor, CMC, Vellore	External, Scientist & Epidemiologist

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Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Mrs. Nirmala Margaret	MSc Nursing	Addl. Deputy Nursing Superintendent, College of Nursing, CMC, Vellore	Internal, Nurse
Dr. Asha Solomon	MSc Nursing	Associate Professor, Medical SurgicalNursing, CMC, Vellore	Internal, Nurse
Dr. Santhanam Sridhar	MBBS, DCH, DNB	Professor, Neonatology, CMC, Vellore	Internal, Clinician
Dr. Ajith Sivadasan	MD, DM	Professor, Neurological Sciences, CMC, Vellore	Internal, Clinician
Dr. Barney Isaac	M.B.,B.S. D.N.B (Respiratory Diseases)	Associate Professor, Pulmonary Medicine, CMC, Vellore	Internal, Clinician
Dr. Winsely Rose	MBBS, MD (Paed)	Professor, Paediatrics, CMC Vellore	Internal, Clinician
Dr. Thomas V Paul	MBBS, MD, DNB, PhD	Professor, Endocrinology, CMC, Vellore	Internal, Clinician
Dr. Vivek Mathew	MD (Gen. Med.) DM (Neuro) Dip. NB (Neuro)	Professor, Neurology, CMC, Vellore	Internal, Clinician

We approve the project to be conducted as presented.

Kindly provide the total number of patients enrolled in your study and the total number of Withdrawals for the study entitled: "Changing spectrum of pesticide poisoning –Past and present - in the context of policy changes related to pesticide bans" on a monthly basis. Please send copies of this to the Research Office (research@cmcvellore.ac.in).

Fluid Grant Allocation:

A sum of 20,000/- INR (Rupees Twenty thousand Only) will be granted for 18 Months.

Yours sincerely,

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS., MD., DM.
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

IRB Min. No. 11922 [OBSERVE] dated 06.03.2019

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