ELEVATED BLOOD LEAD LEVELS AND ASSOCIATED HEALTH EFFECTS AMONG PEOPLE INVOLVED IN RESIDENTIAL AND AUTOMOBILE PAINTING OCCUPATION FROM RURAL AND URBAN AREAS OF VELLORE, TAMIL NADU

Dissertation submitted in partial fulfilment of the requirement of

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Examination to be held in May 2022

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CERTIFICATE

This is to certify that "Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu" is a bona fide work of Dr. Mithula T in partial fulfilment of the requirements for the M.D. Community Medicine Examination (Branch-XV) of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, to be held in May 2022.

Dr. Venkata Raghava Mohan, MD, MPH Guide, Professor
Department of Community Health
Christian Medical College
Vellore – 632002.

Dr. Vinod Joseph Abraham, MD, MPH Professor and Head
Department of Community Health Christian Medical College
Vellore – 632002.

Dr. Pamela Christudoss
Department of Clinical Biochemistry.
Christian Medical College,
Vellore - 632002

Dr. Arun Jose Nellickal
Department of Clinical Biochemistry.
Christian Medical College,
Vellore - 632002

Dr. Anna B. Pulimood, MD, Ph.D
Principal
Christian Medical College
Vellore – 632002.

DECLARATION

This is to certify that this dissertation titled, "Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu" is a bona fide work done by me, under the guidance of DR. VENKATA RAGHAVA MOHAN, MD, MPH in partial fulfilment of the rules and regulations for the MD Branch XV (Community 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 analyses and evaluation towards the completion of the thesis.

DR. MITHULA T

REGISTRATION NO: 201925054

POST GRADUATE STUDENT

DEPARTMENT OF COMMUNITY HEALTH

CHRISTIAN MEDICAL COLLEGE

VELLORE – 632002.

Certificate - II

This is to certify that this dissertation work titled ‘Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu.

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Submitter email	drmithula92@gmail.com
Similarity	3%
Analysis address	drmithula92.mgrmu@analysis.urkund.com

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W	URL: https://www.aafp.org/afp/2010/0315/p751.html Fetched: 2020-01-31T03:38:09.6870000	1
W	URL: https://wedocs.unep.org/bitstream/handle/20.500.11822/22792/GAELP_operational-framework.pdf?sequence=1 Fetched: 2022-01-20T16:23:31.8170000	1
W	URL: https://cdn.who.int/media/docs/default-source/gho-documents/public-health-and-environment/ech-lead-regulations-database-update31aug2021.xlsx?sfvrsn=ad366101_16 Fetched: 2022-01-20T16:23:21.6030000	1
W	URL: https://emedicine.medscape.com/article/1174752-treatment Fetched: 2020-12-15T20:09:38.7470000	1

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LIST OF COMMON ABBREVIATIONS USED

ABLES	Adult Blood Lead Epidemiology and Surveillance
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CHAD	Community Health and Development
CMC	Christian Medical College
DALY	Disability Adjusted Life Years
EDTA	Ethylenediaminetetraacetic acid
EBLL	Elevated Blood Level
ICMR	Indian Council of Medical Research
IHME	Institute for Health Metrics and Evaluation
IRB	Institutional Review Board
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
Pb	Plumbum
Ppm	Parts per million
PEL	permissible exposure limit
REL	Recommended Exposure Limit
SES	Socio Economic Status
WHO	World Health Organization
ZPP	Zinc Protoporphyrin

TABLE OF CONTENT

INDEX OF TABLES

INDEX OF FIGURES

INDEX OF ANNEXURE

1. INTRODUCTION

Lead is a naturally occurring toxic metal found in the Earth's crust. Its widespread use has resulted in extensive environmental contamination, human exposure, and significant public health problems in many parts of the world (1). There are two types of lead – Organic and inorganic lead.

Essential sources of environmental contamination include mining, smelting, manufacturing, and recycling activities, and, in some countries, the continued use of leaded paint and leaded aviation fuel. More than three-quarters of global lead consumption is for the manufacture of lead-acid batteries for motor vehicles (1,2). Lead is, however, also used in many other products, for example, pigments, paints, solder, stained glass, lead crystal glassware, ammunition, ceramic glazes, jewellery, toys and some cosmetics and traditional medicines (1,3).

Lead in the body is distributed to the brain, liver, kidney, and bones. It is stored in the teeth and bones. Lead poisoning is a medical condition caused by increased levels of heavy metal lead in the body. This can interfere with various body processes and causes toxicity to many organs and tissues. It's also called Plumbism, Colica Pictonum or Saturnism (1,2,3). Lead poisoning may be acute (from intense exposure of short duration) or chronic (from repeat low-level exposure over a prolonged period). During the past century, the adverse effects of lead on children have been of concern to many. And even as the world undergoes a metamorphosis in development and technology, one thing is for sure- "prevention is the best way to deal with lead poisoning) (1).

2. OBJECTIVES

- To assess the prevalence of elevated blood lead levels among people involved in residential and automobile painting occupation from rural and urban areas of Vellore.
- To identify factors associated with elevated blood lead levels among painters from rural and urban areas of Vellore.
- To study the associated health effects due to elevated blood lead levels among the people involved in painting occupation from rural and urban areas of Vellore.

3. JUSTIFICATION

Lead poisoning is one of the most common preventable paediatric and occupational health problems today (1,3). Lead is ubiquitously found and is the most studied of all human toxins; the weight of evidence of its damaging effects on health and the environment is overwhelming (1).

A recent study was done in 2014 among Sany Heavy Industry Company Limited and Xiangjiang Kansai Paint Corporation shows that there were 55 workers (10.4%) whose blood lead level (BLL) were 0.04 mg/L. The maximum value of BLLs was 0.35mg/L. The multivariate logistic regression showed that smoking (OR=2.424), smoking or eating in the workplace (OR=2.139), not washing hands before smoking or eating (OR=1.624), and the cycle of changing masks longer than two weeks (OR=2.158) were positively associated with BLL (4).

In India, many studies have been conducted to estimate the burden of lead poisoning and its risk factors, showing that lead poisoning continues to be a public health problem even after a decline in leaded petrol. Though many cross-sectional studies are conducted, there are very few community-based risk factor studies assessing environmental sources for elevated BLLs in India.

The painters' exposure to lead-based paints can be reduced through less use of lead paints and the correct use of the appropriate personal protective equipment in all stages of handling paints (3,4). Improper handling may result in severe acute poisoning. In some cases, adverse health effects may also result from long-term, low-level exposures. As a result of the widespread diffusion of lead paints, a significant part of the population may be exposed to lead due to occupation. Several groups of people characterized by quite different patterns and degrees of exposure face the risk

of adverse effects. Clinical manifestations occurring during the acute phase are different from those exposed for a longer duration of time. (4).

This study is a community-based cross-sectional study that aims to study the burden and socio-demographic, occupation-related risk factors for elevated blood lead levels and their effects on health in commercial and automobile painting painters residing in Vellore Tamil Nadu.

4. REVIEW OF LITERATURE

4.1 Introduction:

Lead is a chemical element with the symbol Pb (from the Latin plumbum) and atomic number 82. (1,2). Compared to other materials, it's a hefty metal. The melting point of lead is quite low, making it pliable and easy to work. When lead is first cut, it appears silvery with a trace of blue; when exposed to the elements, it darkens to a drab grey colour (3,4). One of the lead's isotopes serves as a nuclear decay endpoint for three key nuclear decay pathways for heavier elements (1,3).

Lead is a post-transition metal that is essentially inert. Acidic and basic reactions with lead and lead oxides demonstrate its amphoteric nature. It also tends to create covalent bonds (5). Rather than the more typical +4 oxidation state, lead compounds are more commonly discovered in the +2-oxidation state in the organs. Like the other lighter metals, lead likes to form chains and polyhedral structures by itself (6,7).

Prehistoric inhabitants in the Near East were aware of lead's easy extraction from its ores. Galena is one of the most important sources of lead and silver. In ancient Rome, a desire for silver sparked the extensive mining and usage of lead (1,3). After the collapse of Rome, lead production dwindled, and it wasn't until the Industrial Revolution that is returned to pre-Roman levels. About ten million tonnes of lead were produced in 2014, with more than half of that coming from recycling. In addition to its low melting point, flexibility, and oxidation resistance, lead is valuable because of its high density, low melting point, and flexibility (8). Because of these features and its availability and low cost, lead has been extensively used in a variety of industries, including building, plumbing and the manufacture of lead-based paint, bullets, and shot as well as in the production of lead-acid batteries (1,8,9).

It wasn't until the late 19th century that lead toxicity was understood, and its usage has since been phased out of a wide range of industries (10,11). However, lead-containing items are sold in many nations, including paints and bullets (12). As a neurotoxin accumulates in soft tissues and bones, lead causes neurological illnesses, such as brain damage and behavioural abnormalities. General health, cardiovascular, and renal systems are all impacted by lead exposure (12,13,14).

4.2 History of public exposure to lead:

The general population has long been exposed to lead in food and drink. Because of the widespread use of lead in Roman water pipes and ceramic containers, particularly for storing wine, lead poisoning was a common occurrence. Around 370 BC, the first cases of occupational lead poisoning were documented (11,15). In the 19th and early 20th centuries, workers in the smelting, painting, plumbing, printing, and other industrial fields were exposed to lead. When Franklin visited Paris in 1767, he was shown a list of patients at La Charite' Hospital who had been admitted owing to symptoms that were indicative of lead poisoning. All the patients had occupations that put them in contact with lead (11,16).

In 1839, Tanqueral des Planches described the symptoms of acute lead poisoning based on 1213 patients hospitalised to La Charite Hospital between 1830 and 1838. As a result of the thoroughness of his work, little new information has been contributed to the clinical picture of acute lead poisoning in adults. Lead poisoning was a widespread problem in the United Kingdom in the mid-19th century, and a parliamentary investigation was launched in 1882 after the deaths of several workers in the lead industry. Because of this, the 1883 Factory and Workshop Act (Prevention

of Lead Poisoning) was passed, requiring lead makers to meet specific minimum standards, such as the supply of ventilation and protective equipment.

Lead poisoning in children from non-occupational exposure has gotten a lot of attention (11,16,17) in particular. Acute occupational lead poisoning has been dramatically reduced in rich countries because of improved working conditions. However, concerns have been raised about the long-term effects of even modest levels of lead exposure.

Although symptoms due to lead poisoning in children were first observed in Australia in 1892, it wasn't until a group of 10 new-borns with lead colic 12 years later that the reason was discovered: peeling lead-based paint. Children exposed to ambient lead at levels that did not cause clinical encephalopathy throughout their childhood were more likely to have long-term abnormalities in cognitive development (11,18,19).

Children who survive acute lead poisoning generally have substantial impairments in their neurobehavioral function, according to case-control studies on mental retardation and hyperactivity linked to ambient lead exposure.

Numerous studies conducted over the last 30 years have shown that even low amounts of lead in the blood may cause serious health problems. A constant decrease has thus been made to the permissible exposure levels in both the working and ambient environments (air, water, soil etc.) (20,21). Chronic exposure to low levels of lead remains a significant public health danger, especially for ethnic minorities and the poor, not withstanding the decline in lead poisoning in wealthy countries (11,22). Furthermore, occupational, and environmental exposures remain a significant problem (23).

4.3 Global lead contamination and multiple sources:

As a result of the industrial revolution and large-scale mining, human population exposure to environmental lead has grown significantly. Compared to other non-essential elements, lead pollutes the environment at a higher rate (10,24,25). It is believed that throughout the last five millennia, the massive processing of lead ores has released over 300 million tonnes of lead into the environment, the majority of which occurred within the last 500 years (26).

Human activities have resulted in a massive rise in the amount of lead circulating in the soil, water, and air worldwide, contributing to persistent global lead pollution (11,30). Because of the increased use of lead in gasoline following the invention of the automobile at the turn of the 20th century, environmental pollution with lead increased dramatically (27). As a result, the general public was exposed to higher levels of ambient lead during the 20th century. Between 1965 and 1990, global consumption of lead progressively increased to almost 5.6 million tonnes (20,28,29). Between 1979 and 1990, lead consumption in emerging nations climbed from 315 000 to 844 000 tonnes per year, whereas in developed countries it barely changed.

An estimated 0.0016µg/dl pre-industrial blood lead level in humans has been estimated; this is 50–200 times lower than the lowest documented levels of persons in remote areas now of the southern and northern hemispheres (0.078 µg/dl and 0.320 µg/dl respectively) (11,19,31). To put that in perspective, it's around 625 times lower than the current US Centers for Disease Control and Prevention (CDC) recommendation for children (i.e., 1 µg/dl) (19). The current population's lead load is 500–1000 times more than their pre-industrial ancestors, as seen by levels of lead in human skeletal remains (32).

4.4 Sources of lead in the environment:

Unlike overt lead poisoning, where there is generally one obvious source, low-level environmental exposure to lead relates to various sources (petrol, industrial processes, paint, solder in canned goods, water pipes) and routes (air, household dust, street filth, soil, water, food) (33). Evaluation of the proportional contributions of sources is consequently difficult and likely to differ between places and demographic groupings. Where lead produced from petrol forms the primary component of atmospheric lead, it is a considerable contributor to the body lead load. It is the most extensively dispersed metal source in the environment (11,34,35). Atmospheric lead deposited in soil and dust may later be swallowed by youngsters and may dramatically boost their blood lead levels (11,36,37). In addition to inhaling lead from the air, food and water are vital sources of baseline exposure to lead for the public who are not employed in the industry (38). It is consequently desirable to phase out the use of lead additives in fuels as fast as feasible worldwide.

Even in nations where significant efforts have been made to eliminate lead, enormous metal reservoirs remain in soil, dust and house paint, and these sources will continue to damage populations for many years (11,39). Even though lead poisoning is a significant public health concern globally, many emerging nations have only begun to identify it as a real issue, as seen by recent research from Africa, Asia, and South America (2,25).

Table 4.1: Environmental exposure to lead.

Medium	Median blood lead level among	
	Children	Adults
Air[b]	0.09 µmol Pb per litre (1.92 µg P Pb/dl) Per µg Pb/m^3 air	0.079 µmol Pb per litre (1.64 µg P Pb/dl) Per µg Pb/m^3 air
Water	-	0.003 µmol Pb/litre (0.06 µg Pb/dl) per µg Pb/litre
Food	**4.6** µmol Pb/litre per µg Pb/day (0.16 µg Pb/dl)	0.002-0.003 µmol Pb/litre (0.04-0.06 µg Pb/dl) per µg Pb/day
Dust	0.09 µmol Pb/litre (1.8 µg Pb/dl) Per 1000 µg Pb/g dust	-
Soil	0.11 µmol Pb/litre (2.2 µg Pb/dl) Per 1000 µg Pb/g soil	-

a. The relationships are curvilinear and are broad guidelines that are not applicable at lower or higher levels of exposure.
b. A value in the range 0.144–0.24 mmol Pb/litre or in the range 3–5 mg Pb/dl per mµg/m3 is obtained when one considers indirect contribution through deposition on soil/dust.
c. The air to blood lead relationship in occupational settings is best described by a curvilinear relationship with slopes in the range 0.02–0.08 mµg/m3 air. The slope is variable but lower than that for humans in the general environment (1.6–1.9 mµg/m3).

4.5 Occupational exposure:

Occupational exposure to lead that results in mild and clinically symptomatic poisoning have decreased substantially in many countries, even though cases of severe lead poisoning have decreased significantly. Adults who work in manufacturing environments where lead is present are more likely to be exposed than others (40,41). Workers are exposed to lead in various jobs, including motor vehicle assembly, panel beating, battery manufacture and recovery, soldering, lead mining and smelting, lead alloy production, and glass, plastics, printing, ceramics, and paint industries (29,32,36). Stricter restrictions and advances in industrial practices have made occupational lead poisoning less common than it used to be in most highly

industrialised countries. However, in underdeveloped nations, it remains an issue of potentially tremendous dimensions (23,42).

There is a lack of regulation of occupational lead exposure in emerging nations, and there is much less monitoring of exposure (11,12,42). The possibility for hazardous exposure to lead during smelting and refining the metal is widely established, both for primary new metal and secondary metal, i.e., scrap lead, smelters, and refineries. Small domestic secondary smelters in various countries are generally positioned near people's houses. Children and adults living close to such operations may be exposed to hazardous lead fumes and dust (11,40).

Workers are also at particular risk in battery manufacture, demolition work, welding, pottery, ceramic ware production (often a home-based occupation involving women and children), small businesses repairing automobile radiators, and jewellery and decorative items by artisans (43,44). The final group is of particular concern since most of the work is done by women and children in unregulated workshops or at home. Many nations, particularly underdeveloped countries and small home-based businesses do not distinguish between the house and the workplace, which means children are exposed to lead even though they make up the majority of participants (2,4,45). Because of the transfer of lead to the embryo in utero and the entrance of lead into people's homes on clothes, where small children become exposed, occupational exposure problems become serious community concerns (46,47).

4.6 Environmental exposure

4.6.1 Developed countries

Since the commercial usage of lead, notably in gasoline, has declined in most industrialised nations, coordinated efforts have decreased the amount of lead released into the environment (11,23). As a result of the phase-out of lead in gasoline and the reduction of ambient exposure to the metal, overall blood lead levels in these nations' populations have dropped considerably in the last two decades. As the following instances show, this tendency is likely to continue.

Between 1976 and 1991, the average blood lead level in Americans aged 1–74 years dropped from 1.28 µg/dl to 0.28 µg/dl, a 78% reduction. Non-Hispanic white children's mean blood lead levels decreased by 77 % (from 1.37 µg/dl to 3.20 µg/dl) while non-Hispanic black children's mean blood lead levels decreased by 72 % (from 2.02 µg/dl to 5.6 µg/dl) (10). Lead levels in the blood of non-Hispanic white children decreased from 85 % to 5.5 %, whereas in those of non-Hispanic black children dropped from 97 % to 20.6 % (34,48). A wide range of demographic groupings (age, sex, race/ethnicity, income level and urban status) indicated losses of the same magnitude. The elimination of lead from gasoline has been the primary factor in the decrease in blood lead levels that has been noticed over the last several years (33).

There was a 0.23 µg/dl overall mean blood lead level in people aged 51 years in the United States up until 1994; 2.2 % of the population had lead levels of 1 µg/dl or higher, which is the health concern level for children, according to the Third National Health and Nutrition Examination Survey (11,22). At 0.27 µg/dl, the average amount of lead in the blood of children aged 1–5 years in the United States was 4.4%. Lead levels in children of non-Hispanic black race/ethnicity, low income, and living in

older homes were all connected (49,50). According to a new study, children who live in old buildings, belong to minorities or are reared in low-income homes are at a higher risk of lead poisoning (11). In 1995–96, 1575 children aged 1–4 years in Australia were provided blood samples for testing. Lead levels in the blood were 0.5 µg/dl. One hundred fifteen of the children tested had a blood lead level of 5.10 µg/dl (7.3%) (23,51). Several countries, including Belgium, Germany, New Zealand, Sweden, and the United Kingdom, had significant decreases in adults' average blood lead levels between 1978 and 1988. Lead exposure in Barcelona's population was recently studied, and the changes over the last decade were reviewed (23). Umbilical cord blood lead levels ranged from 0.40 µg/dl in adults to 0.89 µg/dl in children, with the average blood lead level for all participants being 0.78 µg/dl (52). Blood lead levels have fallen by more than half in the last decade, indicating that the amount of lead in the air has decreased (53).

4.6.2 Developing countries

In underdeveloped countries, lead continues to pose a significant public health danger due to a wide range of sources and pathways of exposure. Exposure from various sources may be significantly greater for those living in poverty than those exposed universally to leaded gasoline. Lead-glazed ceramics is a far more effective source for recurrent exposure to leaded paint in Latin American countries (47,54). Lead mining, smelting, battery manufacturing, and small-scale cottage industries pose a significant environmental risk (50,55).

People living near conventional and cottage lead smelters in Jamaica were asked to study to examine the distribution and causes of environmental and blood lead levels. 44% of children under the age of six who had been exposed to lead had blood lead

levels of 5.25 µg/dl, which is almost twice as high as those in the unaffected group. Ninety-eight % of preschool children and 82 % of students had blood lead levels more than 1 µg/dl (20,23). Children living less than 2 kilometres from a battery facility in Berat and Tirana, Albania, had blood lead levels much higher than those living more than 2 kilometres away.

Children in China may be exposed to lead poisoning due to the country's rapid industrialisation and use of leaded gasoline. Average blood lead levels for children living in industrial and traffic-heavy areas were 2.18–6.79 µg/dl. Moreover, half of the individuals studied had blood lead levels of more than 1 µg/dl, while the rest had levels of less than 1 µg/dl. Non-industrialised children were just as likely to have blood lead levels over 1 µg/dl (23,56). (23,56). Non-smoking women's blood lead levels rose significantly between 1983 and 1998 when automobiles increased significantly (57). In tiny communities with several small companies, the issue of lead exposure in children is especially pressing.

When it comes to countries undergoing industrialisation, this is a common problem. Lead concentrations in airborne particulate matter in Dhaka, Bangladesh, averaged 453 nµg/m3 from November to January during the dry season (49,58). In India, 93 rickshaw pullers were randomly selected, and their mean blood lead concentration was 5.3 µg/dl. A random sampling of 2031 children and adults in five cities with high population densities where leaded gasoline has elevated ambient lead levels was also conducted in India (37). About 51% and 13% of those had levels over 1 µg/dl. 5.1 µg/dl was found in 40 % of the youngsters in Bangalore and 62 % in Mumbai (23,59). A cross-sectional study was carried out on a random sample of 200 children under five living in a Mexican neighbourhood. Samples of floor, window and street dust,

paint, soil, water, and glazed ceramics were collected from the participants' homes. From 0.1 to 3.1 µg/dl of lead in the blood, the mean level was 0.99 µg/dl (60,61) (60,61). Lead levels (>1 µg/dl) were found in almost half of the 518-month-old children examined. Environmental samples were lead-free, except for glazed porcelain. Toxic exposure to automobile exhaust, dirt from children's hands, and glazed ceramics used for food preparation have been linked to elevated blood lead levels (11,61,62).

African children may be particularly vulnerable to lead poisoning due to their lifestyle and socioeconomic factors. However, there is still no clear picture of lead poisoning among Africa's children (23,63). Typical air lead concentrations range from 0.5–3.0 mµg/m3 in urban and rural areas and near mining centres, whereas dust and soil lead concentrations may exceed 1000 mµg/g (11,23). Cottage businesses and the burning of paper products, scrap rubber, battery casings, and painted wood for cooking and heating are also concerns in individual families. Unregulated in various nations include lead paint, solder, and cosmetics (12,27,42).

One out of every 13 mixed-race children had a blood lead level of more than 5.2 µg/dl; this was the highest amount ever recorded among white children (25,47). Blood, air, and dust samples from schools near roads with significant traffic had higher lead than those from other schools (64). Dusty homes, poorly maintained dwellings, overcrowding, low parental education and income levels, and other aspects of family structure and socioeconomic position were linked to elevated blood lead levels (49,53). Children's susceptibility to lead poisoning was thought to be heavily influenced by their social surroundings. In metropolitan areas throughout Africa, lead poisoning seems to be a common problem for children under five (11,18).

However, in some developing countries, lead exposure is decreasing due to the reduced use of lead in gasoline and elsewhere. When leaded petrol was phased out in Thailand between 1984 and 1996, lead levels in Bangkok dropped significantly (11,58). According to a recent study, only 4.6 % of the 1000 babies aged 6–72 months in Chiang Mai, Thailand, had blood lead levels of more than 5.1 µg/dl (63). For pregnant women in urban and rural Chiang Mai, the geometric mean level of blood lead was 0.416 µg/dl and 0.33 µg/dl respectively, during the period from February to September 1994, when 37 pregnant women were in urban areas, 53 in per urban areas, and 28 in rural areas. 2.11 and 3.12 µg/dl, respectively, were the geometric mean amounts in cord blood (43,65). It is estimated that around 4% of the maternal blood samples and 1.7% of the cord blood samples had lead levels more than 1 µg/dl. Bangkok's pollution levels were higher than Chiang Mai, with 5.2% and 2.4% of 500 pregnant women and newborns having blood lead levels more than 1 µg/dl, respectively (65,66). Before unleaded gasoline was introduced to Bangkok, researchers had achieved similar findings, which were found to be favourable (18).

4.7 Burden of lead levels in paints and its health effects.

As of 2019, the Institute for Health Metrics and Evaluation (IHME) projected that lead exposure was responsible for 900,000 deaths and 21.7 million years of healthy living lost (disability-adjusted life years, or DALYs) globally. A large portion of the cost fell on nations with low and moderate incomes (23,67). Additionally, according to IHME's projections, lead exposure will be responsible for 62.5% of the global burden of developmental, intellectual disability in 2019, 8.2% of the global burden of hypertension, 7.2 % of the global burden of ischaemic heart disease, and 5.65 % of the global burden of stroke in 2019.

Even though India has no legal restrictions, a voluntary threshold of 1000 parts per million (ppm) for lead in paints is suggested. According to recent research, 84 % of the enamel-based paints marketed by significant businesses in India have lead levels above 1000 ppm, and 61% included lead levels above 5000 ppm, even though plastic or water-based paints contained lower levels of the metal (26,45).

Global burdens for idiopathic developmental, intellectual impairment (IDI), hypertension (hypertension), ischemic heart disease (ischemic heart disease), and stroke (stroke) were all projected to be attributable to lead exposure in 2016, according to the IHME (25,46,47).

Because lead in paint is a constant source of exposure in many countries, the world health organisation (WHO) has teamed together with the UN Environment Program to launch the Global Alliance to Eliminate Lead Paint (25). Work to prevent children from being exposed to lead paint and reduce occupational exposure will be prioritised and accelerated as part of this strategy. The phasing out of lead paint by 2020 is one of the priority actions for governments included in the WHO *Road map to enhance health sector engagement in the Strategic Approach to International Chemicals Management towards the 2020 goal and beyond*(45,47).

The elimination of lead paint will contribute to the achievement of the following Sustainable Development Goal targets(68):

- 3.9: By 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination; and
- 12.4: By 2030, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, under agreed international

frameworks, and significantly reduce their release to air, water and soil to minimise their adverse impacts on health and the environment.

4.8 Sources of lead exposure

Specific jobs and industries are more likely to come in contact with lead(27,36)

- Artists (materials used may contain lead)
- Auto repairers (car parts may contain lead)
- Battery manufacturers (batteries contain lead)
- Bridge reconstruction workers (old paint may contain lead)
- Construction workers (materials used may include lead)
- Firing range instructors and gunsmiths (ammunition has lead)
- Glass manufacturers (lead may be used in glass production)
- Lead manufacturers
- Lead miners, refiners, and smelters
- Manufacturers of bullets, ceramics, and electrical components.
- Painters (old paint and commercial paint may contain lead)(57,69)
- Plastic manufacturers (materials made may contain lead)
- Plumbers and pipefitters (pipes may contain lead)
- Police officers (ammunition contains lead)
- Radiator repairers (radiators may contain lead)
- Recyclers of metal, electronics, and batteries (may contain lead)
- Rubber product manufacturers (process contains lead)
- Shipbuilders (materials used may include lead)
- Solid waste incinerator operators (waste may contain lead)
- Steel welder (galvanised steel is coated in part with lead)"

4.9 Routes of exposure:

People can become exposed through occupational and environmental sources. This mainly results from(70,71):

· Inhalation of particles generated by burning materials containing lead, for example, during smelting, strip leaded paint, and using leaded gasoline or leaded aviation fuel; and

· Taking of lead-contaminated dust, water (from leaded pipes), and food (from lead-glazed or lead-soldered containers).

4.10 Absorption, distribution, and excretion of lead:

- Respiratory tract absorption is the primary route of exposure for those exposed through their jobs. Inorganic lead is absorbed through the lungs and the digestive system. Particle size is the primary factor influencing lead absorption in the lungs (72). About 30–40 % of inhaled lead is predicted to enter the bloodstream. There is little transcutaneous lead absorption when inorganic lead compounds, such as those present in paint are applied to the skin. Organic (tetraethyl) lead, on the other hand, which is present in gasoline, can be absorbed via the skin.
- Lead accumulates in the blood, soft tissues, and bone after absorption. Erythrocytes contain 99 % of the lead in blood, whereas plasma and serum contain roughly 1 % (73). It is more important for lead to be distributed to target organs, including the brain, teeth, and bone, via plasma rather than whole blood since plasma is more concentrated than whole blood (73,74). Lead has a half-life of 35 days in blood, 40 days in soft tissue, and 20 to 30 years in bones. Over 95% of the lead in the body is stored as insoluble phosphate in the bones.

Pregnant women's bones contain lead, which is released into the bloodstream and reaches the growing foetus (65). The urinary tract is the primary route through which lead is excreted, although it is not the only one. Chelating drugs can increase the excretion of lead in the urine, which is the basis for treating lead poisoning using this strategy (74). Because of lead's biological half-life, estimated at ten years, it is slowly eliminated from the body, allowing buildup in the body (75,76).

4.11 Lead exposure limits

A Time Weighted Average of 50 micrograms per cubic metre of air (µg/m) over 8 hours is the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) (77).

Over eight hours, the Occupational Safety and Health Administration (OSHA-mandated permissible exposure limit (PEL) for lead is 50 µg/m3 (77,78).

General industrial and construction workers must meet the OSHA Permissible Exposure Limit (PEL) for the lead of 30 µg/m3 over 8 hours (78).

According to some research, OSHA's PEL and NIOSH's REL may be too high to safeguard against some health impacts (77,78).

4.12 Lead poisoning

· Lead poisoning is a medical condition caused by increased levels of heavy metal lead in the body. This can interfere with various body processes and causes toxicity to many organs and tissues. It's also called Plumbism, Colica Pictonum or Saturnism (1,43,79)**.**

Lead poisoning may be acute (from intense exposure of short duration) or chronic (from repeat low-level exposure over a prolonged period) (79). Acute lead poisoning

is rare. Many reported cases of acute poisoning may be exacerbations of chronic lead poisoning when significant quantities of lead are suddenly released into the bloodstream from the bone (79). In acute lead poisoning, lead levels will be between 100-120 µg/dl whereas, in chronic lead poisoning, lead levels will be between 40-60 µg/dl (21,79,80).

4.13 Household paints and lead poisoning:

· The term "paint" includes varnishes, lacquers, enamels, glazes, primers, or coatings used for many purposes. Paint is a mixture of resins, pigments, fillers, solvents, and other additives (44).

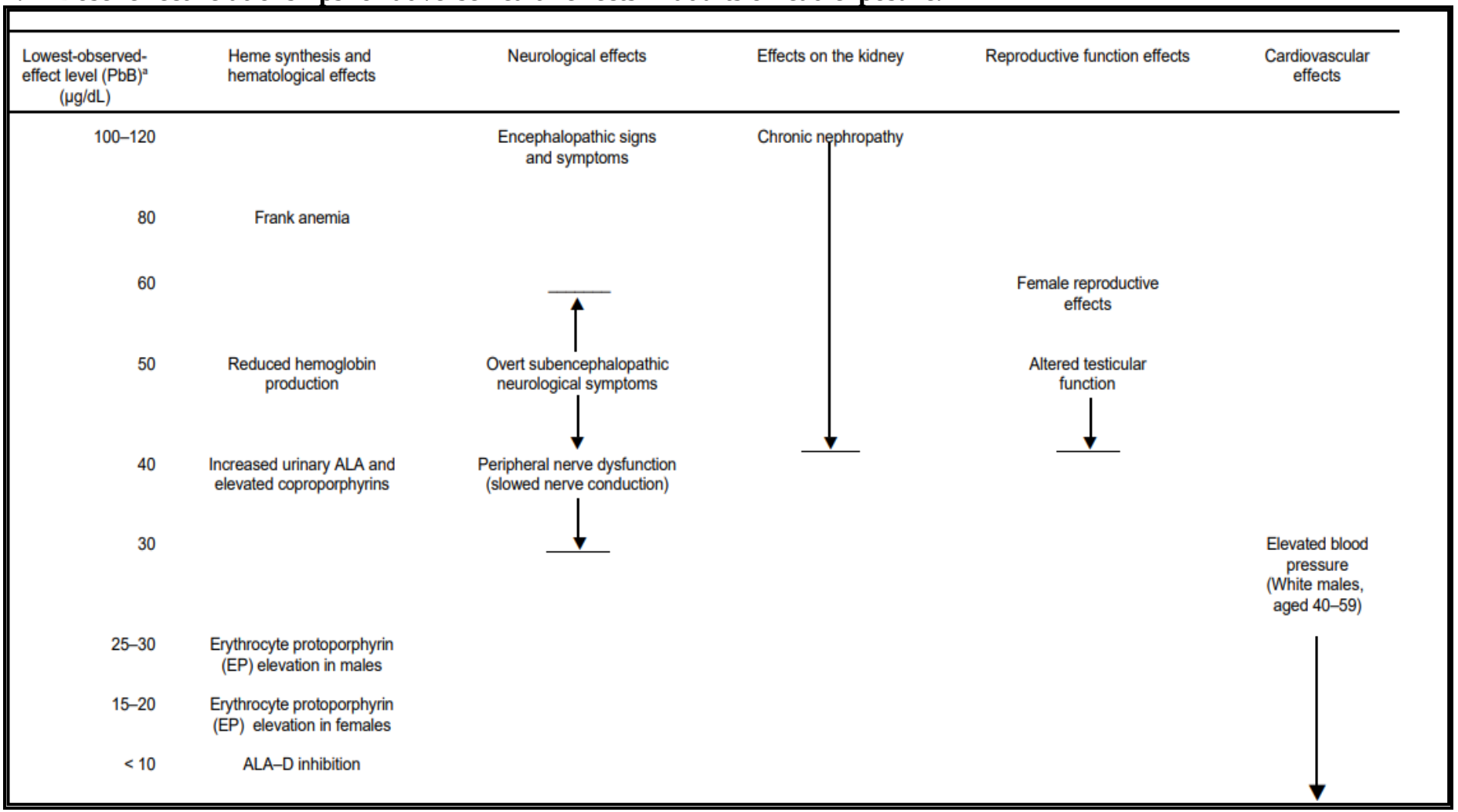
· "Lead paint" is one or more lead compounds added. Lead compounds that are typically added to paint include, but are not limited to: monoxide, octanoate, chromate, Lead 2-ethyl hexanoate, Lead sulfate, Lead oxide, Lead molybdate, Lead nitrate, Lead sulfa-chromate yellow, lead peroxide, Lead carbonate (white lead), Lead chromate oxide and Tri lead - bis (carbonate) – dihydroxide (71,81).

· Yellow-coloured paints were found to contain more amount of lead than white and other colours (81).

· "Lead poisoning mainly occurs due to dried off paints, as it starts to decay and its dust contaminates the entire environment putting human health at risk (43). The removal of lead paint is another primary reason for increased lead concentration in the home environment if not done safely (57,82).

· The paint industry in India can be broadly segmented into major paint manufacturers and micro, small and medium enterprises. Major paint manufacturers comprise almost 64% of the paint market share in India (44). The lead concentration in paints produced by the five major paint manufacturers (Asian Paint, Kansai Nerolac, Berger Paints, ICI /Akzo Nobel and Shalimar) all were less than 90 ppm (ranging from <8 – 32 ppm) in both yellow and white coloured paints (26,44,57)."

4.14 Dose- effect relationships for adverse health effects in adults of lead exposure.



OSHA – Occupational safety and Health administration.

4.14.1 Neurotoxic effects:

The neurological system, particularly the central and peripheral nervous systems, is particularly affected due to lead poisoning in adults. As a result, the blood-brain barrier and brain tissues are harmed by lead (83,84,85). Blood lead levels (BLLs) more than 80 µg/dL may lead to coma, encephalopathy, or even death in extreme cases. Chronic, high-lead exposures have historically resulted in a "wrist drop" or "foot drop" of paralysis in the peripheral nervous system, two or more times higher than the OSHA permissible exposure limit of 50 µg/m (83,86,87). Overt indications of lead poisoning are rare in the United States because of improved lead exposure control in recent decades. Even while OSHA regulations allow for lead exposures that do not cause these evident neurologic clinical signs, lead doses acceptable under the OSHA guidelines may negatively affect the central nervous system (88,89). Fatigue, irritability, sleeplessness, headaches, and mild signs of mental and intellectual impairment are common symptoms for workers with blood lead levels (BLLs) between 4 and 5 µg/dL. (84,89). Workers' motor nerve conduction velocity is reduced by BLLs as low as 30 to 40 µg/dL, yet these lead exposure levels are not linked with clinical symptoms (88). Early signs of neurologic injury to the central and peripheral nerve systems might be seen in these symptoms (90,91).

4.14.2 Hematologic effects:

High and long-term lead exposure can cause anaemia, a common sign with BLLs more than 80 µg/dL. This anaemia is the outcome of lead poisoning, which impairs red blood cell production and function (92). The formation of heme (the nonprotein, iron-containing component of haemoglobin) is inhibited by lead, and the ion transport mechanism in red blood cell membranes is damaged by lead. If you're looking for an

indication of lead's effect on heme production, you can measure the free or zinc protoporphyrin [ZPP] content in red blood cells (92,93,94). However, increased protoporphyrin levels can be caused by other factors (such as an iron deficit) (95,96). It is possible to see an impact on heme synthesis at low BLLs, although the therapeutic relevance of these effects is yet unclear (97). OSHA mandates lead and ZPP levels, haemoglobin and hematocrit measurements, red cell indices, and an examination of a peripheral blood smear to determine red blood cell morphology as part of the medical evaluation for lead-exposed employees (20,71,86).

4.14.3 Renal effects:

Glycosuria and aminoaciduria can occur because of renal tubular damage caused by high lead exposure (98,99). The proximal tubule cells showed prominent inclusion bodies at blood lead levels between 40 and 60 µg/dl (59,90,100). Lead builds up in the mitochondria, affecting energy-dependent functions, including tube transport and structural and functional changes. The smooth muscle of the arteries may also be affected (101,102).

4.14.4 Reproductive and developmental effects:

Lead has been shown to cause stillbirths and miscarriages in the past (20). Pregnant women exposed to BLLs below 15 µg/dL have been found to have shorter gestational times and less mental development and growth than those exposed to BLLs beyond this level in several studies done in the US and internationally (65,87).

The fetus developing nervous system is particularly susceptible to lead exposure. (65). The capacity of lead to pass the placental barrier and cause neurological damage in the foetus results in neurological toxicity in the offspring of exposed female workers (89,103). Some of the accumulated bone lead is released into the blood during

pregnancy, posing a particular risk to expectant mothers (104). According to many studies done simultaneously in the United States and other countries, lead to as little as 10 µg/dL have been shown to cause intellectual and behavioural abnormalities in children (105,106).

Male infertility may be linked to BLLs of 60 µg/dL or higher (103). According to studies, male employees who are exposed to lead at levels as low as 40 µg/dL have lower sperm counts and poor sperm morphology. Male employees exposed to lead with BLLs of 30 to 40 µg/dL have been shown to have lower sperm quality and hormonal alterations (103,107,108).

Children of lead-exposed workers have an increased risk of congenital disabilities, mental retardation, behavioural disorders, and death in the first year of life. OSHA recognised this when it promulgated its general industry lead standard in 1978. This risk could occur even at parental BLLs below the 50 µg/dL BLL allowed under the standard (76,78). A lead standard that would protect workers against all physiological changes, symptoms, and reproductive impacts in both men and women was not practicable at the time. As a result, OSHA recommends that men and women who wish to become parents restrict their BLLs to 30 µg/dL. (15,77,79). "Fetal protection" policies devised by at least a few big businesses have since been implemented to safeguard the health and safety of women who are pregnant or lactating (105).

4.14.5 Cardiovascular effects:

Hypertension and cardiovascular disease were more common in those who had chronically high lead exposures before the turn of the century (109,110). In the United States, lead poisoning is no longer associated with such severe health consequences. Small increases in blood pressure have been found among employees exposed to

levels of lead permitted by OSHA regulations (22). BLL increases have also been linked to minor increases in blood pressure in studies done in the general population, where lead exposures are significantly lower (13,90). BLLs below 10 µg/dl (86) appears to be associated with this correlation. According to a new study, males with long-term lead exposure, as indicated by bone lead levels, are more likely to develop high blood pressure (109).

4.14.6 Carcinogenic effects:

Animal studies have indicated that lead is carcinogenic to them. In animal experiments, it is apparent that several lead compounds eaten or supplied by subcutaneous or intraperitoneal injection induce cancer in rats in levels approaching the maximum tolerable dosage (61,87). Several studies have looked at the link between lead exposure in the workplace and the development of cancer in those employees (50). Workers who are exposed to high amounts of lead may be at greater risk of developing cancer, according to two recent studies (60). Based on animal studies, the International Agency for Research on Cancer (IARC) has classified lead and inorganic lead compounds as potentially carcinogenic to humans (3,58,62). Lead has been ranked as an animal carcinogen by the American Conference of Governmental Industrial Hygienists (ACGIH), signifying that it has been proved to be carcinogenic in animals (111,112,113).

4.14.7 Immunology:

Lead acetate has been shown to decrease the body's ability to fight infection and increase death. Immunoglobulin plaque-forming cells are reduced in the presence of lead (114). According to some studies, workers with blood lead levels between 20 and 85 µg/dl may be more susceptible to colds. The proportion and an absolute number of B lymphocytes in employees with blood lead concentrations of more than 50 µg/dl had both risen (92). It indicates that employees with blood lead levels >60 µg/dl have decreased immune cell activity and aberrant T-cell subsets, according to a new Chinese paper (115).

4.14.8 Endocrinology:

The conversion of vitamin D into its hormonal form, 1, 25-dihydroxy vitamin D, maybe inhibited in children with persistently high blood lead levels (>62 µg/dl) (116,117). Cell growth and maturation and the formation of teeth and bones may be harmed as a result. However, early research found that blood lead levels of 33–55 µg/dl decreased 1,25-dihydroxy vitamin D levels to levels seen in children with severe renal insufficiency (62,118,119). Osteoporosis or osteomalacia may result from the combination of lead and cadmium exposure in smelter employees, which raised the levels of 1α-dihydroxycholecalciferol (34,43).

4.15 Laboratory test for lead:

· Blood lead level (BLL) - Human exposure is usually assessed through the measurement in the blood(120).

· Hematology - Hypochromic anaemia, red blood cells with basophilic stippling, elevated protoporphyrin levels (erythropoietin protoporphyria (EPP) or zinc protoporphyrin (ZPP)(93).

· Liver Function shows elevated transaminase levels (acute poisoning) (120),

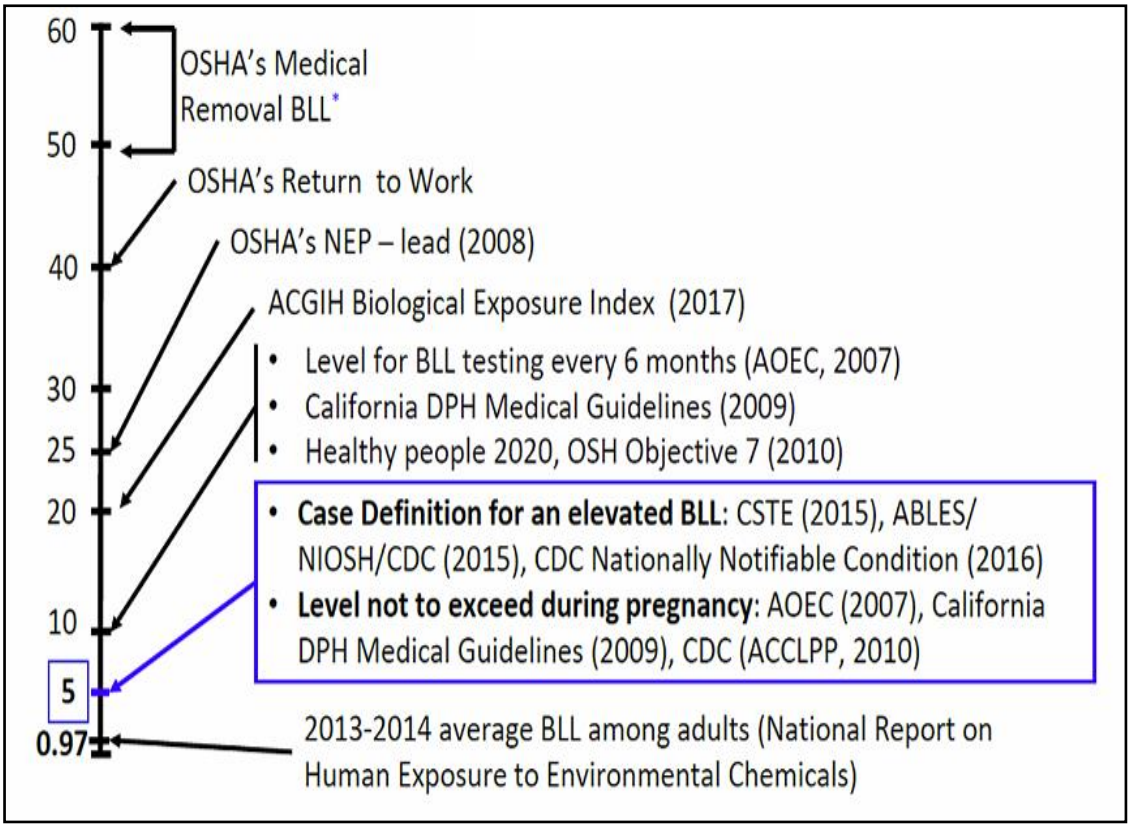
· Other -Hyperuricaemia, hypocalcemia (121).

· Urine -Proteinuria, glucosuria and aminoaciduria (acute poisoning) (122)

· Radiological investigation shows lead lines in the metaphases of long bones (chronic poisoning) (123).

4.16 Blood Lead Level concentration (43,46,86)

Figure 3.1: CDC- Adult Blood Lead Epidemiology and Surveillance (ABLES)



4.16.1 OSHA Blood Lead guidelines(78)

S.no	OSHA guidelines	Blood lead level	Intervention
A.	Blood lead levels requiring employee removal. (Level must be confirmed with second follow-up level within two weeks of first report.)	≥60 μg per dL (2.90 μmol per L) or average of last three samples or all blood samples over previous six months (whichever is a longer time period) is 50 μg per dL (2.40 μmol per L) or greater unless last blood sample is 40 μg per dL (1.95 μmol per L) or less	Nil
B.	Frequency with which employees exposed to action level of lead (30 μg per m^3 TWA) must have blood lead level checked. Zinc protoporphyrin test is also strongly recommended on each occasion that a blood lead level is obtained.	Last blood lead level is less than 40 μg per dL (1.95 μmol per L)	Every six months
		Last blood level is between 40 μg per dL (1.95 μmol per L) and level requiring medical removal (see A above)	Every two months
		Employees removed from exposure to lead because of an elevated blood lead level	Every month
C.	Permissible airborne exposure limit for workers removed from work due to an elevated blood lead level (without regard to respirator protection)	30 μg per m^3 per 8-hour TWA	
D.	Blood lead level confirmed with a second blood analysis, at which employee may return to work	≤40 μg per dL (1.95 μmol per L)	

Occupational Safety and Health Administration (OSHA) – guidelines for lead-exposed workers.

4.17 Health-based management recommendations for lead-exposed adults(123). -- CDC (Centre for disease control and prevention)

Blood lead level (µg/dL)	**Short Term Risks Lead exposure < 1 year**	**Long Term Risks Lead exposure ≥ 1 year**	**Management**
< 5	None documented	None documented	Indicated
5 – 9	Possible spontaneous abortion Possible postnatal developmental delay	Possible spontaneous abortion Possible postnatal developmental delay Possible hypertension and kidney dysfunction.	Discuss health risks Reduce lead exposure for women who are or may become pregnant.
10 – 19	Possible spontaneous abortion Possible postnatal developmental delay Reduced birth weight	Possible spontaneous abortion Reduced birth weight Possible postnatal developmental delay Hypertension and kidney dysfunction Possible subclinical neurocognitive deficits.	As above for BLL 5-9 µg/dL, plus: Decrease lead exposure Increase biological monitoring Consider removal from lead exposure to avoid long-term risks if exposure control over an extended period does not decrease BLL below 10 µg/dL, or if medical condition present that increases risk with continued exposure.
20 – 29	Possible spontaneous abortion Possible postnatal developmental delay Reduced birth weight	Possible spontaneous abortion Possible postnatal developmental delay Reduced birth weight Hypertension and kidney dysfunction Possible neurocognitive deficits	Remove from lead exposure if repeat BLL measured in 4 weeks remains ≥ 20 µg/Dl
30 - 39	Spontaneous abortion Possible postnatal developmental delay Reduced birth weight	Spontaneous abortion Reduced birth weight Possible postnatal developmental delay Hypertension and kidney dysfunction Possible neurocognitive deficits Possible non-specific symptoms	Remove from lead exposure Refer for prompt medical evaluation Consider chelation therapy for BLL over 50 µg/dL with significant symptoms or signs of lead toxicity

CDC – The National Institute of Occupation safety and Health (NIOSH).

Blood Lead Level (µg/dL)	**Short Term Risks Lead exposure < 1 year**	**Long Term Risks Lead exposure ≥ 1 year**	**Management**
40 – 79	Spontaneous abortion Reduced birth weight Possible postnatal developmental delay Non-specific symptoms** Neurocognitive deficits Sperm abnormalities	Spontaneous abortion Reduced birth weight Possible postnatal developmental delay Non-specific symptoms Hypertension, Anemia Kidney dysfunction/nephropathy, Subclinical peripheral neuropathy Neurocognitive deficits Sperm abnormalities Colic Possible gout	Remove from lead exposure Refer for prompt medical evaluation Consider chelation therapy for BLL over 50 µg/dL with significant symptoms or signs of lead toxicity
≥ 80	Spontaneous abortion Reduced birth weight Possible postnatal developmental delay Non-specific symptoms** Neurocognitive deficits Encephalopathy Sperm abnormalities Anemia	Spontaneous abortion Reduced birth weight Possible postnatal developmental delay Non-specific symptoms** Hypertension Nephropathy Peripheral neuropathy Neurocognitive deficits Sperm abnormalities Anemia Colic Gout	Remove from lead exposure Refer for immediate/urgent medical evaluation Probable chelation therapy

** Medical conditions that may increase the risk of continued exposure include chronic renal dysfunction (serum creatinine > 1.5 µg/dL for men, > 1.3 µg/dL for women, or proteinuria), hypertension, neurological disorders, and cognitive dysfunction.*

*** Headache, fatigue, sleep disturbance, anorexia, constipation, arthralgia, myalgia, decreased libido, etc.*

4.18 Health-based medical surveillance recommendations for lead-exposed workers (123).

CDC – The National Institute of Occupation safety and Health (NIOSH)

5. S. No	Category of Exposure	Recommendations
1	All lead-exposed workers*	Baseline or preplacement medical history and physical examination Baseline blood lead level (BLL), Serum creatinine.
Blood lead level (BLL)		
2	< 10 µg/dL	BLL every month for first 3 months of placement, or upon change in task to higher exposure, then BLL every 6 months. If BLL increases > 5 µg/dL, evaluate exposure and protective measures. Increase monitoring if indicated.
3	10 – 19 µg/dL	As above for BLL < 10 µg/dL, plus: BLL every 3 months. Evaluate exposure, engineering controls, and work practices. Consider removal. Revert to BLL every 6 months after 3 BLLs < 10 µg/dL.
4	> 20 µg/dL	Remove from exposure if repeat BLL measured in 4 weeks remains ≥ 20 µg/dL, or if first BLL ≥ 30 µg/dL. Monthly BLL testing. Consider return to lead work after 2 BLLs < 15 µg/dL a month apart, then monitor as above.

4.19 Global movement to phase out lead from paints:

In 2008, the Strategic Approach to International Chemical Management (SAICM) highlighted lead in paints as an issue of global concern and advocated efforts to phase out lead from decorative paints. (10). As a result, the United Nations and the World Health Organization developed an alliance called "The Global Alliance to Eliminate Lead Paint" (GAELP) (122), which is backed by the UNEP/WHO Advisory Group, governments, non-governmental organisations, industry, and academia (26,67).

The association's ultimate goal is to prevent children from coming into contact with lead-based paint and reduce the number of lead workers exposed. To eradicate lead poisoning, it is necessary to gradually phase out the production and sale of lead paint worldwide (26).

4.20 Regulation on lead in paint for acceptance:

The Government of India notified the "Regulation on Lead contents in Household and Decorative Paints Rules, 2016" on November 1st 2016, which came into force from November 1st, 2017(123).

Salient features of the regulations are:

· **Prohibition**: Paints containing more than 90 parts per million metallic leads are prohibited from being manufactured, traded, exported, or imported.

· **Self-certification:** As of November 2017, the marking "Lead content does not exceed 90 parts per million" is required on all household and decorative paints made or imported after that date.

· **Temporary Provision:** Paints made before enacting the rules have been given a two-year grace period to sell their stock and comply with the standards.

Additionally, importers and producers must submit their products to annual testing before entering the supply chain. The new rule has also designated the Central Power Research Institute as the testing agency (26,67).

The Central Pollution Control Board officially announced this procedure for measuring lead levels in household and decorative paints on October 31st, 2017.

5. METHODOLOGY

5.1 Study design

This was a community-based cross-sectional study carried out among people primarily involved in residential and automobile painting occupations in Vellore.

5.2 Study duration

This study was conducted between September 2020 to November 2021.

5.3 Study Setting

Vellore city is located on the bank of the Palar River in the northeastern part of Tamil Nādu. It is separated into four zones that are further subdivided into 60 wards, covering an area of 87.915 km^2 and housing a population of 3,936,331 as reported by the 2011 census (126).

Out of the total Vellore population, 43.24% live in urban regions of the district. In total, 1,701,987 people live in urban areas, of which males are 844,587 and females are 857,400. As per the 2011 census, 56.76% of the Vellore districts live in rural areas of the village. The total Vellore district population living in rural areas is 2,234,333, of which males and females are 1,117,101 and 1,117,243 respectively (126).

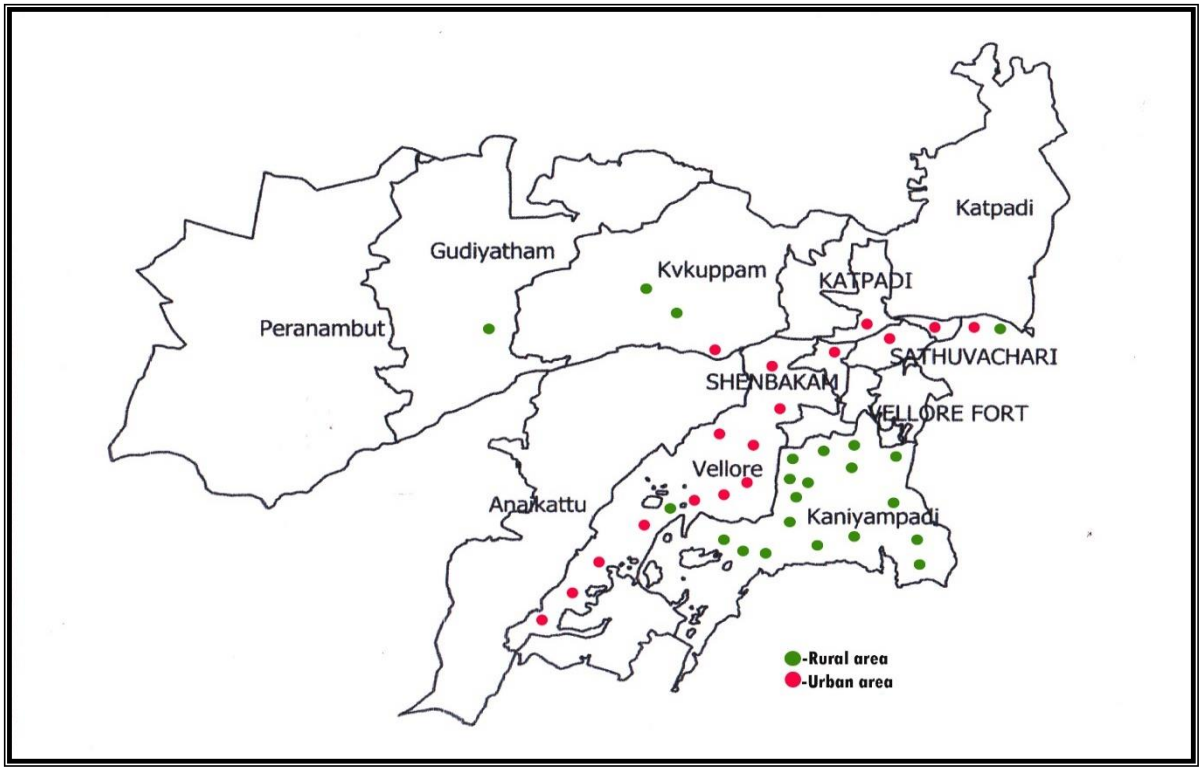
Christian Medical College (CMC), Vellore is a not-for-profit minority educational institution established in 1900. (127).

The department of Community Health at CMC, Vellore, provides primary and secondary health care services to approximately 200,000 from rural, urban, and tribal community areas of Vellore District through its Community Health and Development (CHAD) programme. This programme covers the Kaniyambadi block, urban slums of Vellore and the Jawadhi Hills area. The 135 bedded community health and

development (CHAD) hospital serves as a base hospital for the peripheral programme and a secondary health centre (127).

This study was conducted among people primarily involved in residential and automobile painting occupations residing in rural and urban areas of Vellore. This study was carried out by meeting the participants either at their workplace or residence.

Figure 5.1: Map showing the distribution of study participants in Vellore.



(Source: Deputy directorate of health services, Vellore Health Unit District (HUD))

5.4 Study participants

5.4.1 Inclusion Criteria for Painters:

• Adult **males** above 18 years.

• Permanent residents of Vellore district.

• Involved in residential and automobile painting occupation.

5.4.2 Exclusion Criteria: None

5.5 Materials and methods:

Institutional Review Board cleared the proposal for this study (IRB) and the Ethical committee of the Christian Medical College, Vellore (IRB Min no:13250 dated on 04-08-2020). The information sheet was provided, and written informed consent was obtained from each participant before enrolment in the study.

5.5.1 Sample Size:

Based on a similar study by Shailja Chambial et, the 16% prevalence of elevated blood lead level (BLL) among occupational painters was used to estimate sample size

n=4pq/d2 [100]

p: prevalence of elevated blood lead level in painters was estimated to be 16% (from previous study)

q: 1-p (100 -16 =84)

Absolute precision (d) = 6

n = 4 x 16x 84/ 6X6 = **149**

Total no of study participants n = 150

Blood Lead Level (BLL) in the Adult Population of Jodhpur: A Pilot Study.Indian Journal of Clinical Biochemistry, volume 30, year of publication 7-2015. Shailja Chambial1 • Kamla Kant Shukla1 • Shailendra Dwivedi1 • Pankaj Bhardwaj2 • Praveen Sharma.

5.5.2 Sampling method

List of residential and automobile painters was compiled from multiple sources, which included information from the department of civil engineering at CMC, from the demographic health and surveillance database maintained in the CHAD program supported by the department of community health, CMC in addition to information from commercial paint shops and automobile service units.

From the list obtained, 150 study participants were chosen by simple random sampling. Data collection for this study was done before and after the Covid 19 lockdown, between January to April 2021, and September to December 2021.

5.5.3 Study tools:

5.5.3.1 Structured questionnaire (Annexure 1)

A structured questionnaire was developed based on inputs from institutional experts and an extensive literature review. It included details on the socio-demographic details, housing characteristics, personal habits (WHO STEPS questionnaire), presenting clinical complaints, lead exposure history, working skills, Personal protective equipment (PPE) used, facilities available at workplace and personal hygiene measures among residential and automobile painters. People who paint cars, autos, trucks, bikes, and buses were classified as automobile painters in this study, whereas those who paint houses and other residential places were classified as residential painters. This questionnaire was pilot tested and then administered to the study participants in Tamil (local language).

5.5.3.2 Clinical examination:

Anthropometric measurements (height, weight), heart rate, blood pressure and detailed clinical examination were done for all participants. Body Mass Index (BMI) calculated with height and weight. The study participants were also examined for the presence of a Burtonian line (thin, black-blue line visible along the margins of gums, at the base of teeth) and Mees line (white lines of discolouration across the nails of the fingers and toes). Burtonian and mees line are clinical signs found in chronic lead poisoning.

5.5.3.3 Laboratory investigations

About 6ml of fresh blood was collected by venipuncture under strict aseptic precautions from the participants to assess the Blood lead levels (BLL), Complete Blood Count (CBC), Alanine Transaminase (SGPT) and serum creatinine in three different vacutainers. The samples collected were analyzed in CHAD Hospital and the Department of Clinical Biochemistry, CMC.

5.5.3.3.a Blood Lead level (BLL)

For Lead Blood Level (BLL), 4 ml of whole blood sample was collected using whole blood Li heparine vacationer, refrigerated at 4 degrees C and analyzed using Perkin Elmer USA Nexion analyzer. This multi-element technique works on the principle of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) at CMC's clinical biochemistry department.

Table 5.1: Classification of blood lead level (BLL)

Categories	**Blood Lead Level (BLL)**
Normal	<=5 μg/dL
Mild	> 5 μg/dL and <=10 μg/dL
Moderate	>10 μg/dL and < 20 μg/dL
Severe	>=20 μg/dL

(Source: Centers for Disease Control and Prevention (CDC) [2019] - Adult Blood Lead Epidemiology and Surveillance (ABLES))

5.5.3.3.b Complete Blood Count (CBC)

For whole blood hematology determinations**,** 2ml of blood was collected in BD vacutainer spray coated K2 Ethylenediaminetetraacetic acid (EDTA) tubes and analyzed using SYS MEX analyzer (Subcode: KX21).

Table 5.2: Classification of anaemia:

Men (15 years of age and above)		
Non-Anaemia	**Anaemia**	
13.0 or higher (GM%)	Mild	11.0 – 12.9 (GM%)
	Moderate	8.0 – 10.9 (GM%)
	Severe	<80 (GM%)

(Source: World health organization (WHO)- Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity)

5.5.3.3.c Alanine Transaminase (SGPT)

Sample collected using BD vacutainer plus plastic serum tubes have spray – coated silica was analysed using COBAS (Subcode CS11). Alanine Transaminase (ALT) is more specific than Aspartate Aminotransferase (AST) in case

of chronic lead poisoning. The Alanine Transaminase (SGPT) normal range is about 5 to 49 units per litre of blood serum.

In this study value more than 49 U/L was considered elevated.

5.5.3.3.d Serum Creatinine

Sample collected using BD vacutainer plus plastic serum tubes. The blood sample centrifuged using REMI (Subcode R-8C) and processed using COBAS (Subcode CS11). The reference range for serum is 0.2 to 1.3 milligrams per decilitre (mg/dL). In this study value more than 1.3 mg/dl was considered elevated.

5.6 Data sources and measurements:

Serial No	Domain	Variable	Source of data	Method of assessment (measurement)
1	Socio-demographic	Age Gender Education Occupation Type of family Type of house, Family income Socioeconomic Status	Data collected by interviewing the participant	Semi structured pilot tested interviewer administered questionnaire
2	Medical history	Presenting complaints Other co-morbidities	Self-reporting by the participant, Patient case record	History and details from case records available
3	Personal Habits	Alcohol consumption Smoking Habit Smokeless tobacco use	Data collected by interviewing the subject.	WHO core STEPS questionnaire.
4	Lead exposure risk in general population and Residential	working skills, Personal protective equipment taken,	Validated Questionnaire	Lead Exposure risk assessment questionnaire

	commercial painters	personal hygiene measures, Present Medical condition		
5	Anthropometry	Height Weight BMI	Height weight measurement	Using Stadiometer, weighing scale and inch tape.
6	Vitals	Blood Pressure Heart rate	BP recording Manual counting	Mean of 2 measured BPs
7	Presentation of Chronic lead poisoning	Burtonian line Wrist and foot drop Tremor	Clinical examination	Inspection Deep tendon reflexes
8	Complication of chronic lead poisoning	Lead induced encephalopathy	Complete CNS examination	Deep tendon reflex, sensory examination
		Lead induced nephropathy	Blood pressure Lab investigation	BP recording Serum creatinine
		Lead induced Abdominal discomfort	Validated questionnaire Clinical examination	History Abdominal examination SGPT
		Lead induced dermatitis	Validated questionnaire Clinical examination	History and general examination
9	Laboratory investigation	Blood lead level Complete blood count. SGPT Creatinine	4ml blood collected from the study subjects.	BLL was analysed using lead ICP mass spectrometry analyser in the department of Biochemistry

5.7 Categorization of Study variables:

5.7.1 Exposure variables:

- The age of the study participant was categorized as < 40 years and >= 40 years. Based on the median age of 40 years.
- The place of residence was divided into urban or rural based on the documented address.
- The education of the study participant was categorized based on the number of years of completed schooling into higher (>= median year), lower (< median year).
- Per capita income was used to classify the families of the study participants into one of the five socioeconomic classes based on the BG Prasad scale (modification 2021). They were categorized into 'Upper/Middle' (upper, upper-middle, middle classes) and 'Lower' (lower middle, lower) SES.
- A semi-structured pilot-tested questionnaire was used to assess the presence of comorbidities and symptoms experienced by the participants in the last 2 weeks.
- Alcohol, smoking, smokeless tobacco usage was assessed among study participants using the WHO STEPS questionnaire.
- Residential and automobile painter's- working skill, personal protective equipment used, facilities available at workplace and personal hygiene measures followed.
- The study participants were asked a set of questions regarding their practice at the workplace. Each question was scored, and the median value of 3 can be considered to categorize them as appropriate and inappropriate practice.

- Body Mass Index was calculated and classified according to the WHO classification.

BMI (kg/m^2)	Classification
<18.5	Underweight
18.5 – 24.9	Normal
25-29.9	Overweight
>= 30	Obese

(Source: World Health Organisation (WHO)- Body mass index (BMI))

- An automated OMRON BP apparatus was used to measure blood pressure and classified according to JNC- 8 Classification of BP.

JNC-8 Classification of BP			
Classification	Systolic Blood Pressure (mmHg)		Diastolic Blood Pressure (mmHg)
Normal	<120	AND	<80
Prehypertension	120-139	OR	80-89
Stage 1 HTN	140-159	OR	90-99
Stage 2 HTN	>=160	OR	>=100

(Source: The JNC 8 Hypertension Guidelines- 2013)

Laboratory investigation – Blood lead level (BLL), Complete blood count, SGPT and Creatinine

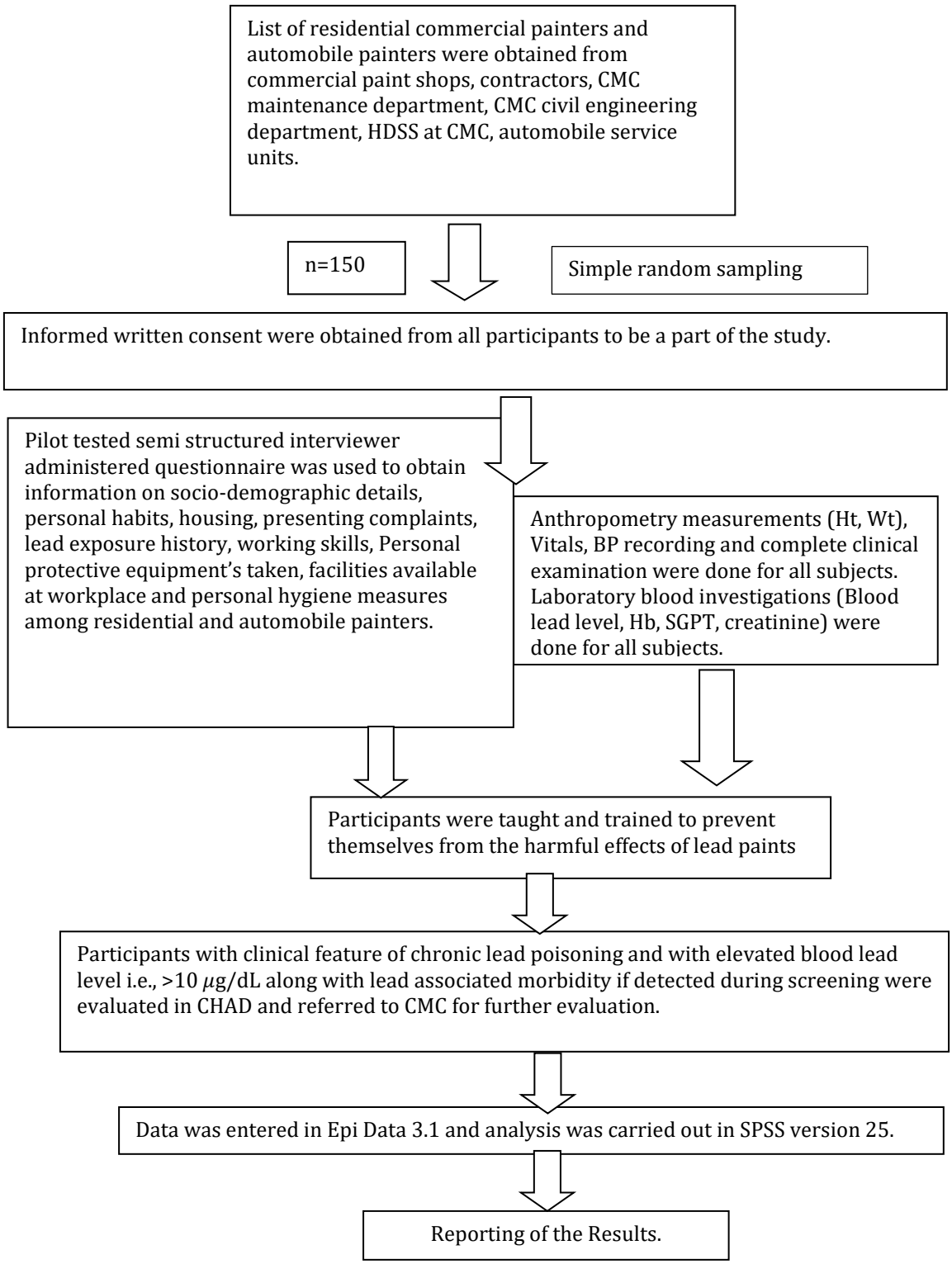
5.7.2 Outcome variables:

Elevated blood lead levels among people involved in painting occupation and general population > 10 μ/dl was considered as participants having high blood lead level.

5.8 Data entry and Analysis:

Data entry was done using Epidata- Version 3.1 (The Epidata Association, Odense, Denmark). Data was analysed using Statistical Package for Social Sciences (SPSS 24.0).

Figure 5.2: Detailed diagrammatic algorithm of the study:



6. RESULTS

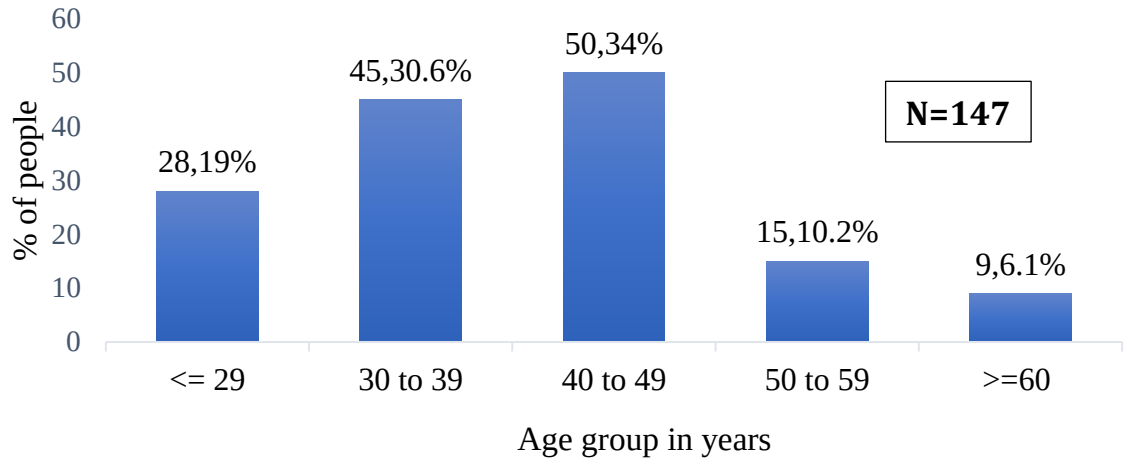
SECTION A: UNIVARIATE ANALYSIS

6.1 DEMOGRAPHIC DESCRIPTION OF THE STUDY POPULATION

A total of 147 occupational painters (residential/automobile) were studied both from urban and rural areas of Vellore, Tamil Nadu.

6.1.1 Age distribution of the study participants(n=147).

Figure 6.1: Age distribution of the study participants



The age of the participants varied between 19 and 86 years. The mean age of the subjects was 40 years with a standard deviation of 11 years and the median was 40 years (Interquartile range 31-47).

6.1.2 Place of distribution of the study participants.

Table 6.1: Place of distribution of the study participants(n=147).

Place of distribution	Frequency	Percentage
Rural	104	71%
Urban	43	29%

Among 147 study participants ,71% (n=104) of them were from urban areas

6.1.3 Distribution of the study participants according to marital status.

Table 6.2: Distribution of the study participants according to marital status(n=147).

Marital status	Frequency	Percentage
Single	39	26.5
Married	107	72.8
Separated	1	0.7

Among 147 study participants,72.8 % (n=107) of the study subjects were married while 27.2% (n=40) were either unmarried or separated.

6.1.4 Distribution of the study participants according to educational status.

Table 6.3: Distribution of educational status of study subjects(n=147).

Education of the respondent	Frequency	Percentage
No education	3	2.0
Primary ($\leq 5^{th}$ standard)	15	10.2
Middle school (6^{th} to 8^{th})	42	28.6
High school (9^{th} and 10^{th})	61	41.5
Higher Secondary (11^{th} and 12^{th})	19	12.9
Graduate	7	4.8

Only 2% (n=3) of the study population did not have any formal education. Nearly 28.6% (n=42) of the study subjects had middle school education and 41.5% (n=61) of the study subjects had high school education. Only 7(4.8%) of the study participants were graduates.

6.1.5 Distribution of the study participants according to type of family.

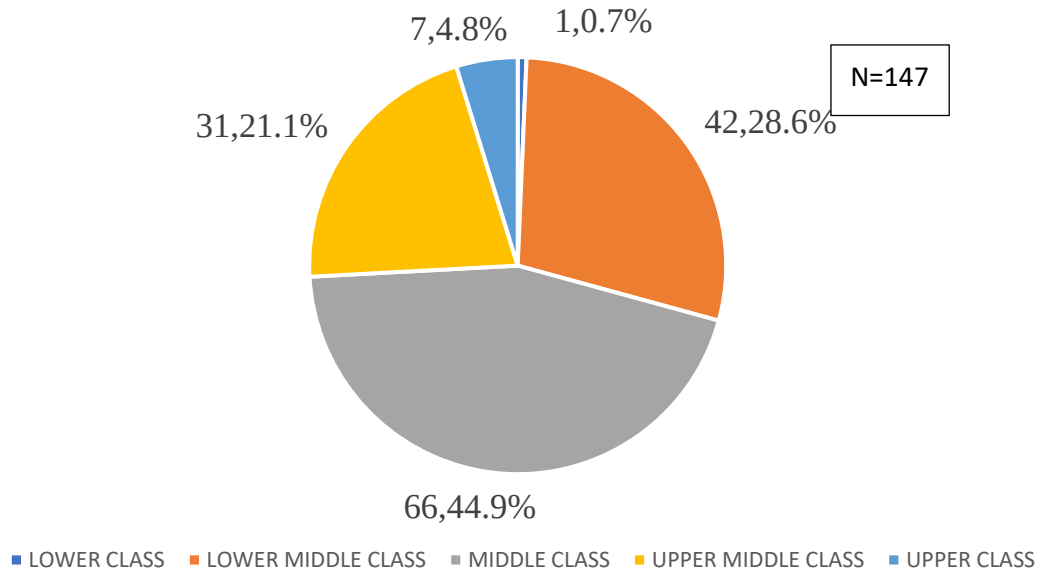
Table 6.4: Distribution of the study participants according to type of family(n=147).

Type of Family	Frequency	Percentage
Joint	51	34.7
Extended	8	5.4
Nuclear	88	59.9

More than half of the study population, n=88 (59.9%) belonged to nuclear families and 40.1% (n=59) belonged to either joint or extended family.

6.1.6 Socioeconomic status of the study participants as measured by B.G. Prasad 2021 scale(n=147).

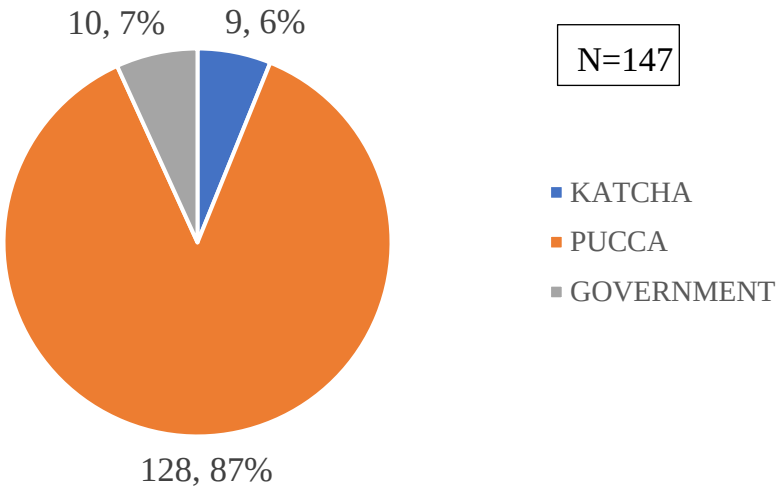
Figure 6.2: Distribution of the study participants according to socioeconomic status



Among 147 study participants, 29.2% of the subjects were from the lower socioeconomic group and 44.9% were from the middle socioeconomic class.

6.1.7 Distribution of the study participants according to the type of house(n=147).

Figure 6.3: Distribution of the study participants according to the type of house



About 87% (n=128) of the study participants lived in pucca houses.

6.1.8 Characteristics of housing among study participants.

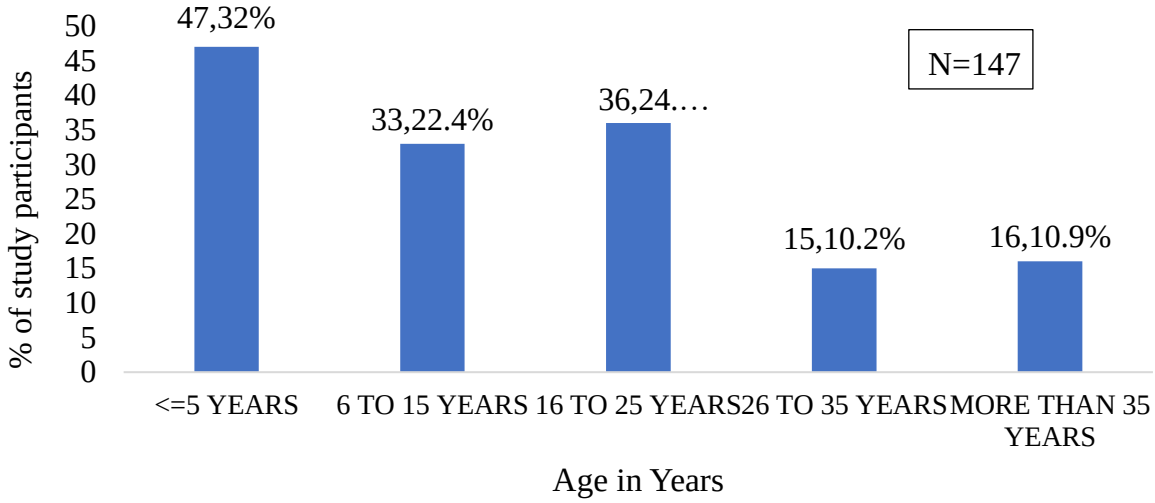
Table 6.5: Characteristics of housing among study participants(n=147).

Characteristics	Type	Frequency	Percentage
Type of roof	Concrete	105	71.4
	Asbestos	22	15.0
	Tiled	18	12.2
	Thatched	2	1.4
Type of floor	Concrete/ Tiled	140	95.2
	Earth	7	4.8
Type of wall	Brick wall	145	98.6
	Thatched	2	1.4

6.1.9 Age of the study participant's house(n=147).

The mean age of the study participant's house was 16 years with standard deviation of 13.5 years and the median was 12 years.

Figure 6.4: Age of the study participant house



Among 147 study participants, 32% (n=47) of the subject's house were built within the last 5 years. 11% of the study participant resided in the houses which were built more than 35 years ago.

6.1.10 Material used to paint the study participant's houses

Table 6.6: Material used to paint the study participant's houses(n=147).

Material	Frequency	Percentage
Thatched	2	1.0
White cement	29	19.7
No paint	6	4.0
Enamel / Distemper	19	12.9
Emulsion	91	61.9

Out of the 147 study participants house, 61% (n=91) of them were painted with emulsion while 30.6% (n= 45) of the house's paints were either white cement or distemper.

6.2 MEDICAL HISTORY OF THE STUDY PARTICIPANTS:

Table 6.2.1 Co-morbid conditions present among the study subjects.

Out of the 147 study participants, 88% (129) reported not to have any comorbid conditions and 12% (18) had comorbid conditions. Few participants had more than one comorbid condition.

Table 6.7: Co-morbid conditions among the study subjects(n=18).

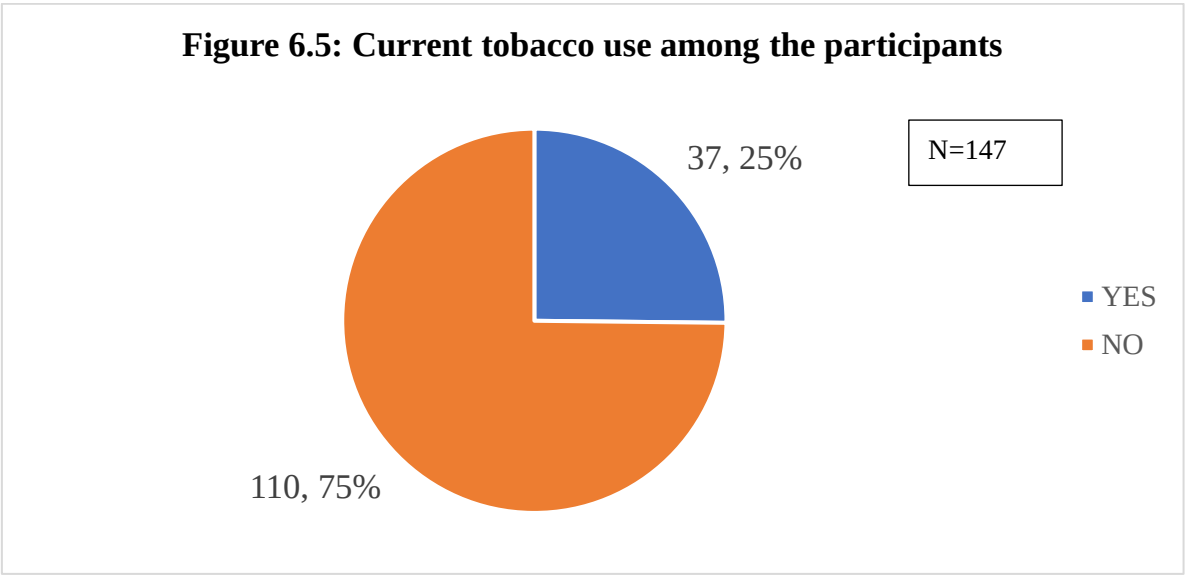
Comorbidity	**Frequency**	**Percentage**
Hypertension	9	50
Coronary heart disease	2	11
Type 2 diabetes mellitus	13	72
Epilepsy	1	5
No comorbidity	**129**	**88**

Among 18 study participants who had comorbidities, 50 % of them (9) had diagnosed hypertension. 72% of the participants (13) had type 2 diabetes mellitus and were on treatment. 2 participants (11%) had cardiovascular comorbidity of either coronary heart disease or stroke.

6.3 USE OF ALCOHOL AND TOBACCO AMONG THE SUBJECTS (N=147) (BASED ON WHO STEPS CORE QUESTIONNAIRE)

6.3.1 Smoking status among study participants(n=147).

Figure 6.5: Current tobacco use among the participants



Among 25% (37) of the 147 participants gave history of smoking currently. Out of the 37 participants who smoked, 35 (94.5%) men gave history of currently smoking daily.

6.3.2 History of alcohol consumption among study participants.

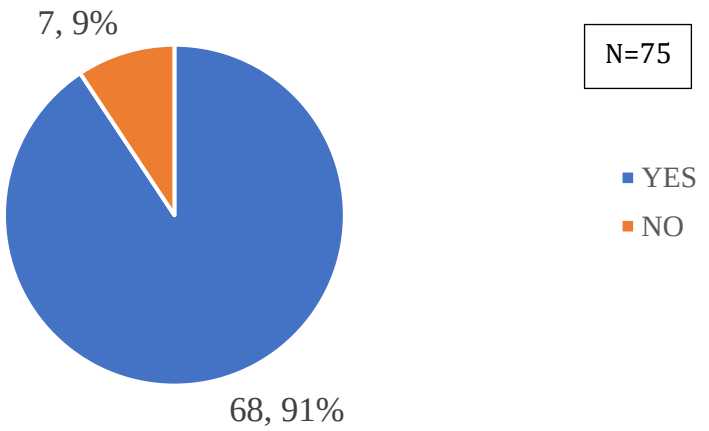
Table 6.8: Pattern of alcohol consumption among study participants(n=147).

History of alcohol consumption	Frequency	Percentage
Ever	75	51.0
Never	72	49.0
Total	147	100

Among 147 subjects, 51% (n=75) of them reported that they had ever consumed alcohol whereas 49% (n=72) said that they had never consumed alcohol during their lifetime.

6.3.3 History of alcohol consumption among participants in the past 30 days(n=75).

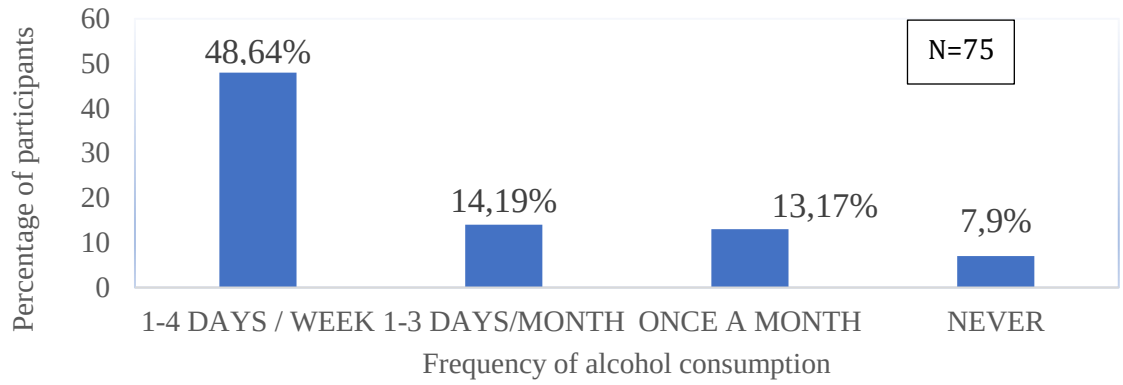
Figure 6.6: Alcohol consumption among participants in the past 30 days



Among the 75 participants with history of alcohol intake, 68 participant (91%) had history of alcohol consumption in the past 30 days.

6.3.4 Frequency of alcohol consumption in the past 30 days(n=75).

Figure 6.7: Frequency of alcohol consumption among study participant in the past 30 days

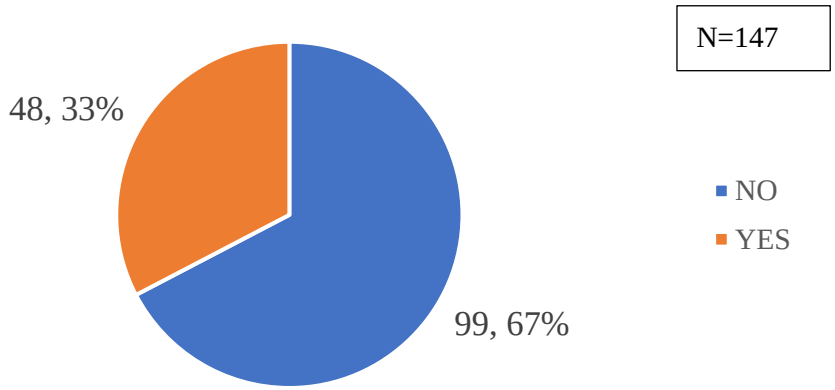


Among total participants ,64% (48) of them who consumed alcohol had a drink on one to four days per week.

6.4 OTHER SOURCE OF EXPOSURE TO LEAD

6.4.1 Participants involved in other occupation involve lead within last 3 years(n=147).

Figure 6.8: Participants involved in other occupations that involve lead exposure within last 3 years



Among the 147 occupational painters, 33% (48) painters were involved in occupations such as car mechanic, leather factory, mason, welding, farmer, silk industry, toy manufacturing etc which increases the risk of lead exposure.

6.4.2 Percentage of occupational painters using cosmetics containing lead.

Table 6.9: Percentage of occupational painters using cosmetics containing lead(n=147).

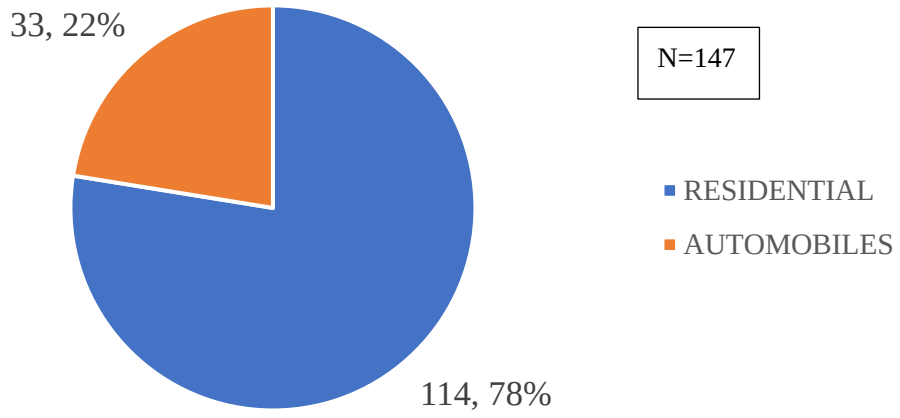
Cosmetics	Frequency	Percentage
Kajal / Surma	12	8.1
Kumkum (Sindoor)	68	46.3
Face cosmetics	55	37.4
None	12	8.2

Out of the 147 study participants, 46.3 % (n=68) of them reported using kumkum while 45.6% (67) were either using face cosmetics or surma and kajal. Most used face cosmetics among the subject were those which are commonly available in the local stores such as fair & lovely, fair, and handsome and Garnier white natural.

6.5 JOB CHARACTERISTICS AMONG RESIDENTIAL AND AUTOMOBILE PAINTERS.

6.5.1 Percentage of people involved in Residential and Automobile painting(n=147).

Figure 6.9: Percentage of people involved in residential and automobile painting.



Among 147 study participants, 78% (114) of the participants are residential painters and 22% (33) of the participants are automobile painters.

6.5.2 No of years the study participants involved in painting occupation:

In this study the mean (SD) and median (IQR) years the study participants involved in painting were16.76 (10.2) and 15(50) years respectively.

Table 6.10: No of years the study participants involved in painting occupation (n=147):

Characteristics	Categories	Residential Painting (N-114)	Automobile Painting(N=33)	Overall (N=147)
No. of years involved in painting occupation	1-10 years	39(3.2%)	13(39.4%)	52(35.4%)
	11-20 years	37(32.5%)	12(36.4%)	49(33.3%)
	21-30 years	28(24.6%)	7(21.2%)	35(23.8%)
	>30 years	10(8.8%)	1(3%)	11(7.5%)

Among the study participants (147), majority of them 35.4% (52) worked for 1-10 years. Among the residential group (144), 32.5% (37/144) involved in painting for 11-20 whereas majority of automobile painters,39.4% (13) involved in this field only for the past 10 years.

6.5.3 Workdays in a week in which the study participants were involved in painting occupation(n=147):

In this study the mean (SD) and median (IQR) no. of days the study participants involved in painting were 5.52 (1.1) and 6(4) days respectively.

Table 6.11: No of days in a week the study participants involved in painting.

Characteristics	Categories	Residential Painting (N-114)	Automobile Painting(N=33)	Overall (N=147)
No. of days in a week involved in painting	3-4 days	17(14.9%)	9(27.3%)	26(17.7%)
	5-6 days	87(76.3%)	17(51.5%)	104(70.7%)
	All days	10(8.8%)	7(21.2%)	17(11.6%)
	Mean (SD)	5.55 (0.9)	5.42 (1.5)	5.52(1.1)

Among residential painters, 14.9% (17) worked for only 3-4 days and 85% (97) worked all days in a week whereas among automobile painters 27.3% (9) of them worked only 3-4 days and 72.7% (24) of them worked all days in a week.

6.5.4 No of hours a day the study participants involved in painting occupation(n=147):

In this study the mean (SD) and median (IQR) no. of hours a day the study participants involved in painting were 7.46(2.3) and 8(12) years respectively.

Table 6.12: No of hours a day the study participants involved in painting(n=147).

Characteristics	Categories	Residential Painting (N-114)	Automobile Painting (N=33)	Overall (N=147)
No. of hours a day involved in painting	<= 6 hours	8(7%)	21(63.6%)	118(80.3%)
	>6 hours	106(93%)	12(36.4%)	29(19.7%)
	Mean (SD)	8.08 (1.5)	5.33 (3.4)	7.46(2.3)

Among study participants (147), only 19.7% (29) worked more than 6 hours a day. 93% (106/144) residential painters worked more than 6 hours a day whereas majority of the automobile painters 63.6% (21) worked less than 6 hours a day.

6.5.5 Procedures followed by painters at workplace.

Table 6.13: Procedures followed by painters at workplace(n=147).

Characteristics	Categories	Residential Painting (N-114)	Automobile Painting (N=33)	Overall (N=147)
Store paints	Workplace	70(61.4%)	28(84.8%)	98(66.7%)
	Go down	42(36.8%)	5(15.2%)	47(32%)
	Home	2(1.8%)	0	2(1.4%)
Mix paints	Manually mixed	102(88.5%)	23(69.7%)	125(85%)
	Premixed	12(10.5%)	10(30.3%)	22(15%)
Fate of empty cans	Store materials	46(40.4%)	2(6.1%)	48(32.7%)
	Throw away	64(56.1%)	11(33.3%)	75(51%)
	Sell them	4(3.5%)	20(60.6%)	24(16.5%)
Painting method	Manual painting	92(80.7%)	3(9.1%)	95(64.6%)
	Electric gun	4(3.5%)	28(84.8%)	32(21.8%)
	Both	18(15.8%)	2(6.1%)	2(6.1%)

Among the study participants (147), majority of them 66.7% (98) store their paints and paint related products at workplace and godown. Only 1.4% (2) residential painters store them at home.

Among the study participants (147), 125(85%) use their hands or locally available stick to mix paints whereas 15% (22) buy paints which are available premixed from paint stores.

Among the study participants, 32.7% (48) use empty cans to store materials and 51% (75) dispose them in commonly used bins. Only 24 (16.5%) sell them to rag pickers for recycling and reuse.

Among the residential painters, 92(80.7%) follows only manual method of painting (use brush and roller) whereas 84.8% (28) automobile painters use electric gun to paint. Only 6.1% (2) among the participants use both methods to paint.

6.5.6 Personal Protective Equipment (PPE) used by study participants(n=147).

Among study participants (147), only 68.1% (51) uses face mask, 29.2% (32) people use hand gloves, 90.4% (133) use separate clothes during painting, 12% (18) use googles and 10.2% (15) use boots while painting.

Majority of residential painters ,71.1% (81) use only soap and water to wash hands after painting whereas 84.9% (28) automobile painters use thinner with turpentine to wash hands.

Table 6.14: Personal Protective Equipment (PPE) used by study participants

Characteristics	Categories	Residential Painting (N-114)	Automobile Painting (N=33)	Overall (N=147)
Use face masks	Always	32(28%)	19(57%)	51(35%)
	Sometimes	27(24%)	5(15%)	32(22%)
	Rarely	16(14%)	1(3%)	17(12%)
	Never	39(34%)	8(24%)	47(32%)
Use hand gloves	Always	18(16%)	2(6%)	20(14%)
	Most of the time	1(1%)	0	1(1%)
	Sometimes	7(6%)	2(6%)	9(10%)
	Rarely	6(5%)	1(3%)	7(5%)
	Never	82(71%)	28(85%)	110(75%)
Use Separate clothes	Always	100(88%)	33(100%)	133(90%)
	Never	14(12%)	0	14(10%)
Use googles	Always	10(9%)	2(6%)	12(8%)
	Rarely	5(4%)	1(3%)	6(4%)
	Never	99(87%)	30(91%)	127(88%)
Use boots	Always	8(7%)	3(9%)	11(8%)
	Rarely	3(3%)	1(3%)	4(3%)
	Never	103(90%)	29(88%)	132(90%)
Material used to wash hands	Soap with water	81(71%)	5(15%)	86(59%)
	Thinner + turpentine	33(29%)	28(85%)	61(42%)

6.5.7 Facilities available at workplace.

Table 6.15: Facilities available at workplace(n=147).

Characteristics	Categories	Residential	Automobile	Overall
Hand wash	Yes	112(98.2%)	33(100%)	145(98.6%)
	No	2(1.8%)	0	2(1.4%)
Eat snacks/food	Yes	99(86.8%)	31(93.9%)	130 (88.4%)
	No	15(13.2%)	2(6.1%)	17(11.6%)
Shower	Yes	41(36%)	15(45.5%)	56(38.1%)
	No	73(64%)	18(54.5%)	91(61.9%)
Wash cloths	Yes	39(34.2%)	14(42.4%)	53(36.1%)
	No	75(65.8%)	19(57.6%)	94(63.9%)

In this study 98.6% (145) had facility to wash hands, 88.4% (130) had separate eating facility, 38.1% (56) had facility to take shower during emergency and 53(36.1%) had facility to wash clothes during spill at workplace.

6.5.8 Practice of study participants regarding personal hygiene

Table 6.16: Practice of study participants regarding personal hygiene(n=147).

Characteristics	Categories	Residential Painting (N-114)	Automobile Painting (N=33)	Overall (N=147)
Wash hands after work	Yes	112(98.2%)	32(97%)	144(98%)
	No	2(1.8%)	1(3%)	3(2%)
Wash hands before food	Yes	74(64.7%)	29(87.9%)	103(70.1%)
	No	40(35.1%)	4(12.1%)	44(29.9%)
Use same clothes at home	Yes	9(7.9%)	15(45.5%)	24(16.3%)
	No	105(92.1%)	18(54.5%)	123(83.7%)
Take Bath immediately after reaching home	Yes	68(59.6%)	28(84.8%)	96(65.3%)
	No	46(40.4%)	5(15.2%)	51(34.7%)

Of the total study participants (147), 98% (144) wash hands after work, 70.1% (103) wash hands before food and 65.3% (96) take bath immediately after reaching home. Only 16.3% (24) participants use same clothes at home.

6.5.8 Symptoms reported by study participants within last 2 weeks.

Table 6.17: Symptoms reported by study participants within last 2 weeks(n=147).

Symptoms	Residential	Automobile	Overall
Breathlessness	19(16.7%)	5(15.2%)	24(16.3%)
Cough and cold	25(21.9%)	20(60.6%)	45(30.6%)
Skin Rashes	27(23.7%)	7(21.2%)	34(23.1%)
Metallic Taste	9(7.9%)	1(3%)	10(6.8%)
Tooth pain	22(19.3%)	3(9.1%)	25(17%)
Weight loss	28(24.6%)	3(9.1%)	31(21.1%)
Fatigue	36(31.6%)	11(33.3%)	47(32%)
Loss of sleep	11(9.6%)	5(15.2%)	16(10.9%)
Loss of appetite	11(9.6%)	1(3%)	12(8.2%)
Irritability	28(24.6%)	9(27.3%)	37(25.2%)
Headache	36(31.6%)	7(21.2%)	43(29.3%)
Memory problem	13(11.4%)	5(15.2%)	54(36.7%)
Difficulty in concentration	26(22.8%)	10(30.3%)	18(12.2%)
Numbness	20(17.5%)	7(21.2%)	36(24.5%)
Weakness of limbs	22(19.3%)	5(15.2%)	27(18.4%)
Difficulty to get up from	1(0.9%)	10(30.3%)	29(19.7%)
Difficulty to wear footwear	2(1.8%)	7(21.2%)	1(0.7%)
Difficulty in combing hair	7(6.1%)	7(21.2%)	2(1.4%)
Vague Abdominal pain	16(14%)	0	10(6.8%)
Hearing difficulty	2(1.8%)	0	18(12.2%)
Nausea and vomiting	7(6.1%)	3(9.1%)	3(2%)
Constipation	16(14%)	2(6.1%)	16(10.9%)
Joint pain	2(1.8%)	1(3%)	41(27.9%)
Vision problem	12(10.5%)	4(12.1%)	7(38.8%)
Low Back pain	33(28.9%)	8(24.2%)	14(9.5%)

6.6ANTHROPOMETRIC MEASUREMENTS & CLINICAL EXAMINATION

Table 6.18: Anthropometric measurements of the study population(n=147).

Anthropometric measurements	Mean (SD)	Median (IQR)	Minimum	Maximum
Height	161.73(6.72)	162(158 – 164)	145	178
Weight	66.56(12.22)	65(58-75)	42	105
BMI	25.43(4.44)	25.28(22-28)	16.5	44.27

BMI is not normally distributed, and the median BMI is 25.28 kg/m^2 with an interquartile range of 22 to 28.

Table 6.19: Nutritional status of the Study Population based on BMI(n=147).

Body Mass Index (WHO classification)	Frequency	Percentage
Underweight (<18.5)	5	3.4
Normal (18.5 – 24.9)	67	45.6
Overweight (25.0 – 29.9)	56	38.1
Obesity ($\geq$30.0 kg/m^2)	19	12.9

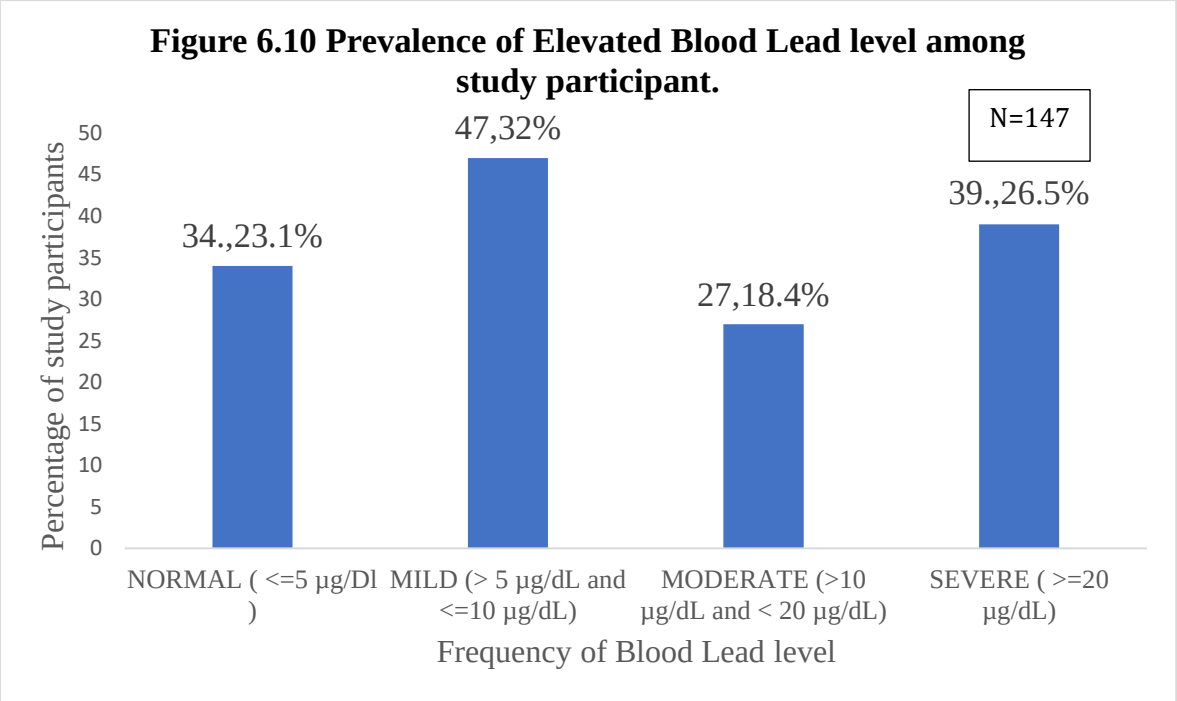
A large proportion of p 38.1 % of the study population fell under the overweight range. A further 12.9% were obese. 3.4% were underweight leaving behind a nearly 45.6% of the population in the normal BMI group.

Table 6.20: Distribution of Blood Pressure measurements among the painters(n=147).

JNC-8 Classification of BP	Frequency	Percentage
Normal	28	19
Prehypertension	53	36.1
Stage 1 HTN	38	25.9
Stage 2 HTN	28	19

Among those who having comorbidity,50%(n=9) of the study population had diagnosed hypertension and were on treatment for the same. According to JNC classification, 36.1% (n=53) were prehypertensive, 44.9% (n=66) had been diagnosed to have systemic hypertension.

6.6.1 Prevalence of Elevated Blood Lead level among study participants(n=147).



Among study participants (147), 32% (47) had blood lead level more than 5 and less than 10. 44.9% (66) had blood level more than 10. Only 23.1% (34) participants had blood lead level less than 5µg/dL.

6.6.2 Prevalence of Elevated Blood Lead level among residential and automobile painters

Among residential painters, 10.5% (12/114) had blood lead level ranging between >10 µg/dL and < 20 µg/dL (MODERATE). 27(18.4%) automobile painters had blood lead level that falls under moderate category. Only 3 % of automobile painters and 28.8% of residential painter had blood lead level range within normal range.

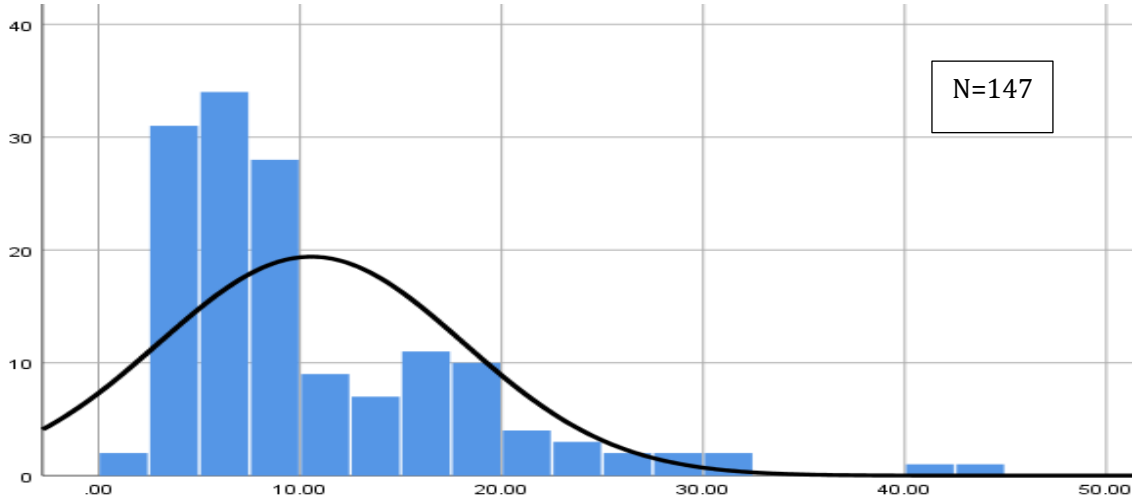
Table 6.21: Prevalence of Elevated Blood Lead level among residential and automobile painters(n=147).

CDC Classification of BLL's		Residential Painters (N-114)	Automobile Painters (N=33)	Overall (N=147)
NORMAL	<=5 µg/dL	33(28.9%)	1(3%)	34(23.1%)
MILD	(> 5 & <=10 µg/dL)	58(50.9%)	3(9%)	47(32%)
MODERATE	(>10 & < 20 µg/dL)	19(16.7%)	18(54.5%)	27(18.4%)
SEVERE	(>=20 µg/dL)	4(3.5%)	11(33.3%)	39(26.5%)

In this study, 26.5% (39) participants had very high blood lead level (>=20 µg/dl) and categorised as having severe lead poisoning.

6.6.3 Distribution of Blood lead level (BLL) among painters (n=147).

Figure 6.11: Distribution of Blood lead level (BLL) among painters



The blood lead levels (BLLs) of the participants varied between 2.3 µg/dL and 43 µg/dL. The mean blood lead level (BLL) of the subjects was 10.5 µg/dL with a standard deviation of 7.5 µg/dL and the median was 7.8 µg/dL (Interquartile range 2.3-43 µg/dL).

6.6.3 Prevalence of anaemia among residential and automobile painters.

Table 6.22: Categorization of Anaemia

Categories		Residential Painters (N-114)	Automobile Painters (N=33)	Overall (N=147)
No anaemia	(>13 GM%)	105(92.1%)	32 (97%)	137(93.2%)
Mild anaemia	(11.0 – 12.9 GM%)	5(4.4%)	1(3%)	6(4.1%)
Moderate anaemia	(8.0 – 10.9 GM%)	3(2.6%)	0	3(2%)
Severe anaemia	(<80 GM%)	1(0.9%)	0	1(0.7%)

In this study, 6.8% (10) participants were categorised as having anaemia. 93.2% (137) had haemoglobin value within normal range.

SECTION B: BIVARIATE ANALYSIS

Table 6.23: Association of sociodemographic characteristics with elevated blood lead level (BLL >10µg/dL).

Variable	Categories	Elevated BLL (>=10 µg/dL)	Normal BLL (<10 µg/dL)	p value	OR	95% CI (Lower-Upper)
Age	< 40 years	32(43.8%)	41(56.2%)	0.033*	2.10	1.05 - 4.20
	>= 40 years	20(27%)	54(73%)			
Marital status	Unmarried	18(46.2%)	21(53.8%)	0.100	1.86	0.88 - 3.94
	Married	34(31.5%)	74(68.5%)			
Education	Up to 8th	23(38.3%)	37(61.7%)	0.533	1.24	0.62 - 2.46
	More than 8th	29(33.3%)	58(66.7%)			
SES	Lower/ Lower middle/ middle	29(26.6%)	80(73.4%)	<0.001*	0.23	0.10 - 0.51
	Upper / Upper middle	23(60.5%)	15(39.5%)			
Area of Residence	Urban	29(65.9%)	15(34.1%)	0.027*	0.40	0.18 – 0.91
	Rural	85(82.5%)	18(17.5%)			

Of the 147 study participants ,43.8% (32/52) painters with elevated blood lead level were aged below 40 years. There was a strong significant association with the participants age and elevated blood lead level. (Chi sq. value= 4.542, p value=0.033, OR=2.107, CI: 1.05 – 4.20).

Of the 147 study participants ,46.2% (18/52) painters with elevated blood lead level were unmarried. There was no statistically significance difference between the marital status and elevated BLLs.

Of the 147 study participants ,38.3% (23/52) painters with elevated blood lead level studied up to 8th standard. There was no statistically significance difference between educational level and elevated BLLs.

Of the 147 study participants ,26.6% (29/52) painters with elevated blood lead level belongs to lower socio-economic status. There was a strong significant association with socio-economic status and elevated blood lead level. (Chi sq. value= 14.182, p value=<0.001, OR=0.236, CI: 0.19– 0.514).

Of the 147 study participants ,65.9% (29/52) painters with elevated blood lead level belong to urban area of Vellore. There was a strong significance association between area of residence and elevated BLLs. (p value=0.027, OR=0.40, CI: 0.18 – 0.91).

Table 6.24: Association of housing characteristics with elevated BLL (>10µg/dL).

Variable	Categories	Elevated BLL (>=10 g/dL)	Normal BLL (<10 g/dL)	p value	OR	95% CI (Lower-Upper)
Type of House	Pucca	47(34.1%)	91(65.9%)	0.280	0.43	0.10 - 1.61
	Katcha	5(55.6%)	4(44.4%)			
Age of the house	<=12 years	31(41.9%)	43(58.1%)	0.096	1.77	0.89 -3.54
	>12 years	21(28.8%)	52(71.2%)			
Material used to paint house	Painted	34(30.9%)	76(69.1%)	0.051	0.47	0.22 - 1.01
	Other than paints	18(48.6%)	19(51.4%)			

Variable	Categories	Elevated BLL (>=10 /dL)	Normal BLL (<10 g/dL)	p value	OR	95% CI (Lower-Upper)
Type of roof	Concrete	29(27.6%)	76(72.4%)	0.002*	0.31	0.15-0.66
	Others	23(54.8%)	19(45.2%)			
Type of floor	Cement floor	39(34.8%)	73(65.2%)	0.802	0.90	0.41-1.98
	Others	13(37.1%)	22(62.9%)			
Type of wall	Brick wall	49(34.8%)	92(65.2%)	0.666	0.53	0.10-2.73
	Others	3(50%)	3(50%)			

Among those with elevated blood lead level (52) 30.9% (34) lived in the painted house There was no statistically significance difference between material used to paint house and elevated BLLs.

Table 6.25: Association of other sources of exposure to lead with elevated blood lead level (i.e., >10µg/dL)

Variable	Categories	Elevated BLL (>=10 /dL)	Normal BLL (<10g/dL)	p value	OR	95% CI (Lower-Upper)
Occupation with lead	Yes	14(29.2%)	34(70.8%)	0.273	0.66	0.31-1.38
	No	38(38.4%)	61(61.6%)			
Kajal/Surma	Yes	4(50%)	4(50%)	0.374	1.89	0.45-7.98
	No	48(34.5%)	91(65.5%)			
Kumkum	Yes	25(36.8%)	43(63.2%)	0.744	1.12	0.56-2.20
	No	27(34.2%)	52(65.8%)			
Face cosmetics	Yes	20(36.4%)	35(63.6%)	0.846	1.07	0.53-2.15
	No	32(34.8%)	60(65.2%)			

Of the 147 participants,8.1% (12) had the habit of using kajal/Surma. Among them, 29.2% (14/52) painters with elevated blood lead level had the habit of using kajal. There was no statistically significance difference between the presence of this habit and elevated BLLs.

Of the 147 participants, 46.3% (68) had the habit of using Kumkum. 50% (4/52) of painters with elevated blood lead level had habit of using Kumkum. There was no statistically significance difference between the presence of this habit and elevated BLLs.

Of the 147 participants, 37.4% (68) had the habit of using face cosmetics. 36.4% (20/52) of painters with elevated blood lead level had habit of using face cosmetics. There was no statistically significance difference between the presence of this habit and elevated BLLs.

Table 6.26: Association of duration of painting with elevated BLL (>10µg/dL)

Variable	Categories	Elevated BLL (>=10 /dL)	Normal BLL (<10 g/dL)	p value	OR	95% CI (Lower-Upper)
Type of painting job	Automobile	29(87.9%)	4(12.1%)	<0.001*	28.68	9.16 - 89.78
	Residential	23(20.2%)	91(79.8%)			
Duration of occupation	> 5 years	41(33.3%)	82(66.7%)	0.241	0.59	0.24 -1.43
	< 5 years	11(45.8%)	13(54.2%)			
Days involved in painting per week	>4days	44(36.4%)	77(63.6%)	0.588	1.28	0.51 - 3.19
	<=4days	8(30.8%)	18(69.2%)			
Working hours per day	>=6 hours	19(65.5%)	10(34.5%)	<0.001*	4.89	2.06 - 11.62
	<6 hours	33(28%)	95(72%)			

Out of 147 participants, 114(77.5%) were automobile painters and 33(22.4%) were residential painters. 87.9% (29/33) automobile painters and 20.2% (23/114) had elevated blood lead level. There was a strong association with the job involved and elevated blood lead level. (Chi sq. value= 28.68, p value=<0.001, OR=28.68, CI:9.16 - 89.78)

In this study the mean (SD) and median (IQR) years the study participants involved in painting are 16.76 (10.2) and 15(50) years respectively. 33.3% (41/52) painters with elevated blood lead level worked for more than 5 years in this field. There was no statistically significance difference between the longer years at work and elevated BLLs.

In this study the mean (SD) and median (IQR) no. of days the study participants involved in painting are 5.52 (1.1) and 6(4) years respectively. 36.4% (44/52) painters with elevated blood lead level worked for more than 4 days per week. There was no statistically significance difference between the longer days at work and elevated BLLs.

In this study the mean (SD) and median (IQR) no. of hours a day the study participants involved in painting are 7.46(2.3) and 8(12) years respectively. 65.6% (19/52) painters with elevated blood lead level worked for more than or equal to 6 hours per day. There was a strong association with the longer hours at work and elevated blood lead level. (Chi sq. value= 28.68, p value=<0.001, OR=28.68, CI:9.16 - 89.78)

Table 6.27: Association of job characteristics with elevated BLL (>10µg/dL)

Variable	Categories	Elevated BLL (>=10 µg/dL)	Normal BLL (<10 µg/dL)	p value	OR	95% CI (Lower-Upper)
Painting method	Electric gun	32(61.5%)	20(38.5%)	<0.001*	6.0	2.84-12.64
	Manual painting	20(21.1%)	75(78.9%)			
Paint storage	Workplace	40(40.8%)	58(59.2%)	0.051	2.12	1.98 - 4.57
	Others	12(24.5%)	37(55.5%)			
Method to mix paints	Premixed	12(54.5%)	10(45.5%)	0.010*	0.27	0.10-0.51
	Hands to mix	102(81.6%)	23(18.4%)			
Dispose of empty cans	Store materials	11(22.9%)	37(77.1%)	0.028*	0.42	0.19 - 0.92
	Others	41(41.4%)	58(58.6%)			

Among those with elevated blood lead level (52), 54.5% (12) painters used electric gun to spray paint and 21.1% (20) painters used brush or roller to paint. There was a significant association with painting method and elevated blood lead level. (Chi sq. value= 24.095, p value=<0.001, OR=6, CI:2.848-12.642)

Among those with elevated blood lead level (52), 61.5% (20) painters use premixed paints. There was a strong association with the method to mix paints and elevated blood lead level. (Chi sq. value= 7.865, p value=0.010, OR=0.271, CI:0.109-0.514)

Among those with elevated blood lead level (52), 40.8% (40) painter store paints and paints related materials at workplace and 22.9% (11). There was no statistically significance difference between the paint storage and elevated BLLs.

Among those with elevated blood lead level (52), 22.9% (11) make use of empty paint cans to store materials at home. There was a strong association with dispose of empty cans and elevated blood lead level. (Chi sq. value= 4.838, p value=0.028, OR=0.421, CI:0.192-0.920).

Table 6.28: Association of participants practice with elevated BLL (>10µg/dL).

Variable	Categories	Elevated BLL (>=10 /dL)	Normal BLL (<10 g/dL)	p value	OR	95% CI (Lower-Upper)
Practice	Inappropriate practice	36(39.6%)	55(60.4%)	0.176	1.636	0.800-3.348
	Appropriate practice	16(28.6%)	40(71.4%)			

Of the 147 study participants, 38% (56) had appropriate practice.39.6% (36) participants with elevated blood lead level had inappropriate practice. There was a no statistically significance difference between inappropriate practice at work and elevated BLLs.

Table 6.29: Association of Personal Protective Equipment (PPE) used by study participants with elevated blood lead level (i.e., >10µg/dL)

Variable	Categories	Elevated BLL (>=10 g/dL)	Normal BLL (<10 g/dL)	p value	OR	95% CI (Lower-Upper)
Face mask usage	Never	16(34%)	31(66%)	0.817	0.91	0.44-1.90
	Always	36(36%)	64(64%)			
separate clothes usage	Never	2(14.3%)	12(85.7%)	0.083	0.27	0.59-1.28
	Always	50(37.6%)	83(62.4%)			
Hand gloves usage	Never	36(32.7%)	74(67.3%)	0.247	0.63	0.29-1.36
	Always	16(43.2%)	21(56.8%)			
Goggles usage	Never	47(36.4%)	82(63.6%)	0.472	1.49	0.50-4.44
	Always	5(27.8%)	13(72.2%)			
Boots usage	Never	44(33.3%)	88(66.7%)	0.125	0.43	0.14-1.28
	Always	8(15.3%)	7(4.7%)			

Among those with elevated blood lead level (52), only 36% (36) avail oneself of facemask,37.6% (50) use separate clothes,43.2% (16) use hand gloves ,27.8% (47) use googles and only 15.3% (8) use boots while working. This is no statistical significance difference with use of personal protective equipment's and elevated blood lead level.

Table 6.30: Association of Socioeconomic status with type of painting.

Socio-economic status	Residential painting (n=109)	Automobile painting (n=38)	p value	OR	95% CI
Lower/lower middle/middle	95(83.3%)	19(16.7%)	<0.001*	6.78	2.90-15.84
Upper/upper middle	14(42.4%)	19(57.6%)			

Table 6.31: Association of creatinine level with elevated blood lead level.

Blood lead level (BLL)	Elevated Creatinine (>1.3 g/dl)	Normal Creatinine (<=1.3 /dl)	p value	OR	95% CI
Elevated BLL	1(1.9%)	51(98.1%)	0.66	1.84	0.11-30.08
Normal BLL	1(1.1%)	94(98.9%)			

Table 6.32: Association of haemoglobin level with elevated blood lead level.

Blood lead level (BLL)	Anaemia (< 13gm/dl)	No anaemia (>=13gm/dl)	p value	OR	95% CI
Elevated BLL	2(3.8%)	50(96.2%)	0.49	0.43	0.89-2.12
Normal BLL	8(8.4%)	87(91.6%)			

Table 6.33: Association of alanine transaminase (SGPT) level with elevated blood lead level.

Blood lead level (BLL)	High SGPT (>=50)	Normal SGPT (<50)	p value	OR	95% CI
Elevated BLL	3(5.8%)	49(94.2%)	1.00	1.10	0.25-4.80
Normal BLL	5(5.3%)	90(94.7%)			

Among those with elevated blood lead level (52), only 1(50%) painter had high creatinine level, 2(20%) painters were anaemic, and 3 (37.5%) painters had high SGPT level. This was no statistical significance difference with laboratory investigations and elevated blood lead level.

SECTION C: MULTIVARIATE ANALYSIS

To adjust for potential confounders, selected variables which were strongly established risk factors from this and other studies or chi square p-value up to 0.1 were chosen from the univariate analysis for multivariate analysis. A logistic regression analysis was performed to study the risk factors for elevated BLLs among residential and automobile painters after adjusting for potential confounders. The following variables were used as exposure variables: Age < 40 years , Education up to 8th standard ,Lower socio-economic status, Living in pucca house, Urban residence, Use electric gun to paint, Age of the house (<=12 years), Material used to paint house, No of years involved in painting, No.of working days in a week (>4days), Store paints at workplace, Use empty cans to store material, Inappropriate practice, House with concrete roof and Manually mixing paints.

Table 6.34: Multivariate logistic regression model for factors associated with elevated BLLs

Variables	Categories	Elevated BLL	Normal BLL	Odds ratio (OR) (Unadjusted)	Odds ratio (OR) (Adjusted)	95% confidence Interval (adjusted OR)	
						Lower	Upper
Age	< 40 years	32(43.8%)	41(56.2%)	2.10	1.57	0.61	4.06
	>= 40 years	20(27%)	54(73%)				
Education	Up to 8th	23(38.3%)	37(61.7%)	1.24	0.91	0.34	2.46
	More than 8th	29(33.3%)	58(66.7%)				
Socioeconomic status	Upper/upper middle	23(60.5%)	15(39.5%)	0.23	0.48	0.16	1.41
	Lower/lower middle/middle	29(26.6%)	80(73.4%)				
Residence	Urban	29(65.9%)	15(34.1%)	0.40	1.28	0.42	3.90
	Rural	85(82.5%)	18(17.5%)				
Age of the house	<=12 years	31(41.9%)	43(58.1%)	1.77	1.37	0.50	3.74
	>12 years	21(28.8%)	52(71.2%)				
Type of roof	Concrete	29(27.6%)	76(72.4%)	0.31	0.35*	0.12	0.96
	others	23(54.8%)	19(45.2%)				
Kajal/Surma	Yes	4(50%)	4(50%)	1.89	1.16	0.12	10.60
	No	48(34.5%)	91(65.5%)				

Variables	Categories	Elevated BLL	Normal BLL	Odds ratio (OR) (Unadjusted)	Odds ratio (OR) (Adjusted)	95% confidence Interval (adjusted OR)	
						Lower	Upper
Occupation involved	Automobile	28(87.9%)	4(12.1%)	28.68	12.56*	2.53	62.24
	Residential	23(20.2%)	91(79.8%)				
Manual hours involved in painting occupation	More than 576 hours	18(25%)	54(75%)	0.40	0.38*	0.14	0.99
	< 576 hours	34(45.3%)	41(54.7%)				
Painting method	Electric gun	32(61.5%)	20(38.5%)	6.0	1.56	0.48	5.06
	Manual painting	20(21.1%)	75(78.9%)				
Personal protective equipment	Appropriate use	12(15.2%)	67(84.8%)	0.12	1.18	0.44	3.17
	Inappropriate use	40(58.8%)	28(41.2%)				
Method to mix paints	Hands to mix	102(81.6%)	23(18.4%)	0.27	1.13	0.26	4.97
	Premixed	12(54.5%)	10(45.5%)				
Paint storage	Workplace	40(40.8%)	58(59.2%)	2.12	1.39	0.49	3.90
	Others	12(24.5%)	37(55.5%)				

7. DISCUSSION

In this community-based cross-sectional study, the main objectives were to study the risk factors for elevated blood lead levels among residential and automobile painters residing in urban and rural areas of Vellore. The mean (SD) blood lead levels of the 147 study participants were 10.5(7.5) µg/dL, the median was 7.8µg/dl, and it ranged from 2.3 to 43µg/dl. Nearly 36% (52) of the study participants had elevated blood lead levels (BLL) based on the current CDC recommended value of 10mcg/dl, thus indicating that lead poisoning is a significant health problem among occupational painters in this region.

Among residential painters, 10.5(12/144) had blood lead levels ranging between > 10µg/dl and <20µg/dl (Moderate), 27(18.4%) automobile painters had blood lead levels that fell under the moderate category. Only 3% (1) of automobile painters and 29% (23) of residential painters had blood lead levels within the normal range. It has been well documented that the burden of lead poisoning varies between countries and between different regions within a country. Lead poisoning accounts for about 0.6% of the global burden of disease. The highest burden was in low- and middle-income countries (2). The Institute for Health Metrics and Evaluation (IHME) estimated that in 2019, lead exposure accounted for 900 000 deaths and 21.7 million years of healthy life lost (disability-adjusted life years, or DALYs) worldwide due to long-term effects on health (24). Limited information is available from India on blood lead levels' burden among occupational painters. The proportion of study participants with elevated blood lead levels (BLL) in this region was higher than those reported from other parts of India (16%) (9).

Socio-demographic correlates for Lead poisoning.

Constraints with lead measurements and study design have been an issue in India. Only a few studies are available from India looking at factors that might correlate with blood lead levels among occupational painters. At the individual level, significant predictors associated with elevated BLL's among painters included age, educational status, Lower SES, housing, and job characteristics in the developing countries (43).

In this study, the odds of elevated BLL's among participants less than 40 years were twice that of the others with a p-value of 0.033 and 95%CI (1.052-4.20). People residing in the urban residential area were 60% more likely to have elevated BLL's with a p-value of 0.027 with 95%CI (0.18-0.91). Similarly, participants from lower socioeconomic status were 77% more likely to have elevated BLL's when compared to higher socioeconomic status.

The elevated blood lead levels among painters less than 40 years would have been influenced by many factors like increased manhours in painting, barriers to use PPE's and increased exposure to environmental pollutants. Low socioeconomic status and residing in an urban area would have exposed them to more significant environmental pollutants, evident in their blood lead levels.

Housing characteristics and elevated blood lead level

About 87% (128) of the study participants lived in pucca houses. It is generally considered that concrete roofs are safer and more shift, painted, porous, and less durable. The majority of the participants (71.4%) lived in houses with concrete roofs, while the others lived in homes with tiled, thatched, tin or asbestos roofs. There was

a strong significant association between people living on concrete roofs and elevated blood lead levels in this study. This may be due to the painted concrete roofing.

Lead in paint has always been a matter of concern. As the colour starts ageing and peeling surfaces such as walls, windows, doors, and grills, people are more exposed to lead-containing flaking paint or even ingest dust rich in lead contributed by the flaking paint. The phenomenon is often seen in older paints used due to lack of legislation regarding lead contraction in paint nearly 20 years back in India. Thus, the house's age is a significant risk factor associated with elevated blood lead levels. This study also showed similar results that participants with elevated blood levels were two times more likely if the participant stayed in a house >=12 years of age.

Similarly, a study done among preschool children residing in urban slums shows that the risk factor for elevated blood lead levels was recently painted houses [Adjusted OR 7.05 (95%CI 1.84-26.99)] and age of the house >=10 years. [Adjusted OR 6.53 (95%CI 2.43-17.58) (19).

In addition to exposure at the workplace, they have an additional route from the houses and environment they live. This is likely because the older homes still have layers of older paint under newer ones, slowly contributing to the dust in the atmosphere. In most places, even if a newer layer of paint has been painted, a few layers of older paint are always scraped off and sandpapered to make the base smooth for newer paint to adhere better. This process can also rack up lead-laden dust contributing to EBLL's.

Duration involved in painting and elevated blood lead level.

Longer duration of exposure to lead-laden dust could be significant contributors for EBLL's. In this study, the mean (SD) hours the study participants involved in painting were 722(576) hours, respectively.

This study had a substantial link between long working hours and higher blood lead levels with adjusted OR 0.38 with 95%CI (0.14-0.99). Among the study participants (147), 35.4% (52) worked for 1-10 years. Among the residential group (14), 32.5% (37/144) were involved in painting for 11-20 years, whereas most automobile painters, 39.4% (13), were involved in this field only for the past 10 years.

Usage of cosmetics and their association with EBLL's

Lead imparts lustre and shimmer when added to cosmetics and thus is widely used due to its availability and cost. In this study, 46.3 % (68) of the participants said they used Kumkum, whereas 45.6 % (67) said they used facial cosmetics, Surma, or kajal. In this study, participants using kajal/Surma had an equal chance of having elevated blood lead levels with non-users. Hence there was no association made. A study done among preschool children residing in urban slums showed no association found in using cosmetic items and elevated BLL's (19).

Personal protective equipment and their association with EBLL's.

Although paint begins as a liquid, it is swiftly transformed into an airborne powder by pressured sprayers. Aerosols, or suspended liquid particles, enter the air as a mist with a solid nucleus of colours trapped inside. These relatively big particles deposit deep in the lungs, posing a risk of long-term health concerns. As a result, wearing personal

protective equipment (PPE) is essential to avoid contact with paint and other similar substances.

In this study, only 68.1 % (51) of the total participants in this research used a face mask, 29.2 % (32) used hand gloves, 90.4 % (133) used different garments while painting, 12 % (18) used google, and 10.2 % (15) used boots. Odds of having elevated blood lead levels among inappropriate use of PPE's were 1.2 times higher than those using appropriate PPE's with adjusted OR 1.18 and 95% CI (0.44-3.17).

Similarly, a study done among spray painters (n=120) in Nigeria showed that spray painters reported excessive tear production, recurrent cough, and short-term memory loss more frequently than controls ($P<0.05$). In addition, 89% of painters noticed paint-stained sputum immediately after spray painting. The prevalence ratio of respiratory symptoms was higher in spray painters than controls (prevalence ratio=21.0, CI=2.9–153.6) (85).

Personal hygiene and their association with EBLL's.

It is essential to maintain personal cleanliness at work to protect oneself from the damaging consequences of lead intoxication. Several professional procedures, including sanding, scraping, and blasting, expose painters to lead throughout the day. In this study, 38 % (56) of individuals with normal blood lead levels had appropriate practices, whereas 39.6% (36) of those with increased blood lead levels had inappropriate practices.

The odds of having elevated blood lead levels among painters with inappropriate practices were 1.6 times more than those with appropriate practices with a p-value of 0.176 and 95% CI (0.80-3.34).

Multivariate analysis

After adjusting for potential confounders, multivariate analysis revealed painters involved in automobile painting were 12.56 times higher odds of having elevated blood lead levels [adjusted OR=12.56,95%CI (2.53-62.24)] as compared to those who were involved in residential painting. Similarly, people living in residences with concrete roofing were protected from having elevated blood lead levels [adjusted OR=0.35%,95%CI (0.12-0.96)].

8. LIMITATIONS

1. The study sample was not equally distributed throughout the rural and urban regions of Vellore. This would have affected the characteristics of the houses and their interaction.
2. We did not get a similar number among automobile and residential painters.
3. Usually lead has a half-life of around 35 days in peripheral blood. Reduced occupational exposure due to Covid induced lockdowns may have affected the prevalence of elevated BLLS among these commercial painters.
4. Possibility of recall, information and selection biases is a potential limitation.

9. CONCLUSIONS

- According to the revised CDC guideline value of 10mcg/dl, 35.7 % (52) of the study participants had elevated blood lead levels.
- Prevalence among residential and automobile painters
    i. Residential painters(n=114)
        - 51% of study participants had BLL between >5 and <=10µg/dl.
        - 16.7% of study participant had BLL between>10 and <20µg/dl.
        - 3.5% of study participant had BLL equal to or above 20µg/dl.
    ii. Automobile painters(n=33)
        - 9% of study participants had BLL between >5 and <=10µg/dl.
        - 54.5% of study participant had BLL between>10 and <20µg/dl.
        - 13.3% of study participant had BLL equal to or above 20µg/dl.
- Risk factors for elevated blood lead levels
    - On Bivariate analysis: Age (<40 years), Socioeconomic status (Lower), Area of residence (Urban), material used to paint house, Type of roof, use of kajal/Surma, Occupation involved, man hours at work, painting method, method to mix paints, dispose of empty cans and inappropriate use of personnel protective equipment
    - Multivariate analysis after adjusting for potential confounders
        i. Study participants involved in automobile painting [adjusted OR=12.56,95%CI (2.53-62.24)]
        ii. Manhours involved in painting [adjusted OR=0.38,95%CI (0.14-0.99)].
        iii. People living under concrete roof [adjusted OR=0.35,95%CI (0.12-0.96)].

10. RECOMMENDATIONS

1. Information about the dangers and symptoms of lead poisoning to seek medical assistance as soon as possible.

Occupational painters must be informed on the risks and hazards of painting and the painting process and their health consequences and change in practice.

2. All painters should be encouraged to use personal protective equipment (PPE) at work.

3. Painters and people in similar occupations should have periodical health examination and laboratory testing; should be a component of primary health care program.

4. The legislation against the use of lead in the paint must be rigorously followed.

5. Painters should be taught about job exposure and cleaning up after themselves, as well as hand washing, and to avoid smoking.

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ANNEXURE: 1

QUESTIONAIRE – ENGLISH VERSION

ELEVATED BLOOD LEAD LEVELS AND ASSOCIATED HEALTH EFFECTS AMONG PEOPLE INVOLVED IN PAINTING OCCUPATION AND GENERAL POPULATION FROM RURAL AND URBAN AREAS OF VELLORE, TAMIL NADU.

SECTION-A- SOCIODEMOGRAPHIC DETAILS

1. Participant ID :
2. Name of the participant :
3. Age :
4. Name of Village/ Ward :
5. Area: a) Rural b) Urban
6. Marital status :

Date of survey:
Village No:
Ward No:
Street:
Contact No:

CHAD hospital No :	CMC hospital No:	HDSS ID No:

a) Unmarried b) Married c) Separated d) Divorced e) Widower

7. Education (in completed years):
8. Type of family: a) Nuclear b) joint c) Extended
9. Total no of family members:
10. Total Monthly income (in INR):
11. Number of family members belonging to following age group :

S.No	Age group	Members
11.a	Less than 15 years	
11.b	15 to 45 years	
11.c	45 to 59 years	
11.d	More than 60 years	

SECTION B-HOUSING DETAILS

12. Type of house : a) Katcha b) Pucca c) Government d) Hut

13. Type of roof : a) Tin b) Tiled c) Thatched d) Concrete e) Asbestos

14. Type of floor: a) Concrete b) tiled floors c) Earth d) Mud e) Clay

15. Type of walls: a) Concrete b) tiled c) Thatched d) Mud e) Clay

16. When was your house built? _____

17. Type of material used to paint your house? a) Soda-lime b) Thatched c) white cement d) No paint e) Enamel f)Emulsion g) Distemper h) Don't know.

18. Number of times the house was painted in the last 5 years_____

19. How often do you sweep your house in a day? _____

20. How often do you mop your house in a week? _____

21. Location of any industry or factory near the house? a) Yes b) No

21. a) If yes ,approximately what distance ? _____

22. Do you live near a busy road/ highway? a) Yes b) No

22.a) If yes ,approximately what distance ? _____

SECTION C- COMORBIDITIES AND CURRENT MEDICAL HISTORY

23. Do you have any co-morbidities ? a)Yes b) No

	If Yes, fill the details in the corresponding box:				
	Other Co morbidities		No	Yes	If Yes, duration
23.a	Hypertension				
23.b	Diabetes Mellitus				
23.c	Coronary Heart Disease				
23.d	Psychiatry disorder				
23.e	Seizure disorder				
23.f	Chronic kidney disease				
23.g	Thyroid disorders				
23.h	Cerebrovascular Accidents				
23.i	Others	1			
		2			
		3			

24. Current medical history

S.No	Symptoms	No	Yes	If yes, duration of problem
24.a	Breathlessnes			
24.b	Cough with expectoration(> 2weeks)			
24.c	Any itching / irritation/ peeling/ discoloration of skin or hands, feet or face			
24.d	Metallic taste in mouth			
24.e	Pain in teeth			
24.f	Weight loss			
24.g	Fatigue			
24.h	Loss of sleep			
24.i	Loss of appetite			
24.j	Irritability			
24.k	Headaches			
24.l	Memory problems			
24.n	Difficulty concentrating			
24.m	Numbness or tingling of hand or feet			
24.o	Weakness of limbs			
24.p	Difficulty in getting up from squatting position			
24.q	Slipping of footwear			
24.r	Difficulty in combing hair or buttoning shirts			
24.s	Abdominal pain			
24.t	Hearing loss			
24.u	Nausea/vomiting			
24.v	Constipation			
24.w	Joint pain			
24.x	Others			

SECTION D: WHO STEPS CORE For Alcohol and Tobacco Usage.

25. Do you currently smoke any tobacco products, such as cigarettes, cigars or pipes?

    a) Yes b)No (if No skip to question 25)

26. Do you currently smoke tobacco products daily? a) Yes b) No

27. If yes, on average, how many do you smoke each day? _____

28. If yes, number of years of tobacco use?

29. Do you currently use Tobacco in non –smoke form? a)Yes b) No

30. If yes , nature, quantity per day_____

31. If yes, number of years of non smoke tobacco use? _____

32. Any other substance abuse? a) Yes b) No

33.a) If yes, specify? _____

33. Have you ever consumed an alcoholic drink such as beer, wine, and spirits? a) Yes b)No

34. If yes, during the past 12 months, how frequently have you had at least one alcoholic drink?

    a)Daily b) 5-6 days/week c) 1-4 days/week d)1-3 days/month e) less than once a month

35. Have you consumed an alcoholic drink within the past 30 days? a) Yes b) No

36. During the past 30 days, on how many occasions did you have at least one alcoholic drink?

    Number----------b) Don’t Know.

SECTION E- LEAD EXPOSURE HISTORY

37. Do you work in an occupation or have any hobbies mentioned below?

Sl. No.	Occupation	No	Yes	If Yes, mention
37.a	Auto mechanics/bodywork Plumbing			
37.b	Farm/Migrant Farm Work			
37.c	Metal Sculpting			
37.d	Furniture Refinishing			
37.e	Smelting Metals			
37.f	Blowing Glass			
37.g	Tanning industry			
37.h	Renovation Work			
37.i	Metal Work/Welding Casting			
37.j	Printing			
37.k	Car repair			
37.l	Battery Recycling/Smelting/Recycling			
37.n	Ac mechanic			
37.m	Radiator Repair			
37.o	Plastics manufacturing			
37.p	Ceramic Making			
37.q	Toy making(Metal)			
37.r	Home Repairs/Remodeling High Construction			
37.t	Old painted pottery to store food			
37.u	Mason			
37.v	Cell service			

38. Do you regularly apply any of the following ?

a) Kajal b) surma c) Sindoor d) Face cosmetics e) None

SECTION F-RESIDENTIAL COMMERCIAL AND AUTOMOBILE PAINTERS

39. How long have you been involved in painting occupation (in approx number of years)?
40. How many days a week, are you involved in painting occupation? _____
41. On an average, how many hours a day, are you involved in painting occupation? _____
42. Where do you store the paint? a) Home b) godown c) workplace d) others
43. How do you usually mix the paints? a) Premixed b) Manually mixed c) Mechanically.
44. Where do you usually mix the paints? a) Home b) godowns c) workplace d)others
45. What do you do with the empty cans used to procure and store paints?
    a) Store materials b) Throw away c) Buried d)sell them e)Given to rag pickers
46. How do you paint? a) Manual painting b) electrical gun c)sprayers d) others _____
47. Do you use facemasks or any protective device to cover mouth and nostril, while painting?
    a) Always b) Most of the time c) Sometimes d) Rarely e) Never.
48. Do you use hand gloves or any other protective equipment for hand protection while painting? a) Always b) Most of the time c) Sometimes d) Rarely e) Never. (If answer is "never" skip question no 50 and 51)
49. What is the hand protective equipments used by you made of a) Plastic b) rubber c) paper d) others specify_____
50. Is the hand protective equipments material permeable to liquids and fine solids? a) Yes b) No c) Don't know
51. Do you use any separate clothes, while involved in painting? a) Always b) Most of the time c) Sometimes d) Rarely e) Never.
52. Do you use safety goggles or any other protective equipment for eye protection while involved in painting? a) Always b) Most of the time c) Sometimes d) Rarely e) Never.
53. Do you use safety boots or any other protective equipment (safety shoes) while involved in painting? a) Always b) Most of the time c) Sometimes d) Rarely e) Never.
54. How would you wash the paints off your hands and legs? a) Water b) Soap with water c) Kerosene d) Thinner e)Others ,Specify……..

55. Do you know of others you work with who have medical conditions due to long term involvement in painting occupation? a)Yes b)No

56.a) if yes ,specify the details_____

56. Facilities available in the most recent work place

S.No	QUESTIONS	YES	NO
56.a)	Are facilities available for Hand washing in the work area?		
56.b)	Are facilities available for eating in the work area?		
56.c)	Are facilities available for Showers in the work area?		
56.d)	Are facilities available for laundering of work clothes by the workplace?		

57. Personal hygiene measures followed in the most recent work place

S.No	QUESTIONS	YES	NO
57.a)	Do you wash your hands immediately after painting?		
57.b)	Do you smoke in the work area?		
57.c)	Do you wash your hands before eating or smoking in the work		
57.d)	Do you wear your work clothes home?		
57.e)	Do you take bath immediately after going home?		

SECTION G- ANTHROPOMETRY, EXAMINATION AND LABORATORY INVESTIGATION

GENERAL EXAMINATION

Height_____ Weight _____

Pallor_____ Icterus_____ Cyanosis _____Clubbing _____ Pedal edema ____

Vitals : Pulse___/min

Blood Pressure 1(mm/Hg)	Blood pressure 2(mm/Hg)	Average Blood pressure(mm/hg)

Burtonian line in the Gums ____ Oral Mucosal erosions _____Tremors_____

SYSTEMIC EXAMINATION

Cardiovascular examination _____

Respiratory examination_____

Abdominal examination _____

Central Nervous System Examination

Orientation (place, person, time) _____

Memory (object recall) _____

Coordination (Finger nose test) _____ (walking in straight line) _____

Visual-spatial (design copying) _____

Gait_____

Motor Examination

	Upper limb right	Upper limb left	Lower limb right	Lower limb left
Bulk				
Tone				
Power				
Reflex				
Biceps				
Triceps				
Supinator				
Knee				
Ankle				

Sensory examination

	Upper limb right	Upper limb left	Lower limb right	Lower limb left
Vibration				

Laboratory investigation

Sl No.	Investigation	Date	Result
1	Complete blood count		
2	Blood lead level		
3	Creatinine		
4	SGPT		

ANNEXURE – 2

INFORMATION SHEET – ENGLISH VERSION

INFORMATION SHEET DATE:

This informed consent information sheet applies to adult consent (over 18 years old)

The following information is provided to inform you about the research project and your participation in it. Please read this form carefully and feel free to ask any questions you may have about this study and information given below. You will be given an opportunity to ask questions, and your questions will be answered. Also you will be given a copy of this information sheet. Your participation in this research study is voluntary. You are also free to withdraw from this at any time.

Purpose of the study

The purpose of this study is to assess the health effects as a result of elevated blood lead level due to long term exposure to paints among people involved in painting occupation in rural and urban block of Vellore, Tamil Nadu.

Procedures to be followed

The study involves collection of blood, answering a few questions and a quick physical examination.

The investigator will come and perform the following procedures:

1. Collect 8 ml of blood by injecting a needle syringe into your vein under aseptic precautions.
2. The investigator will interview you regarding your socio demographic / socio economic status medical history, occupation history, precautions at work place etc. The interview will take approximately 10 minutes.
3. A physical examination, respecting all aspects of privacy.
4. Anthropometry measurements include height and weight.

Expected cost: Nil

Description of the discomforts, inconveniences, and / or risks that can be reasonably expected as a result of participation in this study.

There is no major risk associated with this procedure. The injection for collecting blood may be painful. Rarely some people may faint during the procedure. But there is no major proven risk associated with this procedure.

Unforeseeable risk: Nil

Compensation in case of study related injury: Nil

Anticipated benefits from this study:
If you are participating in this study, you can get an idea of your health status apart from your blood lead levels. If there are any problems in the same, you will be referred to CHAD / CMCH hospital, where you will be assessed further.

The potential benefits to science and humankind that may result from this study are an increased understanding of the prevalence health ill-effects due to long term exposure to lead in paints. The knowledge of the same can be used in preventing diseases which occurs as a result of lead exposure. Also guidelines regarding personal protection when painting lead paints and other chemicals of toxic nature can be planned and recommended.

Alternative treatment available: Not applicable.

Compensation for participation: Nil

Circumstances under which the principal investigator may withdraw you from the study participation: Nil

What happens if you choose to withdraw from study participation?

Your questionnaire results will be destroyed and your data will not be included in any result.

Contact information:

If you have any questions about this research study or possibly, please feel free to contact:
Dr.T.Mithula at 9487851556. Also feel free to find more information about the Christian Medical College's Institutional Review Board at 0416-2284207.

Confidentiality:

All efforts, within reason, will be made to keep your personal information in your research record confidential.

Privacy:

Your information may be shared with , the Christian Medical College, or the government , Christian Medical College Institution Review Board , if we required doing so by law.

Signature of participant …….……Date …….

Signature of the investigator …….....…… Date …….

ANNEXURE – 3 ; CONSENT FORM – ENGLISH VERSION

WRITTEN INFORMED CONSENT DOCUMENT

Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu.

Subject's initials: …… Subject's name:

…….

Date of birth / Age: …….....

Before you agree, the investigator should have told you about (i) the purposes, procedures and duration of research:

(ii) the procedures which are experimental; (iii) any foreseeable risks, discomforts and benefits of the research;

(iv) how confidentiality will be maintained.

The investigator should also have you about (i) any available compensation or medical treatment if injury occurs;

(ii) the possibility of unforeseeable risks; (iii) circumstances when the investigator may halt your participation

(iv) any added costs to you; (v) what happens if you decide to stop participating

If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

Please initial the box:

1. I confirm that I have read and understood the information sheet dated_____ for the above study and have had the opportunity to ask questions ( ).
2. I understand that my participation in the study is voluntary and that I and free to withdraw at any time, without giving any reason without my medical care and legal rights being affected.
3. I understand that Sponsor of the study, others working on the sponsor's behalf, the Ethics committee and regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in research to it, even if I withdraw from the trial.

I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published ( ).

4. I agree not to restrict the use of any data or results that arise from this study provided such is only for scientific purposes(s) ( ).
5. I agree to participate in the above study ( ).

If you have any questions about this research study, please contact
Dr. Mithula.T at 9487851556 or
my advisor, **Dr. Venkataraghava Mohan** at 9443109044.

Your study in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

Signing this document means that the research study, including the above information, has been described to you orally, and that you voluntary agree to participate.

Signature of the participant …….
Date …….
(Or Left Thumb Impression)

Signature of Investigator ……..
Date ……
(Or Left Thumb Impression)

ANNEXURE - 4

TAMIL VERSION QUESTIONAIRE WITH INFORMATION SHEET AND CONSENT FORM

பகுதி – A தனிப்பட்ட (சமூக) தகவல்கள்

1. பங்குபெறுபவரின் அடையாள எண் :
2. பங்குபெறுபவரின் பெயர் :
3. வயது :
4. கிராமத்தின் பெயர் / வார்டு :
5. இடம் : அ) கிராமம் ஆ) நகரம் :

ஆய்வு நடத்தும் தேதி :
கிராமத்தின் எண் :
வார்டு எண் :
தெரு பெயர் :
தொடர்பு எண் :

சாட் எண	சிஎம்.சி. எண்	HDSS ID No: அடையாள எண்

6. திருமண நிலை :

   அ) திருமணமாகாதவர் ஆ) திருமணமனாவர் இ) பிரிந்து வாழ்பவர்

   ஈ) விவாகரத்தானவர் உ) விதவை (மனைவியை இழந்தவர்)

7. கல்வி :
8. குடும்பத்தின் வகை : அ) தனிகுடும்பம் ஆ) கூட்டு குடும்பம்

   இ) விரிவாக்கப்பட்ட குடும்பம்
9. குடும்பத்தில் உள்ளவர்களின் மொத்த எண்ணிக்கை :
10. மொத்த மாத வருமானம் :
11. வயது வாரியாக குடும்பத்தில் உள்ளவர்களின் விவரம் :

வ. எண்	வயது	எண்ணிக்கை
11. a	15 வயதிற்கு குறைவாக	
11. b	15 - 45 வயதிற்குட்பட்டவர்கள்	
11. c	45 – 59 வயதிற்குட்பட்டவர்கள்	
11. d	60 வயதிற்கு மேற்பட்டவர்கள்	

பகுதி - B இருப்பிடம் (வீட்டின்) தகவல்கள்

12. வீட்டின் வகைகள் அ)கச்சா ஆ)பக்கா இ)அரசாங்க உதவியோடு கட்டிய (மானிய) வீடு ஈ) குடிசை
13. மேல் கூரையின் வகை: அ) தகரம் ஆ) ஓடு இ) கூரை ஈ) சிமெண்ட் கூரை உ) ஆஸ்பெட்டாஸ் வீடு
14. தரையின் வகை அ) சிமெண்ட் பூசப்பட்டது ஆ) டைல்ஸ் போடப்பட்டது இ) மண் பூசப்பட்டது ஈ) களிமண்
15. சுவற்றின் வகை அ) சிமெண்ட் பூசப்பட்டது ஆ) டைல்ஸ் இ) ஓலை வேயப்பட்டது ஈ) மண் உ) களிமண்ணால் பூசப்பட்டது
16. எப்போது உங்கள் வீடு கட்டப்பட்டது :
17. உங்கள் வீட்டை வண்ணம் தீட்ட எந்த வகை பொருள் பயன்படுத்தப்பட்டது:
    அ) சுண்ணாம்பு கலவை ஆ) ஓலை இ) வெள்ளை சிமெண்ட் ஈ) வண்ணம் பூசவில்லை உ)எணாமல் ஊ) எமல்சன் பெயிண்ட் எ) டிஸ்டம்பர் ஏ) தெரியவில்லை
18. கடந்த 5 ஆண்டுகளில் எத்தனை முறை உங்கள் வீட்டிற்கு வண்ணம் அடிக்கப்பட்டது?...
19. உங்கள் வீட்டை ஒரு நாளில் எத்தனை முறை பெறுக்குவீர்கள் .....
20. உங்கள் வீட்டை ஒரு வாரத்தில் எத்தனை முறை பெறுக்குவீர்கள் .....
21. உங்கள் வீட்டின் அருகில் ஏதேனும் தொழிற்சாலையோ அல்லது உற்பத்தி ஆலையோ உள்ளதா? அ) ஆம் ஆ) இல்லை
22. அதிக வாகனங்கள் செல்லும் சாலை / பெருஞ்சாலையின் அருகில் வசிக்கிறீர்களா
    அ) ஆம் ஆ) இல்லை ஆம் என்றால் எவ்வளவு தொலைவில் ? .....

பகுதி – C உடலில் உள்ள நோய் குறித்த தகவல்கள்

23. உங்களுக்கு ஏதேனும் சுகவீனம் உள்ளதா? : அ) ஆம் ஆ)இல்லை

ஆம் என்றால்,கீழ் குறிப்பிட்டுள்ள கட்டத்தில் நிரப்பவும் :				
	நோய்கள்	இல்லை	ஆம்	ஆம் என்றால், கால
23a	இரத்த கொதிப்பு			
23b	சர்க்கரை நோய்			
23c	இருதய நோய்			
23d	மனநிலை கோளாறு			
23e	இழுப்பு நோய்			
23f	நாள்பட்ட சிறுநீரக நோய்			
23g	தைராய்டு குறைபாடு			
23h	நரம்பு சார்ந்த பாதிப்பு			
23i	மற்றவை			

24. தற்சமயம் உள்ள மருத்துவ விபரம் (குறைகள்) :

வ.எண்	அறிகுறிகள்	இல்லை	ஆம்	ஆம் என்றால், எத்தனை
24a	மூச்சு திணறல்			
24b	சளியோடு கூட இரும்பல்			
24c	நமைச்சல் /எரிச்சல் /தோல் உரிதல் /தோல் அல்லது கை, கால் அல்லது முகத்தில் நிற மாற்றம்			
24d	வாயில் இரும்பின் சுவை			
24e	பல் வலி			
24f	எடை குறைதல்			
24g	உடல் சோர்வு			
24h	தூக்கமின்மை			
24i	பசியின்மை			
24j	எரிச்சல்			
24k	தலைவலி			
24l	ஞாபகமறதி போன்ற			
24m	கவனம் செலுத்துவதில் சிரமம்			
24n	கை/கால் பகுதியில் கூச்சம் அல்லது மருத்தல்			
24o	கை/கால்களில் தளர்வு /சோர்வு			
24p	உட்கார்ந்து எழுவதில் சிரமம்			
24q	காலனிகள் கழுவுதல்			
24r	தலை வாருவதில் அல்லது சட்டை பட்டன் அணிவதில்			
24s	அடிவயிற்றில் வலி			
24t	கேட்பதில் குறை			
24u	குமட்டல் /வாந்தி			
24v	மலச்சிக்கல்			
24w	மூட்டு வலி			
24x	மற்றவை			

பகுதி – D குடிப்பழக்கம் மற்றும் புகையிலை பழக்கத்தை கண்டறிய பயன்படுத்தப்படும் WHO வின் அளவுகோல்

25. தற்சமயம் சிகரெட், சிகார்ஸ் அல்லது பைப்பு பிடிக்கும் பழக்கம் உள்ளதா?

அ) ஆம் ஆ) இல்லை (இல்லை என்றால் அடுத்த கேள்வி …..செல்லவும்)

26. புகையிலை சார்ந்த பொருட்களை தினமும் நீங்கள் புகைக்கிறீர்களா? அ)ஆம் ஆ) இல்லை

27. ஆம் என்றால், சராசரியாக ஒரு நாளில் எத்தனை பிடிப்பீர்கள்? ……..

28. ஆம் என்றால், புகையிலை பிடிக்கும் பழக்கம் எத்தனை ஆண்டுகளாக உள்ளது? …

29. தற்சமயம் புகையிலையை, புகையாக பிடிக்காமல் வேறு ஏதேனும் முறையில் பயன்படுத்துகிறீர்களா? அ) ஆம் ஆ) இல்லை

30. ஆம் என்றால், ஒரு நாளில் எவ்வளவு?

31. ஆம் என்றால், புகையில்லாமல் புகையிலையை எத்தனை ஆண்டுகளாக பயன்படுத்தி வருகிறீர்கள்? ……..

32. வேறு வகையான போதை பொருள் பழக்கம் உள்ளதா? அ) ஆம் ஆ) இல்லை

33. நீங்கள் பீர், ஒயின் மற்றும் சாராயம் (எரி) போன்றவற்றை எப்பொழுதாவது பயன்படுத்தி உள்ளீர்களா? அ) ஆம் ஆ) இல்லை

34. ஆம் என்றால், கடந்த 12- மாதங்களில் எத்தனை நாட்களுக்கு ஒரு முறை மது அருந்தினீர்கள்?

அ. தினமும் ஆ. 5 -6 நாட்கள் /1 வாரத்தில் இ. 1 – 4 நாட்கள் / வாரத்தில்

ஈ. 1 -3 நாட்கள் /1 வாரத்தில் உ. ஒரு மாதத்தில் ஒருமுறையாவது

35. கடந்த 30 நாட்களில் மது அருந்தினீர்களா? அ) ஆம் ஆ)இல்லை

36. கடந்த 30 நாட்களில் எத்தகைய சூழ்நிலையில் ஒருமுறையாவது மது அருந்தினீர்களா?

அ) எண்ணிக்கை : …… ஆ) தெரியவில்லை

பகுதி – E

37. ஈயம் போன்ற உலோகத்தோடு தொடர்புடைய வேலை அல்லது பொழுதுபோக்கு நிகழ்ச்சியில் பங்கு பெற்றீர்களா?

வ.எண்	அறிகுறிகள்	இல்லை	ஆம்	ஆம் என்றால், எவ்வளவு நாள்?
37a	ஆட்டோ மெக்கானிக்ஸ்			
37b	விவசாயம் / இடம் பெயர்ந்து விவசாய பணி			
37c	உலோகம் வடித்தல்			
37d	இருக்கை (ம) நாற்காலி பழுது			
37e	உலோகத்தை உருக்குவது			
37f	கண்ணாடி பொருட்களை ஊதி செய்வது			
37g	தோல் தொழிற்சாலை			
37h	பராமரிப்பு பணி			
37i	உலோக பணி / வெல்டிங் / உருவாக்குவது			
37j	அச்சடித்தல்			
37k	கார் பழுது பார்த்தல்			
37l	பேட்டரி பழுது பார்த்தல் / உருவாக்குவது / மறுபயன்பாட்டிற்கு			
37m	AC மெக்கானிக்			
37n	ரேடியேட்டர் பழுது பார்த்தல்			
37o	பிளாஸ்டிக் உருவாக்குவது			
37p	செராமிக் செய்வது			
37q	பொமண்மை செய்தல் (உலோகம்)			
37r	வீட்டு பொருடகள் பழுது			
37s	பழைய மண் பானைகளுக்கு வண்ணம் தீட்டுதல் (உணவு			
37t	கட்டிட தொழில்			
37u	கை தொலைபேசி பழுது			

38. கீழ் குறிப்பிட்டுள்ள பொருட்களில் எவையேனும் தினசரி பயன்படுத்துகிறீர்களா?

அ.காஜல் ஆ. சுர்மா இ. சிந்தூர் ஈ. முகபூச்சு உ. மற்றவை

பகுதி – F பெயிண்ட் தொழிலாக மற்றம் மோட்டார் வாகனங்களுக்கு வண்ணம் தீட்டுவது

39. இந்த பெயிண்டு அடிக்கும் தொழிலில் எத்தனை ஆண்டுகளாக ஈடுபட்டு வருகிறீர்கள்? (எத்தனை ஆண்டுகள்.....)
40. ஒரு வாரத்தில் எத்தனை நாட்கள், இத்தகைய பெயின்டிங் தொழிலில் ஈடுபடுவீர்கள்? ..
41. சராசரியாக ஒரு நாளில் எத்தனை மணிநேரம் இந்த பெயின்டிங் தொழிலில் ஈடுபடுவீர்கள்?
42. அவ்வாறு பயன்படுத்தும் பெயிண்டை எங்கு பாதுகாத்து வைப்பீர்கள்?
    அ. வீட்டில் ஆ. கிடங்கு இ. வேலை செய்யும் இடத்தில் ஈ. மற்றவை
43. பொதுவாக பெயின்டை எப்படி கலக்குவீர்கள்?
    அ. முன்னதாகவே கலந்தவை ஆ. கையால் கலக்குவது இ.கருவி கொண்டு கலக்குவது
44. பொதுவாக எந்த இடத்தில் பெயிண்டை கலக்குவீர்கள்?
    அ. வீட்டில் ஆ. கிடங்கு இ. வேலை செய்யும் இடத்தில் ஈ. மற்றவை
45. காலியான பெயிண்டு டப்பாவை என்ன செய்வீர்கள்?
    அ. கிடங்கில் ஆ. வெளியில் எரித்தல் இ. புதைத்தல் ஈ. விற்று விடுவது
    உ. தூய்மையாளரிடம் கொடுப்பது
46. எப்படி பெயின்டு (வண்ணம்) அடிப்பீர்கள்?
    அ. கையால் அடிப்பது ஆ. எலக்டிரிகல் கன் இ. ஸ்பேரேயர்ஸ் உ. மற்றவை
47. உங்கள் வாய், மூக்கு போன்றவற்றை பாதுகாக்க பெயின்டு அடிக்கும் பொழுது முககவசம் அணிவீர்களா?
    அ. எப்போதும் ஆ. அடிக்கடி இ. எப்பொழுதாவது ஈ. சில நேரங்களில் உ. இல்லை
48. நீங்கள் பெயின்ட் அடிக்கும் பொழுது கையுறை போன்ற பாதுகாப்பு சாதனங்களை பயன்படுத்துவீர்களா?
    அ. எப்பொழுதும் ஆ.அதிகப்படியான நேரத்தில் இ. சில நேரங்களில்
    ஈ. எப்பொழுதாவது உ. இல்லை
    (எப்போதும் இல்லை என்றால் கேள்வி எண் 50 மற்றும் 51 கேட்க தேவையில்லை)
49. நீங்கள் பயன்படுத்தும் கை – பாதுகாப்பு சாதனங்கள் எந்த வகையை சார்ந்தது?
    அ. பிளாஸ்டிக் ஆ. ரப்பர் இ. காகிதம் ஈ. மற்றவை
50. அத்தகைய கையுறை சாதனங்கள் திரவம், கடினமான பொருட்களுக்களை கையாள ஏற்றதா? அ. ஆம் ஆ. இல்லை இ. தெரியாது
51. பெயின்ட் அடிக்கும் பொழுது, மாற்று ஆடை பயன்படுத்துவீர்களா?
    அ. எப்பொழுதும் ஆ.அதிகப்படியான நேரத்தில் இ. சில நேரங்களில்
    ஈ. எப்பொதுதாவது உ. இல்லை
52. நீங்கள் பெயின்ட் அடிக்கும் போது கண் - பாதுகாப்பு உபகரணங்களை பயன்படுத்துகிறீர்களா?

அ. எப்பொழுதும் ஆ.அதிகப்படியான நேரத்தில் இ. சில நேரங்களில்

ஈ. எப்பொழுதாவது உ. எப்பொழுதும் இல்லை

53. நீங்கள் பெயின்ட் அடிக்கும் பொழுது கால்களுக்கு பாதுகாப்பு காலணிகளை பயன்படுத்துகிறீர்களா?

அ. எப்பொழுதும் ஆ.அதிகப்படியான நேரத்தில் இ. சில நேரங்களில்

ஈ. எப்பொழுதாவது உ. எப்பொழுதும் இல்லை

54. உங்கள் கையில் மற்றும் காலில் உள்ள பெயின்டை எப்படி கழுவீர்கள்?

அ. தண்ணீர் ஆ. சோப் நீர் இ. மண்ணென்னை ஈ. தின்னர் உ. மற்றவை...

55. உங்களுடன் பெயின்ட் அடிக்கும் வேலை செய்யும் நபர்கள் யாருக்காவது ஏதேனும் நாள்பட்ட உடற் சுகவீனம் கடந்த நாட்களில் உள்ளதை அறிவீர்களா?

அ) ஆம் ஆ) இல்லை

ஆம் என்றால் குறிப்பிடவும்

56. தற்போது வேலை செய்யும் இடத்தில் உள்ள வசதிகள்

வ.எண்.		ஆம்	இல்லை
56a	கை கழுவ வசதி உண்டா?		
56b	உணவு அருந்தும் இடம் உண்டா?		
56c	குளிப்பதற்கான இடவசதி உண்டா?		
56d	வேலை நேரத்தில் பயன்படுத்தும் உடைகளை சுத்தம் செய்வதற்கு ஏற்ற வசதி உண்டா?		

57. கடந்த நாட்களில்இறுதியாக வேலை செய்த இடத்தில் தனிநபர் சுத்தம் /பராமரிப்பு கையாளப்பட்டதா?

வ.எண்.		ஆம்	இல்லை
57a	பெயின்ட் அடித்து முடித்தவுடன் கை கழுவினீர்களா?		
57b	வேலை செய்யும் இடத்தில் புகை பிடிப்பீர்களா?		
57c	உணவு சாப்பிடும் முன் மற்றும் புகைபிடிப்பதற்கு முன் கை கழுவினீர்களா?		
57d	வேலை செய்யும் பொழுது பயன்படுத்தும் உடையை வீட்டில் பயன்படுத்துவீர்களா?		
57e	வீட்டிற்கு சென்றவுடன் குளித்தீர்களா?		

பொதுவான பரிசோதனைகள்

உயரம் …….. எடை …….

கருவம் ……., சயனோசிஸ் ……. கிளப்பிங்……

பாதங்களில் வீக்கம் ……..

உயிரணுக்கள் : துடிப்பு …….. நிமிடங்களில்

இரத்த அழுத்தம் அளவு 1 (mm/Hg)	இரத்த அழுத்தம் அளவு 2 (mm/Hg)	சராசரியான இரத்த அழுத்த அளவு

பல் ஈறுகளில் பர்டோனியல் வரி ……. வாய்வழி சளி அரிப்புகள் …… நடுக்கம் ……

முறையான பரிசோதனைகள்

இருதய பரிசோதனை : ……..

சுவாச பரிசோதனைகள் :……..

வயிறு பரிசோதனைகள் :…….

மத்திய நரம்பு பரிசோதனை :

அறிமுகம் (இடம், நபர், நேரம்) …….

நினைவு (பொருள்களை மீண்டும் கூறசெய்வது)

ஒருங்கிணைப்பு (விரலால் மூக்கை தொடும்பயிற்சி) …….

(நேராக நடக்கச் செய்தல்) ……..

காட்சி இடம் சார்ந்த நுண்ணறிவு (வடிவமைப்பை சரி பார்த்தல் (அ) வடிவமைப்பை சமாளித்தல்) நடை …….

கை, கால் பரிசோதனைகள்:

	வலது மேல்	**இடது**	**வலது கீழ்**	**இடது கீழ்**
மொத்தமாக				
தொனி				
சக்தி				
பிரதிபலிப்பு				
பைசெப்				
ட்ரைசெப்				
சுபினோட்டர்				
முழங்கால்				
கணுக்கால்				

உணாச்சிக்கான பரிசோதனை

	வலது மேல் மூட்டு	இடது மேல்மூட்டு	வலது கீழ் மூட்டு	இடது கீழ் மூட்டு
அதிர்வுகள்				

ஆய்வக பரிசோதனைகள்

வ.எண்.	பரிசோதனைகள்	தேதி	முடிவுகள்
1.	மொத்த இரத்த எண்ணிக்கை		
2.	இரத்த முன்னணி நிலை		
3.	கிரியேட்டினின்		
4.	எஸ்ஜிபீடி		

எழுத்துப்பூர்வமான தகவல் படிவம்

பங்கேற்பாளர் பெயரின் முதல் எழுத்து ..... பங்கேற்பாளரின் பெயர் .....

பிறந்த தேதி /வயது .....

நீங்கள் இந்த ஆய்வில் பங்கு பெறுவதற்கு முன் ஆய்வாளர் கீழ்கண்டவைகளை உங்களிடம் சொல்லியிருக்க வேண்டும்.

1. இந்த ஆய்வின் நோக்கம், நடைமுறைகள், மற்றும் கால அளவுகள் தெரிவிக்க வேண்டும்.
2. இங்கு கடைப்பிடிக்கப்படும் நடைமுறைகள் அனைத்தும் ஆய்விற்கு உட்பட்டவை.
3. எதிர்பார்க்கப்படும் ஆபத்துகள், அசௌகரியங்கள் மற்றும் நன்மைகள் பற்றி எடுத்துரைத்தல்.
4. இரகசியத்தன்மை எப்படி பாதுகாக்கப்படும் என்று எடுத்துரைத்தல்.

ஆராய்ச்சியாளர் மேலும் தெரியப்படுத்துவது:

1. இந்த ஆய்வினால் ஏதேனும் காயங்கள் ஏற்பட்டால் இழப்பீடோ மருத்துவ உதவியோ வழங்கப்பட மாட்டாது.
2. எதிர்பாராமல் ஏற்படும் ஆபத்துகளை எடுத்து உரைத்தல்.
3. உங்கள் பங்கேற்பை ஆய்வாளர் எப்பொழுது வேண்டுமானாலும் நிறுத்தலாம்.
4. எந்த தொகையும் வழங்கப்பட மாட்டாது. (உதவி தொகை)
5. இந்த ஆய்வில் நீங்கள் பங்கேற்பதை எப்பொழுது வேண்டுமானாலும் நிறுத்திக்கொள்ளலாம்.

நீங்கள் பங்கேற்க விருப்பப்பட்டால் எழுத்துப்பூர்வமான தகவல் ஒப்புதல் படிவத்தில் கையொப்பமிட வேண்டும்.

கீழே கொடுக்கப்பட்டுள்ள கட்டங்களில் (டிக்) செய்யவும்.

1. நான் .....(தேதி) அன்று ஆய்வு தகவல் படிவத்தை படித்து, அதில் இருந்த தகவல்களை நன்கு புரிந்து கொண்டேன் மற்றும் எனக்கு கேள்விகள் கேட்க வாய்ப்பு கிடைத்தது என்று உறுதிபடுத்துகின்றேன். ( )
2. இந்த ஆய்வில் என் பங்கு தன்னார்வமானது என்பதை புரிந்து கொண்டு, நான் எந்த நேரத்திலும் இந்த ஆய்விலிருந்து விலகினாலும், அது என் மருத்துவ சிகிச்சையையோ அல்லது எனது சட்ட உரிமைகளையோ பாதிக்காது என்பதை புரிந்து கொண்டேன்.( )
3. நன்னெறிக் குழுவினரோ மற்றும் ஒழுங்கு நடடிவக்கை குழுவினரோ என்னுடைய மருத்துவ பதிவேட்டு விவரங்களை இந்த ஆய்விற்காகவும் வருங்காலத்தில் ஏதேனும் ஆய்விற்காகவும் பயன்படுத்த என்னுடைய அமைதியை பெற தேவையில்லை என்பதையும், நான் இந்த ஆய்விலிருந்து விலகினாலும், என்னிடமிருந்து பெறப்பட்ட குறிப்புகளை பயன்படுத்தி கொள்ளலாம் என்று அறிந்து கொண்டேன். ஆனால் இந்த ஆய்வில் பயன்படுத்திய என்னுடைய விவரங்களை மூன்றாம் நபரிடமோ அல்லது ஒரு படிப்பாகவோ வெளியிடும் போது என்னுடைய அடையாளங்கள் அனைத்தும் மறைக்கப்படும் என்பதை புரிந்துக் கொண்டேன்.( )

4. இந்த ஆய்வில் பயன்படுத்திய விவரங்கள் மற்றும் இந்த ஆய்வின் முடிவுகள் மருத்துவ அறிவியல் ஆராய்ச்சிக்காக பயன்படுத்துவதற்கு எந்த தடைகளும் இல்லை என்பதை ஒப்புக் கொள்கிறேன். ( )

5. நான் இந்த ஆய்வில் பங்கு பெற ஒப்புக் கொள்கிறேன். ( )

இந்த ஆய்வு சம்மந்தமாக ஏதேனும் சந்தேகங்கள் அல்லது கேள்விகள் இருந்தால் டாக்டர். மிதுளா. G 9487851556 அல்லது டாக்டர். வெங்கடராகவா 9443109044 இவர்களை தொடர்பு கொள்ளலாம்.

இந்த ஆய்வில் பங்கேற்பது முற்றிலும் தன்னிச்சையானது. இந்த ஆய்விலிருந்து நீங்கள் விலகினால் அபராதமோ அல்லது நீங்கள் பெற்றுக்கொண்டு வந்த சலுகைகளுக்கு எந்த பாதிப்பும் ஏற்படாது.

பங்கேற்பாளரின் கையொப்பம் : .....

தேதி : .....

இடது பெருவிரல் ரேகை

ஆய்வாளரின் கையொப்பம் .....

தேதி .....

சாட்சியின் இடது பெருவிரல் ரேகை

தகவல் தாள்

இது தகவலறிந்த ஒப்புதல்தகவல் தாள்

வயது வந்தோருக்கு பொருந்தும் (18 வயதுக்கு மேற்பட்டவர்கள்)

பின்வரும் தகவல்கள் இந்த ஆராய்ச்சியை குறித்தும் மற்றும் உங்கள் பங்கேற்பு குறித்தும் கொடுக்கப்பட்டுள்ளது.

இந்த படிவத்தை கவனமாக படித்து கேள்விகள் இருப்பின் கேட்கவும், கேள்விகள் கேட்க வாய்ப்பு கொடுக்கப்படும். உங்கள் கேள்விகளுக்கு பதில் அளிக்கப்படும். இந்த தகவல் தாளின் ஒரு மாதிரி உங்களுக்கு கொடுக்கப்படும்.

உங்கள் பங்கேற்பு தன்னார்வமானது. ஆய்விலிருந்து தாங்கள் எப்பொழுது வேண்டுமானாலும் விலகிக் கொள்ளலாம்.

ஆய்வின் நோக்கம் :

தமிழ்நாட்டிலுள்ள, வேலூர் மாவட்ட கிராமபுரம் மற்றும் நகர்புரத்தில்வசிக்கும் பெயின்ட் அடிக்கும் வேலை செய்பவரின் இரத்தத்தில் ஈய தாதின் அளவு உயர்ந்திருப்பதினால் உடலில் ஏற்படும் விளைவுகளை கண்டறிவது, இந்த ஆய்வின் நோக்கமாகும்.

பின்பற்றப்படும் நடவடிக்கைகள்:

ஆய்வில் இரத்த சேகரிப்பு செய்யப்படும். சில கேள்விகள் கேட்கப்படும் மற்றும் விரைவான உடல் பரிசோதனையும் செய்யப்படும்.

ஆய்வாளர் வந்து கீழே குறிப்பிட்டவைகளை செய்வார்:

1. உங்களிடம் 8 மில்லி லிட்டர் இரத்தம் உங்கள் நரம்பில் ஊசியை செலுத்தி சுகாதாரமான முறையில் எடுக்கப்படும்.
2. ஆய்வாளர் நேர்காணல் மூலம், உங்களின் சமூக பொருளாதார விவரங்கள், மருத்துவ வரலாறு, தொழில் வரலாறு, வேலையில் முன்னெச்சரிக்கை நடவடிக்கைகள் ஆகியவை கேட்கப்படும். நேர்காணல் 10 நிமிடங்கள் ஏறக்குறைய ஆகும்.
3. தங்களின் தனியுரிமையை மதித்து உடல் பரிசோதனை செய்யப்படும்.
4. உங்களின் உடல்எடை மற்றும் உயரம் அளவெடுக்கப்படும்.

எதிர்பார்க்கபடும் தொகை: எதுவும் இல்லை.

இந்த ஆய்வில் பங்கு பெறுவதால் ஏற்படும் சிரமங்கள் மற்றும் ஆபத்துகள் பற்றிய விளக்கங்கள்: இந்த ஆய்வில் எடுக்கப்படும் நடைமுறைகளின் நிமித்தம் பெரிய ஆபத்து எதுவும்இல்லை. இரத்தம் எடுக்கும் போது வலி இருக்கலாம். சிலருக்கு இதனால் மயக்கம் உண்டாகலாம். இதனால் பெரிய ஆபத்து எதுவும் இல்லை.

எதிர்பாராத ஆபத்து: எதுவும் இல்லை.

ஆய்வில் எதிர்பார்க்கபடும் நன்மைகள்:

ஆய்வில் பங்கு பெறுவதின் மூலம், தங்களின் இரத்தத்தில் உள்ள ஈயத்தின் அளவ நிலையை மட்டுமில்லாமல் தங்களின் உடல் நிலையையும் தெரிந்துக் கொள்ளலாம். ஒரு வேளை ஏதாவது பிரச்சனை தங்களுக்கு இருந்தால் சாட் அல்லது சி.எம்.சி. மருத்துவமனைக்கு மேற்பரிந்துரை செய்யப்படும்.

இந்த ஆய்வின் மூலம் விளையும் நன்மைகளானவை :

வெகு காலமாக பெயிண்டில் உள்ள ஈயத்தின் வெளிப்பாடுகளால் ஏற்படும் உடல்நல பாதிப்புகள் பற்றிய புரிதல் அதிகரிக்கும். இந்த ஆய்வில் கிடைத்த தகவல் மூலம் ஈயத்தின் வெளிப்பாடுகளினால் வரும் நோய்களை தவிர்க்க முயற்சி எடுக்கலாம். ஈயம் கலந்த பெயின்ட் மற்றும் இதர நச்சு இராசயனங்கள் பயன்படுத்துவோர்க்கு, இந்த ஆய்வின் முடிவுகளை வழிகாட்டுதல்களாக திட்டமிட்டு பரிந்துரை செய்யலாம்.

மாற்று சிகிச்சை கிடைக்கிறது: **பொருந்தாது**

எந்த சூழ்நிலையில் ஆய்வாளர் தங்களை ஆய்விலிருந்து விலக்குவார்: எதுவும் இல்லை.

நீங்கள் ஆய்விலிருந்து விலகிக் கொள்ள விரும்பினால் என்ன நடக்கும் :

உங்கள் தகவல்களின் முடிவுகள் அழிக்கப்பட்டும் மற்றும் உங்கள் தகவல்கள் முடிவில் சேர்க்கப்படாது.

தகவல் தொடர்புக்கு :

இந்த ஆய்வை குறித்து கேள்விகள் இருந்தால் தொடர்பு கொள்ள தயங்க வேண்டாம். Dr.T. Mithula Cell – 9487851556. மேலும் தகவல் அறிய கிறிஸ்துவ மருத்துவ கல்லூரியின் நிறுவன விமர்சன குழுவிடம் இந்த தொலைப்பேசியில் 0416 – 2284207 தொடர்பு கொள்ளலாம்.

ரகசியத்தன்மை: ஆராய்ச்சி பதிவில் உள்ள தங்களின் தனிப்பட்ட தகவல்கள் ரகசியத்தன்மை காக்கப்பட காரணத்திற்குல் எல்லா முயற்சியும் எடுக்கப்படும்.

தனியுரிமை: சட்டத்தின் படி, தங்களின் தகவல் கிறிஸ்தவ மருத்துவ கல்லூரி (அ) அரசாங்கம் கிறிஸ்துவ மருத்துவ கல்லூரி நிறுவன விமர்சன குழு ஆகியோரிடம் பகிரலாம்.

சாட்சியின் கையெழுத்து : .....

தேதி : ..... ஆய்வாளர் கையெழுத்து: ..... தேதி :.....

ANNEXURE – 5

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

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

Dr. Anna Benjamin Pulimood, MD., Ph.D.,
Chairperson, Research Committee, Principal

Dr. Suceena Alexander, MD., DM., FASN.,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

November 19, 2020

PG Registrar,
Department of Community Medicine,
Christian Medical College,
Vellore – 632 002.

Sub: Fluid Research Grant: New Proposal:
Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu

PG Registrar, MD Community Medicine, Dr. Venkata Raghava M, Employment Number: 20303. Community Health, Dr. Pamela Christudoss, Employment Number : 13552, Clinical Biochemistry. Dr. Arun Jose Nellickal, Employment Number : 30919 Clinical Biochemistry.

Ref: IRB Min. No. 13250 [OBSERVE] dated 04.08.2020.

Dear I

I enclose the following documents:-

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Suceena Alexander, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Suceena

Dr. Suceena Alexander
Secretary (Ethics Committee)
Institutional Review Board

Dr. Suceena Alexander, MD.,DM.,FASN.
Secretary - (Ethics Committee)
Institutional Review Board
Christian Medical College,
Vellore - 632 002, Tamil Nadu, India.

Cc: Dr. Venkata Raghava, Community Medicine, CMC, Vellore 1 of 5

Ethics Committee Blue, Office of Research, I Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284508 Fax: 0416 – 2262788 E-mail: research@cmcvellore.ac.in

OFFICE OF RESEARCH
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Ref: IRB Min. No. 13250 [OBSERVE] dated 04.08.2020.

Dear

The Institutional Review Board (**Blue**, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu" on August 04, 2020.

The Committee reviewed the following documents:

1. IRB Application form
2. Patient information sheet and Consent Form
3. Questionnaire
4. Cvs. Of Drs. Venkata Raghava M, Pamela Christudoss, Arun Jose Nellickal.
5. No. of Documents 1 – 4.

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on August 04, 2020 in the New IRB Room, Christian Medical College, Vellore 632 004. 2 of 5

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Dr. Suceena Alexander, MD., DM., FASN.,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Name	Qualification	Designation	Affiliation
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
Dr. Suceena Alexander	MD., DM., FASN	Secretary – (Ethics Committee), IRB, Addl. Vice Principal (Research), Professor of Nephrology, CMC, Vellore	Internal Clinician
Dr. Sathish Kumar	MD, DCH	Professor, Child Health, CMC, Vellore	Internal, Clinician
Ms. Grace Rebekha	M.Sc., (Biostatistics)	Lecturer, Biostatistics, CMC, Vellore	Internal, Statistician
Mr. C. Sampath	BSc, BL	Advocate, Vellore	External, Legal Expert
Dr. Ekta Rai	MD MRCA	Professor, Head of the Unit 5, Department of Anaesthesia, CMC, Vellore	Internal, Clinician
Rev. Rainard Pearson	BA., B. Th., M. Div.,	Sr. Chaplin, CMC, Vellore.	Internal, Social Scientist
Mr. Samuel Abraham	MA, PGDBA, PGDPM, M. Phil, BL.	Sr. Legal Officer, Vellore	External Legal Expert
Dr. Barney Isaac	DNB (Respiratory Diseases)	Associate Professor, Pulmonary Medicine, CMC, Vellore	Internal, Clinician
Mrs. Pattabiraman	BSc, DSSA	Social Worker, Vellore	External, Lay Person
Dr. Joe Varghese	MBBS, MD Biochemistry	Professor, Department of Biochemistry	Internal Clinician
Dr. Shyam Kumar NK	DMRD, DNB, FRCR, FRANZCR	Professor, Radiology, CMC, Vellore	Internal, Clinician

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

Dr. Balu Krishna	MBBS MD DNB DMRT	Professor, Department of Radiotherapy, CMC Vellore	Internal Clinician
Dr. Rohin Mittal	MS , DNB	Professor, Department of General Surgery, CMC Vellore	Internal Clinician
Mrs. Ida Nirmal	MSc Nursing	Professor, Addl Deputy Dean, College of Nursing, CMC, Vellore	Internal, Nurse
Mrs. Rebecca Sumathi Bai	MSc Nursing	Professor and Head of Specialty Nursing7, CMC Vellore	Internal, Nurse
Dr. HS. Asha	MBBS, DNB	Professor, Department of Endocrinology, CMC Vellore	Internal Clinician
Mrs. Sophia V	M.Sc Nursing	Addl. Deputy Dean CMC, Vellore	Internal, Nurse
Mrs. Nirmala Margaret	MSc Nursing	Addl. Deputy Nursing Superintendent, College of Nursing, CMC, Vellore	Internal, Nurse
Dr. Rekha Pai	MSc, PhD	Associate Professor, Pathology, CMC, Vellore	Internal, Basic Medical Scientist
Dr. John Jude Prakash	MBBS, MD,	Professor, Clinical Virology, CMC, Vellore	Internal, Clinician
Dr. Winsely Rose	MD (Paed)	Professor, Paediatrics, CMC Vellore	Internal, Clinician
Dr. Premila Abraham	M.Sc. Ph.D	Professor, Department of Biochemistry, CMC, Vellore	Internal Clinician
Dr. Santosh Varghese	MD, DM, FRCP,	Professor, Department of Nephrology, 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: "Elevated blood lead levels and associated health effects among people involved in residential and automobile painting occupation from rural and urban areas of Vellore, Tamil Nadu" on a monthly basis. Please send copies of this to the Research Office (research@cmcvellore.ac.in).

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Additional Vice-Principal (Research)

The Institutional Ethics Committee expects to be informed about the progress of the project, Any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent.** On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in the CMC Intranet and in the CMC website link address: http://www.cmch-vellore.edu/static/research/Index.html.

Fluid Grant Allocation:
A sum of 3,00,000/- INR (Rupees Three Lakh Only) will be granted for 2 years. 1,50,000/- INR (Rupees One Lakh fifty Thousand only) will be granted for 12 months as an Ist Installment. The rest of the 1,50,000/- INR (Rupees One Lakh fifty Thousand only) each will be released at the end of the first year as 2 nd Installment.

Yours sincerely,

Dr. Suceena Alexander
Secretary (Ethics Committee)
Institutional Review Board

Dr. Suceena Alexander, MD.,DM.,FASN.
Secretary - (Ethics Committee)
Institutional Review Board
Christian Medical College,
Vellore - 632 002, Tamil Nadu, India.

IRB Min. No. 13250 [OBSERVE] dated 04.08.2020 5 of 5