Mémoire

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OUTCOME OF TRAINING ON TEACHERS' KNOWLEDGE PERCEPTION AND SELF-EFFICACY FOR PREVENTING CHILDHOOD LEAD POISONING IN IDO LOCAL GOVERNMENT AREA OYO STATE NIGERIA

February 2010

OUTCOME OF TRAINING ON TEACHERS' KNOWLEDGE PERCEPTION AND SELF-EFFICACY FOR PREVENTING CHILDHOOD LEAD POISONING IN IDO LOCAL GOVERNMENT AREA OYO STATE NIGERIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF PUBLIC HEALTH (HEALTH PROMOTION AND EDUCATION) OF THE UNIVERSITY OF IBADAN, NIGERIA.

SUBMITTED TO
DEPARTMENT OF HEALTH PROMOTION AND EDUCATION,
FACULTY OF PUBLIC HEALTH,
COLLEGE OF MEDICINE,
UNIVERSITY OF IBADAN, NIGERIA.

February 2010

DEDICATION

This work is dedicated to God Almighty. All glory, honour, majesty and praises are unto you Lord Jesus for you are the secret of the success of this work. May your name be praised forever!

I also wish to dedicate this piece of work to the loving memory of my late sister Mrs. Oluronke Adewale. Though you are gone, your memory is always fresh like dew in my heart.

ABSTRACT

Exposure of school children to lead from various sources, including the school environment, is a serious threat to their health. Teachers constitute an important channel for reaching pupils and their parents with lead poisoning prevention messages. In Nigeria there is inadequate information about teachers' knowledge of lead poisoning and the effects of training on their knowledge and perceptions regarding lead poisoning. The study therefore assessed primary school teachers' knowledge of lead poisoning and determined the effects of training on their knowledge, perceptions and self-efficacy for preventing childhood lead poisoning in Ido Local Government Area (LGA), Oyo state.

The quasi-experimental study involved an experimental group of 27 teachers nominated by 15 purposively selected schools in Ido LGA and a control group of 30 teachers from 15 schools in Egbeda LGA. The two groups completed a pre-test using a validated questionnaire and the results were used for designing a 4-day training intervention for the experimental group. A post-test was conducted among the two groups using the same questionnaire. Data were analyzed using descriptive, chi-square, and t-test statistics.

The mean ages of the experimental and control groups were 42.4±6.2 and 41.0±6.6 years respectively. Many (40.7%) in the experimental group and 50% of the control had heard about lead. The leading source of information about lead poisoning in both groups was the school (experimental- 22.2%; control- 23.3%). The experimental and control groups' mean knowledge scores at pre-test using a 74-point knowledge scale were 20.2±16.3 and 14.6±14.4 respectively. Mean scores at post-test for the experimental and control groups' were 71.8±3.1 and 19.2±17.8 respectively ($p<0.05$). A significant difference was found between the experimental group's pre-test (20.2±16.3) and post-test (71.8±3.1) scores ($p<0.05$). The control's mean pre-test and post-test knowledge scores of 14.6±14.4 and 19.2±17.8 respectively were not significantly different. At pre-test, none of the respondents in either the experimental or control group knew the tolerable limit of blood-lead concentration of 10μg/dl recommended by the World Health Organization; at post-test all (100%) participants in the experimental group and none in the control group could state it. Perception of the experimental group that lead poisoning is more serious in children than adults changed from 5% at pre-test to 100% at post-test ($p<0.05$), while for the control perceptions were 13.3% and 23.3% for pre-test and post-test respectively with no significant difference. The perception that lead poisoning cannot be prevented through immunization changed from 33.3% at pre-test to 100% at post-test among the experimental group; among the control the proportions of participants with this perception at pre-test and post-test were 13.3% and 16.7% respectively. In the experimental group participant's self-efficacy relating to level of confidence in advocating for school-based lead poisoning control rose significantly from 29% at pre-test to 100% at post-test ($p<0.05$); the values among the control at pre-test and post-test were 26.7% and 23.3% respectively, with no significant difference.

Training intervention was effective in improving teachers' knowledge and influenced their perception and self-efficacy relating to the control of lead poisoning.

Key words: Childhood lead poisoning, Primary school teachers, Training intervention, Perception

Word count: 491

ACKNOWLEDGEMENT

I give thanks and praise to the ALMIGHTY GOD for His love, kindness, grace and faithfulness towards me to undertake this programme. I thank you Lord for the divine health, protection, provision, guidance and the wisdom given to me by you which made the realization of this dream possible.

I sincerely appreciate the assistance of my supervisor, Dr. Frederick O. Oshiname for his patience, guidance and his thorough scrutiny of this research work. He was always ready to listen, make necessary and constructive criticism. He meticulously read and corrected this work at every stage. May the good Lord reward him accordingly.

I also express my gratitude to Prof. O.O. Oladepo (the immediate past Head of Department of the Department who is now the Dean of the Faculty of Public Health), Dr. I. O. Olaseha (the acting. Head of Department of the Department of Health Promotion and Education), Dr. A. Ajuwon and Dr. O. Arulogun. Thank you all for impacting me with sound knowledge and the necessary skills to practice as a health promotion and education specialist. I also appreciate the contributions of Mr. M. A. Titiloye and Mrs. Y. John-Akinola who helped to make this research possible. I sincerely acknowledge the input of Mr. Olubodun, Mr. S. Bello, Mr. T.B. Oyeyemi, Mrs. Ayede, all the non-teaching staff of the Department of Health Promotion and Education and all my class mates of the 2005/2006 set.

My profound gratitude and deep appreciations go to my father Mr.S.F. Karunwi, siblings and Mr. Ogunlolu Wole. Omokehindemi, you are simply wonderful and I am proud of you. The prayers and support given me throughout the period of the programme contributed immensely to this success. May the good Lord bless you all greatly. I sincerely appreciate the prayer support of my church and the MPH student prayer group.
I sincerely appreciate and thank Prof. and Dr. Mrs. Ayoola and family for their prayers and moral support. May the Lord bless you all.

I am equally indebted to the management of Ido and Egbeda LGA Primary Education Board, all the Head teachers and all the study participants. I also acknowledge and appreciate the contributions of the Council for the Development of Social Science Research in Africa (CODESRIA) for sponsoring this study. I am highly indebted to Erma Coty of Santa Cruz Childhood Lead Poisoning Prevention Programme California, United States of America. You all provided the enabling environment, the needed cooperation and literature which made the research work possible and successful. Thank you all.

I wholeheartedly appreciate and thank Dr. Bawa, Odunola, Doyin, Lekan, Niyi, Kehinde and all my colleagues, for the love, friendliness and the social support they all gave me. Your kindness and friendship made my stay in Ibadan a memorable and worthwhile experience. May the Lord bless you all.

CERTIFICATION

I certify that this work was carried out by KARUNWI Abayomi Oluwaseyi in the Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan under my supervision.

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GLOSSARY OF ABBREVIATIONS/ACRONYMS USED:

1. BLL	Blood lead level
2. LGA	Local Government Area
3. g/dL	Gram per deci-litre
4. mg/L	Milligram per Litre
5. pg/dl	Picogram per deci-litre
6. g/l	Gram per Litre
7. ppm	Part per million
8. mg/kg	Milligram per kilogram
9. ng/g	Nanogram per gram
10. cm	Centimeter
11. Kg	Kilogram
12. g/g	Gram per Gram
13. Nm/dl	Nanometer per Deciliter
14. PbB	Blood Lead
15. Pb	Lead
16. EDTA	Ethylene-diamine-tetra-acetic acid
17. DMSA	Dimercapto-meso-2, 3 succinic acid
18. GST	Glutathione-S-transferase)
19. CAT	Catalase
20. IQ	Intelligent Quotient
21. CNS	Central Nervous System
22. USPSTF	U.S. Preventive Services Task Force
23. YNHTI	Yale New Haven Teachers Institute,
24. CDC	Centres for Disease Control and Prevention
25. ATSDR	Agency for Toxic substances and Disease Registry
26. WHO	World Health Organization
27. EPA	The United State Environmental Protection Agency
28. B.C	Before Christ
29. EEHC	European Environment and Health Committee
30. ARFH	The Association for Reproductive and Family Health
31. SHAPE	Strengthening HIV/AIDS Partnership in Education
32. AMREF	African Medical and Research Foundation (AMREF)
33. HBM	Health Belief Model
34. SPEB	Ido Local Government Primary Education Board
35. SPSS	Statistical Package for Social Science
36. NCE	National Certificate of Education
37. B.Sc.	Bachelor of Science
38. OND	Ordinary National Diploma
39. HND	Higher National Diploma
40. PGDE	Post-graduate Diploma in Education
41. FME	Federal Ministry of Education
42. NDHS	Nigerian National Demographic Health Survey
43. Exp	Experimental group
44. ANOVA	Analysis of Variance

45. X^2	Chi-square value
46. AAP	American Association of Pediatrics
47. BAN	Basel Action Network
48. SVTC	Silicon Valley Toxics Coalition
49. SD	Standard deviation
50. NHANES	National Health and Nutrition Examination Survey
51. MPH	Master of Public Health
52. NPC	National Population Commission

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CHAPTER ONE

1.0. INTRODUCTION

1.1. Background

Lead is a natural resource of great economic importance worldwide and it is useful in several industries (Adeniyi and Anetor, 1999). It is used for the production of goods which help to increase people's quality of life. Lead for instance, finds its application in the making of some roofing materials, cisterns, tanks and water pipes. In many countries the substance is used as an additive in paints and gasoline [Yale New Haven Teachers Institute, (YNHTI, 2007a)]. The numerous uses of lead thus make it a ubiquitous substance in most environments (Sridhar, 2000) including water (Nduka and Orisakwe, 2007), soil (Adogame, 1997), air (Ogunsola, 1994b) and a host of other media.

Despite its usefulness, lead could constitute a public health problem of monumental proportion. Its ingestion by children could result in lead poisoning [Centres for Disease Control and Prevention (CDC), 1991]. The physical consequences of childhood lead poisoning are far reaching. They include irreversible cognitive impairment (Needleham, Riess, Tobin, Biesecker and Greenhouse, 1996; Lanphear, Dietrich, Auinger and Cox, 2003), anemia (Nitin, Francine, Ulrich, Anoop, Shamseh and Eric, 2005), delayed puberty in females (Selevan, Rice, and Hogan, 2003; Wu, Buck and Mendola, 2003), reduced stature (Schwartz, Angle and Pitcher, 1986; Bellinger, Leviton, Rabinowitz, Allred , Needleman and Schoenbaum, 1991; Shukla, Dietrich, Bornschein, Berger and Hammond, 1991; Frisancho and Ryan, 1991; Ballew, Khan, Kaufmann, Mokdad, Miller and Gunter, 1999; Rahman, Maqbool and Zuberi, 2002), renal problem (Diouf, 2001; Lin, Lin-Tan, and Hsu, 2003), dental carries (Moss, Lanphear and Auinger, 1999; Gemmel, Tavares, Alperin, Soncini, Daniel and Dunn, 2002), hypertension (Cheng, Schwartz and Sparrow, 2001; Free Health Encyclopedia, 2008) and hearing impairment (Schwartz and Otto, 1991; Free health Encyclopedia, 2008). Lead poisoning is also characterized by social consequences such as increased school drop-out (Sciarillo, Alexander and Farrell, 2003), and increased criminal activities (Nevin, 2007). In view of these problems, an appropriate interventional measure against excessive exposure to lead is desirable [Agency for Toxic substances and Disease Registry (ATSDR), 1992].

Primary school children are among the populations that are highly vulnerable to lead poisoning. Children of school age spend a substantial part of their life in school where they could be exposed to lead poisoning. In Nigeria the official age range for children to be in primary school is six to eleven years. This implies that this is the age group that is at risk of lead poisoning in Nigerian school settings. Childhood lead exposure is particularly possible in old school buildings with flaking lead-based paint. There are other lead based materials in the schools and homes that increase children's vulnerability to lead poisoning. The school is however an important and powerful channel for the dissemination of information about childhood lead poisoning to pupils and their parents. Teachers are important agents for reaching primary school pupils with information about lead and its health implications. They are role models who have been appropriately trained to influence children's behavior and behavioural antecedents. Most good teachers are respected and whatever they say while in school is perceived to be credible by children. Studies have shown that most school-based educational interventions are effective (Gachuhi, 1999; Shuey, 1999; Ajuwon, Titiloye and Oshiname, 2008). There have been school-based programmes for the detection of lead poisoning (Berkowitz, 1995; Wang, Chuang, Ho, Tsai, Yang, Wu and Wu, 2002; Mathee, Schirding, Levin, Ismail Huntley and Cantrell, 2002; Odzen, Kilic, Vehid, Toparlak, Gokcay and Saner, 2004; Kordas, Canfield, Lopez, Rosado, Vargas, Cebrian, Rico, Ronquillo and Stoltzfus, 2006). These programmes are usually aimed at the prevention and control of lead poisoning.

Some intervention programmes have targeted the prevention of childhood lead poisoning. For example in the United States of America (USA), a training curriculum on childhood lead poisoning has been developed for facilitating educational interventions targeted at teachers and students (YNHTI, 2007a). In Boston, Massachutssets, a community directed intervention adopted preventive counselling techniques to prevent childhood blood lead poisoning (Chaisson and Glotzer, 1996).

Most lead-related studies so far carried out in Nigeria only showed the ubiquity of lead in most Nigerian communities including the schools (Okoye, 1994; Agbo, 1997; Adogame, 1997; Okekearu, 1998; Ogusola, Oluwole, Asubiojo and Durosimi, 1994a; Adeniyi and Anietor, 1999; Irene, 2000 and Sridhar, 2000). There were no intervention components. Teachers in Nigeria have pivotal roles to play in the prevention of lead poisoning in school settings. Yet, little or no attention is focused on how to enhance their capacity to be actively involved in school-based lead poisoning prevention and control in Nigeria. A special training on lead poisoning prevention is desirable for teachers because it is not part of their basic training curriculum. Therefore this intervention study focused on the outcome of a training programme on primary school teachers' knowledge, perceptions and self-efficacy related to the prevention of childhood lead poisoning in Ido Local Government Area.

1.2 Statement of problem

Primary school children in Nigeria are vulnerable to lead poisoning. This is so because many of them attend old schools painted with lead based paints. A study conducted in Lagos, Nigeria has shown, for instance, that nursery/primary school children are at risk of lead poisoning and primary school teachers were not knowledgeable about childhood lead poisoning (Irene, 2000).

In a study by Nriagu (1992), a blood lead concentration of 25 ug/dl was reported among 15-30% of children in some urban areas of Kaduna, Nigeria. These reported levels of childhood blood lead concentrations were above the 10 ug/dl permissible blood lead concentrations set for children [World Health Organization (WHO), 2004; CDC, 1991]. According to Wright, Thacher, Pfitner, Fischer and Pettifor (2005), in a study carried out in Jos, up to 70% of young Nigerian children have blood lead concentration above the WHO tolerable limit of 10 ug/dl. It has been observed that the high blood lead concentration reported among Nigerian children is because 96% of paints produced in Nigeria have lead concentration above hazardous level (Adebamowo, Agbede, Sridhar and Adebamowo 2006).

Lead poisoning has grave consequences on people's health especially among pre-primary and primary school age children. The low dietary calcium intake among Nigerian children, as reported by Thacher, Fischer, Pettifor (2000); Pfitzner, Thacher, and Pettifor (2000) further increases their rate of lead absorption and toxicity (Bruening, 1999).

Teachers' involvement in lead poisoning prevention and control in school settings is crucial. In order to be effective as stakeholders in childhood lead poisoning prevention and control, teachers' capacity need to be enhanced through training. A little is however known about teachers' level of knowledge, perceptions and self-efficacy relating to childhood lead poisoning in Nigeria, yet they have pivotal roles to play in the prevention and control of lead poisoning among in-school children. There is also dearth of information about the effects of a training intervention on the knowledge, perceptions and self-efficacy for preventing childhood lead poisoning among primary school teachers in Nigeria. In addition, there is gap in knowledge in respect of the feasibility of training teachers to upgrade their peers' knowledge about lead and lead poisoning and to modify their peers' perception and self-efficacy. This study was therefore designed to diagnose primary school teachers' training needs and to assess the effect of a training intervention on their knowledge, perceptions and self-efficacy for preventing childhood lead poisoning in Ido Local Government Area. The study was also aimed at determining the effect of using the trained teachers to train their colleagues (peers) on lead and lead poisoning prevention and control using the peer education approach.

1.3. Justification

The justification of this study was based on the need to yield evidence-based information on teachers' knowledge, perception and self efficacy concerning childhood lead poisoning. It could also be useful in establishing the effects of training on teacher's knowledge, perceptions and self-efficacy for the prevention of childhood lead poisoning. The outcome of the study has implications for policy formulation aimed at scaling up school-based educational interventions for the prevention and control of lead poisoning among school children in school settings.

1.4. Research questions

The research questions which guided the conduct of this study were as follows:

1. What are teachers' level of knowledge relating to lead poisoning in terms of its cause, consequences, prevention and control?

2. What are teachers' perceptions' about childhood lead poisoning?

3. What are teachers' level of self-efficacy in performing school-based lead prevention and control tasks?

5. What are the effects of training on the teacher's level of knowledge, perception and their self-efficacy for preventing childhood lead poisoning in the school environment?

6. What are the effects of training on teachers' ability to educate their peers about lead and lead poisoning?

1.5. Study objective

1.5.1. Broad objective

The broad objective of this study was to determine the outcome of training intervention on teachers' knowledge, perception and self efficacy for preventing and controlling childhood lead poisoning as well as to determine the effects of using trained teachers to upgrade their peers knowledge and modify their perception and self-efficacy for preventing and controlling childhood lead poisoning in Ido LGA of Oyo State Nigeria.

1.5.2. Specific objectives

The specific objectives of this study were to:

1. Assess primary school teachers' knowledge about lead and childhood lead poisoning and determine their knowledge about ways of controlling and preventing it.
2. Determine primary school teachers' perceptions of childhood blood lead poisoning.
3. Determine primary school teachers' level of self-efficacy in performing lead poisoning prevention and control tasks in school settings.
4. Use the outcome of objectives 1-3 to design and implement a training intervention for selected primary school teachers in Ido LGA.
5. Document the changes in knowledge, perceptions and self-efficacy relating to childhood lead poisoning which may be associated with the training intervention received.

6. Determine the ability of the trained primary school teachers to design and implement a similar training intervention targeted at their peers.
7. Assess the effects of the training programme conducted by the teachers on their peers' knowledge, perceptions and self-efficacy relating to childhood lead poisoning.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Occurrence, characteristics and uses of lead

Lead is a metal and most of it is obtained from galena, an ore consisting of a combination of lead and sulphur. Lead is obtained by crushing galena and then roasting it to drive off the sulphur. Subsequently the crushed roasted product is subjected to a series of other processes before lead is obtained. The lead obtained often contains trace quantities of gold, silver, copper and other metals; this therefore necessitated further purification treatments. The finished lead is casted into lumps called *pigs*. Much lead could also be obtainable from scraps of old batteries and pipes when melted down (YNHTI, 2007b). Lead is a normal constituent of the earth's crust and that traces of it could be found naturally in soil, plants, and water. If left undisturbed, lead is practically immobile. Once mined and transformed into fabricated products, lead could be readily dispersed throughout the environment and becomes highly toxic. Lead has become the most widely scattered toxic metal in the world largely due to anthropogenic factors or activities (The United States National Academy of Science, 1980).

According to Lyla, (2006) lead is the 82^{nd} element on the periodic table and the 36^{th} most common element naturally found on earth. It is a bluish-white lustrous metal. It is a very soft, highly malleable, ductile, and a relatively poor conductor of electricity. Lead is very resistant to corrosion but tarnishes upon exposure to air. It melts at a lower temperature of 327-degree Celsius or 621 Fahrenheit than most other metals. Lead's boiling point is 1.620 degrees Celsius with a specific gravity of 11.35(Lenntech, 2008).

According to Adeniyi and Anetor (1999), lead is a toxic trace metal which is useful in a number of industries and occupations. It is used as an addictive in petrol and paints. Lead is also used in making some kitchen utensils (Nduka, Orisakwe and Maduawguna, 2008). Other consumer products which contain lead as a constituent include; plastic window blinds, candle wicks, costume jewelry (Health Canada, 2001); glass, and home furniture refinishing polish (ATSDR, 2000). The uncontrolled availability and uses of lead, results in lead poisoning which is a major public health problem in many countries (Markowitz, 2000).

2.2. Lead poisoning: a historical perspective

According to the United States National Academy of Sciences, (1980) humanity has used lead for over 6000 years. Lead mining probably predated the Bronze or Iron Ages. The earliest recorded lead mine was in Turkey about 6500 BC. It should be noted that the Bronze Age refers to the period from 2800 to 1050 BC while the Iron age refers to the period when Iron beads were worn in Egypt as early as 4000 B.C (Encyclopedia, 2009). The oldest artifact of smelted lead is a necklace found in the ancient city site of Anatolia, Greece; the estimated age of this necklace is 6,000 to 8,000 years ago. Lead's toxicity was recognized and recorded as early as 2000 BC and its widespread use has been a cause of endemic chronic plumbism in several societies throughout history. According to the United States Academy of Science, the Greek philosopher Nikander of Colophon in 250 BC wrote a report on the colic and anemia which result from lead poisoning. Although Hippocrates related gout to food and wine, the association between gout and lead poisoning was not recognized until between 450-380 BC. Later during the reign of Roman Empire, gout was prevalent among the upper classes of Roman society and it is believed to be a result of enormous lead intake. There are several habits, customs or cultural practices that contributed to human exposure to lead, such as the use of lead in medicines (Obi, Akunyili, Ekpo and Orisakwe, 2006) and cosmetics (Healy, Aslam and Bamgboye, 1984).

Needleham, (1999) reported that the modern understanding of lead poisoning in children has evolved through four stages: The first stage was when childhood lead poisoning was first described in 1892 in Brisbane, Australia. At this time its existence was disputed by elitist physicians in Sydney. A house officer A.J. Turner, at the Brisbane Children's Hospital, diagnosed several children with lead intoxication who had been given a previous diagnosis of meningitis. Also in Brisbane, Australia, J. Lockart Gibson, an ophthalmologist, recognized lead poisoning in children with retinitis and ophthalmoplegia. They investigated and found the source of lead exposure to be paint on rails in the children's homes. Through their efforts, lead was eventually banned from house paint in Australia in 1914. That same year, childhood lead poisoning was first reported in the United States of America.

The second stage according to Needleham, (1999) describes the period after the existence of lead poisoning was accepted. The prevailing belief among pediatricians was that children who did not die during the acute stage of the disease suffered no lasting ill effects. In 1943, Byers demonstrated the persistence of severe residue in children who had recovered from acute lead poisoning. Dr. Randolph Byers, one of America's first pediatric neurologists, noted that several children with learning or behavior disorders had earlier been treated for lead poisoning. Along with Elizabeth Lord, a psychologist at Boston Children's Hospital, Byer conducted detailed psychometric evaluations of 20 children who had reported previous lead poisoning. They found that 19 of the 20 children were behavior disordered or intellectually impaired. Dr. Byer's studies in the early 1940's were the first to prove that children who survived acute intoxication were often left with devastating deficits in intellectual function (Needleham, 1999).

The third stage according to him describes the period in which the reality of the sequelae of lead poisoning was accepted, but the sequelae were thought to afflict only patients who had had the most severe symptoms. In the late 1970s and all through 1980s and early 90's, published papers from around the world showed that there could be intelligent quotient and behavioral deficits at silent doses of lead. With the release of extensive research from numerous studies, each confirming the other, almost all workers in the field agree that lead at silent doses produces deficits in psychological function. These psychological functions relate to intelligence impairment, attention deficit, language function, and perhaps social adjustment (Canfield, Henderson, Cory-slechta, Cox, Jusko, (2003); Bellinger and Needleham, (2003); Scariallo et al, (1992).

Needleham, (1999) described the fourth stage as the period when regulations began to be put in place to accommodate the realization that lead at silent doses could damage the brains of children. Consequently mass public screening programs were conducted to monitor the exposure of young children to lead. For the first time, the focus of lead exposure was centered on primary prevention, with many laws enacted to eliminate lead sources in the environment. Mandatory testing programs were established in many countries to detect early symptoms of lead related problems. Today childhood lead poisoning is a major public health problem globally and several policies including intervention strategies are designed to prevent or ameliorate its effects by many developed countries with little attention given to it in developing countries (Ogunseitan and Smith, 2007).

2.3. Route of lead exposure, epidemiology and public health importance of lead poisoning

Basically, lead poisoning occurs through oral route. Inhalation has also been reported but it is particularly common in low-level poisoning (Chisolm, 2001). The primary route of lead intake in children is ingestion through the gastrointestinal tract (Markowitz, 2000). Only a small amount of ingested lead is needed to raise a child's blood lead level (European Environment and Health Committee [EEHC], 1999). Toxicity depends on the amount of lead and duration of the exposure. The half-life of lead is approximately thirty-five days in blood; it is approximately two years in the brain, and decades in the bone. Blood lead level is primarily an indicator of recent exposure, although it can remain elevated longer due to mobilization of internal stores (New York Department of State Health, 1999).

Another route of lead exposure in infants is through breastfeeding (Health Canada, 2001). Although lead appears in milk the concentration is closer to plasma lead and much lower than blood lead, so little is transferred (American Association of Pediatrics (AAP), 2005). Trans-placental exposure to lead has also been reported. Hence a developing fetus may be exposed to lead in the mother's bloodstream and the blood lead concentration of the infant is reported to be similar to that of the mother. Once absorbed lead is carried in the blood and absorbed by all other tissues of body (Graziamo, Popovac and Factor-Litrak, 1990).

The World Health Organization (WHO) has estimated that there are 120 million people worldwide with Blood lead level (BLLs) above 10 ug/dL and 240 million people with BLLs greater than 5ug/dL (WHO, 2004). According to Fewtrell, Prüss-Ustün, Landrigan and Ayuso-Mateos, (2004) the disease burden from exposure to lead resulting in mild mental retardation (due to intelligent quotient point decreases) and cardiovascular outcomes (due to increases in blood pressure) have been estimated at a global level.

Blood lead levels were compiled from the literature for 14 geographical regions defined by the World Health Organization according to location and by adult and child mortality rates. Adjustments were applied to these levels, where appropriate, to account for recent changes relating to the implementation of lead-reduction programs and the lower levels seen in rural populations. It is estimated that mild mental retardation and cardiovascular outcomes resulting from exposure to lead amount to almost one percent of the global burden of disease, with the highest burden being in developing regions.

The prevalence of lead poisoning in the Asia/Pacific region of the world showed that China and India are currently the most affected in the region. In China, 33.8% of children tested had BLL greater than 10ug/dL. In a region along the Lianjiang River there have been measured lead levels 2,400 times WHO Drinking Guidelines (Basel Action Network (BAN) and Silicon Valley Toxics Coalition (SVTC), 2002).

In India, the George Foundation has been instrumental in identifying the extent of lead poisoning among both children and adults. In a study including seven Indian cities blood lead levels were on average, elevated in over half of the children studied. An interesting source of lead in this region of the world is in the kohl cosmetic used to line the eyes. This contains varying amounts of lead. As a natural health product, kohl has many uses that vary among cultures, including the following; use as an aid in the healing of the infant umbilical cord stump, circumcision after-care, eye infection protection, blood clotting aid, digestive aid, sunglare prevention/eyestrain reliever, and general anti-microbial treatment (George Foundation, 1999).

In Taiwan Wang, Chuang, Ho, Tsai, Yang, Wu and Wu, (2001) assessed the relationship between blood lead concentrations and learning achievement among primary school students. This involved 934 children from 32 primary schools in 11 districts of Kaohsiung city who were randomly selected. Blood lead levels of the children were checked, and they were administered a questionnaire about their family information. Scores of several courses were used in this study on the relationship between a child's blood lead level and his or her academic performance (Ranking with his or her classmates), including Chinese (reading and writing short Chinese articles), Mathematics, History and Society, and Natural Science. Multiple regression models were done with adjustments for the confounding effects of their parents' socioeconomic levels. The mean of 934 blood lead level was 5.50 (1.86) g/dL. Spearman's coefficient showed that class rankings in Chinese, Mathematics, Natural Science, and History and Society were all strongly associated with blood lead levels ($p<0.01$). The multiple regression models revealed that blood lead level exerts a stronger influence on children's language ability (Chinese) than on their ability to calculate (Mathematics).The results suggest that environmental lead exposure adversely affects a child's academic achievement, making a direct link between exposure to lead and academic attainment.

In Istanbul Turkey, Odzen et al (2004) also conducted a study among school children. The aim of this study was to determine the risk factors associated with high lead levels in school children. To that end a questionnaire was designed to gather information about the demographic and socio-economic characteristics of the children. Blood lead concentrations were obtained from capillary blood taken from 760 children in 13 schools and the blood lead concentrations were determined by atomic absorption spectrophotometry. The blood lead level ranged between 4.0 and 23 mg/dL. Some 91.2% of the children (693) had blood lead level of 10 mg/dL. Only 5 (0.6%) had blood lead levels over 15 mg/dL. One child had a blood lead level above 20 mg/dL. Household exposure to smoking, attendance of school near a main street and middle and upper-middle-class socio-economic status were found to be the most important risk factors for a high blood lead level. Children attending schools that were nearest to a main road exhibited higher blood lead levels than children in schools further from a main road. Their findings support the following public health recommendations: children should not experience household exposure to smoking; schools should not be located near main streets; and unleaded gasoline use should be promoted.

In Latin America, majority of the cases of lead poisoning stems from smelters and soil contaminated by years of leaded gasoline, and glaze used in pottery making. Often, drinking water is stored in these vessels, which then leaches the lead from the glaze. Also, lead solder in pipes and in food cans also persists as a source implicated in high blood lead levels in both children and adults (Lyla, 2006). In Mexico Kordas, Canfield, Lopez, Rosado, Vargas, Cebrian, Rico, Ronquillo and Stoltzfus (2006), conducted a study to assess deficits in cognitive function and achievement in Mexican first-graders with low blood lead concentrations. They reported associations between blood lead and cognitive performance for first-grade Mexican children living near a metal foundry. Using a cross-sectional design, they examined the relation between children's concurrent blood lead concentrations of 11.4 mg/dL± 6.1 and their performance on 14 tests of global or specific cognitive functions. The blood lead–cognition relations were modeled using both linear and nonlinear methods. After adjustment for covariates, a higher blood lead level was associated with poorer cognitive performance on several cognitive tests. Segmented linear regressions revealed significant effects of lead but only for the segments defined by a concurrent blood lead concentration below 10–14 mg/dL.

Recent data from the third USA National Health and Nutrition Examination Survey (NHANES III) showed a dramatic decline in the blood lead (PbB) levels of the US population from 12.8 pg/dl during 1976-80 to 2.8pg/dl during 1988-91 (Pirkle, Brody, Gunter, Kramer, Pascal, Flegal and Matte, 1994). Mean PbB levels in children 1 to 5 years old declined by 77% (13.7 to 5.6 pg/dl) (Pirkle et al., 1994). This remarkable public health achievement of the decade can be attributed to the reduction of lead exposures from automobiles, house paint, drinking water and consumer products (Goldman and Carra, 1994; Mushak, 1992). In 1999, the median PbB was 1.9μg/dl (CDC, 1999). In the U.S., African American children have been shown to be at the highest risk for elevated lead levels nationwide. NHANES III data demonstrated prevalence of BLL at or above 10μg/dL of 11.2 % of African American children aged one to five, compared to 2.3% of white children in the same age group; Hispanic children had prevalence rates intermediate to these (Markowitz, 2000). When levels at or above 5μg/dL were assessed, 47% of African American children, 28% of Mexican American children, and 19% of non-Hispanic white children age one to five years had elevated blood lead levels (Bernard, 2003).

Studies emanating from Sub-Saharan Africa have also shown that there is high prevalence of lead poisoning in the region. According to Nriagu, Blankson and Ocran (1996), the available data on PbB and the actual prevalence of childhood lead poisoning in Africa is limited. A prevalence study in 1982 which involved first and second grade children in the Cape Peninsula in South Africa showed a two-fold difference in PbB between the urban (22 ug/dl) and rural (11ug/dl) children (Von Schirnding and Fuggle, 1984). The most detailed studies of childhood lead poisoning in Africa were in South

Africa, especially in the Cape Province. Grobler, Rossouw and Maresky, (1985) found the PbB for children in a remote area of South Africa to be 3.4 ug/dl, a value that was higher than the average for the U.S. population as at 1985.

A study of socially deprived children, aged between 4 and 6 years of age, from pre-school centers in Cape Town found the mean PbB to be 16 pg/dl and that about 4% of the 300 children studied had PbB of 30 pg/dl or higher (Deveaux et al., 1986). The average PbB for children in schools adjacent to highways was18-21 pg/dl compared to 13pg/dl in schools removed from heavily traveled roads. Children with high PbB generally showed signs of behavioral and biochemical abnormalities (Von Schirnding, 1988). A follow up study found that 17% of the school children in Woodstock (located near the central business district of Cape Town) had PbB 230 pg/dl and that about 90% of black children and 68% of white children had PbB of 210pg/dl (Von Schimding, Bradshaw, Fuggle and Stokol, 1991).

A re-survey of grades one and two pupils in Woodstock, South-Africa was done in 1991 following the reduction in lead content of petrol from 0.84 to 0.4 g/l. No significant difference was found in average PbB during 1982 (16pg/dl) and 1991 (16 pg/dl), and about 62% of the children still showed PbB of 15 pg/dl in 1991(Von Schimding, Kibel, Fuggle, and Mathee, 1995a). According to a report by Alliance to End Childhood Lead Poisoning [AECLP] (1994), 100% of the children aged 0-2 years old and 82% of those aged 3-5 years who live in the urban areas of Africa have PbB concentration of 10pg/dl or higher; these estimates were however believed to have been exaggerated. Reported average PbB in various communities of the Cape Province, South Africa include 14pg/dl in Hout Bay, 15 pg/dl in Mitchell's Plain and 16pg/dl in both Woodstock and Schotchesklo (Von Schimding, Mathee, Robertson, Strauss and Kibel, 1995b). Between, 93 and 100% of the children in these communities had PbB of 10pg/dl. In the mining village of Aggeneys (Northwest Cape), average PbB in children was found to be 16pg/dl and close to the 13 pg/dl in the village of Pella located about 40 km from Aggeneys (von Schimding et al., 1995a). The high PbB levels in rural and urban communities constitute evidence that childhood lead poisoning associated with elevated lead levels in the environment has become pervasive throughout the province.

Mathee, Schirding, Levin, Ismail, Huntley and Cantrell, (2002) in South Africa also carried out a study to determine blood lead levels among school children living in three areas of Johannesburg: inner city suburbs and the low-income townships of Alexandra and Westbury to the north and west of the city center. The results indicated that blood lead levels ranged from 6 to 26μ/dL, with a mean level of 11.9μ/dL. The blood lead levels of 78% of children equaled or exceeded the current international acceptable level (10ug/dl). Maternal educational status and the presence of smokers in the home were among the factors associated with elevated blood lead levels.

In Nigeria, there are no national surveys of blood lead levels in the general population. Sentinel studies indicate that these levels are very high compared with current acceptable limits (Committee on the Phase-out of Leaded gasoline in Nigeria, 2002). Omokhodion, (1994) has determined the blood lead levels of a segment of the general population in Ibadan using atomic absorption spectrophotometry. The mean blood lead levels of 11.4μg/dl and 12.3μg/dl were recorded for females and males respectively. Only 38% of the population studied had PbB which was less than 10pg/dl. Average PbB in non-occupationally exposed adults in Lagos, Nigeria has been recently found to be 13 dl (Ogunsola et al., 1994a).

Adeniyi and Anietor, (1999) carried out a two-phased study; one based in Southwest Nigeria involving 137 subjects comprising 86 occupationally exposed subjects and 51 controls. Phase 2 of the study involved 880 occupationally unexposed subjects. In phase one in occupationally exposed individuals PbB was significantly higher than in controls ($p < 0.001$); 95.3% of the test subjects had PbB greater than 40/μdl, the universal upper limit of acceptable PbB in Pb workers. About 70% had PbB greater than 55microg/dl, a level now considered indicative of excessive exposure. In addition, about 40.0% of the lead (Pb) workers had PbB of 60μ/dl and above, a level indicative of the need to remove affected individuals from further exposure. Only about 5.0% of the Pb workers had PbB below 40μ/dl. Interestingly, in the control subjects only about 18% had blood Pb levels falling within commonly acceptable PbB levels. About 7.0% of controls (Occupationally unexposed) had PbB level within the range considered indicative of moderate toxicity. Over 8.0% had PbB above levels acceptable in occupational exposure while about 4.0% fell within the range indicative of severe toxicity. The PbB for unexposed population therefore, also gives cause for toxicity. Phase two study revealed that excessive use of alcohol and tobacco, undue exposure to exhaust from vehicles using leaded gasoline, exclusive use of contaminated wells as sources of drinking water and increased consumption of contaminated table salt may all be pathways for increased Pb burden in this environment. These data suggest Pb poisoning of a high magnitude arising from occupational and environmental factors.

Lead levels in blood and urine of university students, petrol station attendants and pregnant women resident in Abeokuta, an urban town, were determined by Ademuyiwa, Arowolo, Ojo, Odukoya, Yusuf and Akinhanmi, (2002) using the spectrophotometric method in order to assess their exposure to lead. A mean blood lead level of 16.27±2.65µg/dl was found for male university students while the female students had a mean blood lead level of 15.19 ± 2.36µg/dl. The male petrol station attendants had a mean blood lead level of 42.40 ± 2.41 µg/dl whereas their female counterparts had 34.95±4.25µg/dl. The highest mean blood lead concentration (54.52 ± 4.38 µg/dl) was observed in the pregnant women in their third trimester of pregnancy. The urinary excretion of lead followed the same pattern as that of blood. The study provides additional data pointing to the prevalence of elevated blood lead levels in adult population in urban areas of Nigeria.

Among young Nigerian children however, Nriagu, (1992) reported 15-30% of the children in some urban areas of Nigeria with PbB levels over 25µg&dl. A repeated prevalence survey of blood lead poisoning among children one to six years old in Kaduna, in northern Nigeria was investigated. Mean PbB was found to be 10.6 pg/dl, and 2% of the children had PbB levels greater than 30 pg/dl. Highest average PbB levels were found in children 5 years old and were attributed to the tendency for this age group to play longer in contaminated out-door environments. The strongest associations were found between PbB and whether the family owned a car or lived in a house along a tarred road (Nriagu, 1992)

The school environment in Nigeria has been reported to be full of lead (Irene, 2000). A positive statistically significant correlation has been found between lead in various samples in the school environment (hand washings of children, toy washings, playground soil samples, classroom sweepings, roof top water and eye base cosmetic).

A recent study has shown that up to 70% of young Nigerian children now have blood lead levels which are greater than or equal to10μg/dl (Wright et al, 2005). A study to better identify risk factors for lead toxicity among Nigerian families with children at risk of lead toxicity in two geographic wards in Jos, Nigeria, has been conducted. One of the wards had been previously reported to have a high mean blood lead level (37±13μg/dl) and one with a lower mean blood lead level (17±10μg/dl) in young children. Data pertaining to potential risk factors for lead exposure were collected from children and adults in 34 households. It was observed that the mean (SD) blood lead concentration of 275 subjects, aged three weeks to 90 years, was 8.7 (5.7) μg/dl (range 1–34 μg/dl) and 92 (34%) had concentrations greater than or equal to 10μg/dl. In multivariate analysis, an age of five years and under, flaking house paint, residence near a gasoline seller, male gender, increasing maternal and paternal education, and use of a lead eye cosmetic were independently associated with greater blood lead concentration.

The latest in the series of studies carried out to determine the lead levels of children in Nigeria was by Nriagu, Afeiche, Linder, Arowolo, Ana, Sridhar, Oloruntoba, Obi, Ebenebe, Orisakwe and Adesina, (2008) among children aged 2–9 years (average, 3.7 years). The mean blood lead level (BLL) for the children was 8.9±4.8 μg/dL, the median value was 7.8μg/dl while the range was 1–52 μg/dL. About 25% of the children had BLL greater than 10μg/dl. There were important differences in BLLs across the three cities studied, with the average value in Ibadan (9.9±5.2 μg/dL) and Nnewi (8.3±3.5 μg/dL) being higher than that in Port Harcourt (4.7±2.2 μg/dl). Significant positive associations were found between BLL and a child's town of residence ($p<0.001$), age of the child ($p=0.004$), length of time the child played outside ($p<0.001$) and presence of pets in a child's home ($p=0.023$). But significant negative associations were found between BLL and educational level of caregiver ($p<0.001$).

2.4. Sources of lead poisoning in Nigeria

Generally lead contents of petrol sold in African countries have gone up and are among the highest in the world; typical concentrations of lead in regular fuel fall in the range of 0.5 to 1.0 g/l. More than two-thirds of nations in Africa have maximum lead levels above the world media value. In-organic lead compounds (tetraethyl lead and Tetra methyl lead) were extensively used as additives in petrol (AECLP, 1994; Nriagu et al., 1996a). Various studies have been conducted to identify the different sources of lead poisoning in the Nigerian environment.

In Nigeria, the level of lead in petrol is estimated at 0.7g/litre and the national consumption of petrol is estimated at 20 million liters per day with about 150 people per car. It is estimated that at least 15,000kg of lead is emitted into the environment through fuel combustion (Agbo, 1997). The Committee on the Phase-out of Leaded Gasoline [CPLG] in Nigeria, (2002) has reported that the lead level of petrol produced has been reduced to 0.15 g/l at the end of 2002.

Studies in Nigeria have shown that cooking utensils, foods and food products have elevated lead levels. Ketiku and Adeyinka in 1999 reported that imported glazed ceramics (drinking mugs, soup bowls, and cooking pots) in Nigeria released lead up to 0.4ppm. Infant formulas and foods are not exempted however from this menace of elevated lead levels. Baby foods in Africa are being increasingly contaminated with lead (Olaofe, 1988; Ikema, Nwankwoalab, Odueyungboa, Nyavora and Egiebora, 2002). The lead concentrations in mother's milk in Nigeria and Zaire average about 5 pg/d/l (Parr, DeMaeyer, Iyengar, Byearne, Kirkbright, Schoch, Niinisto, Pineda, Vis and Omololu, 1991).

Okoye, (1994) had earlier reported high lead levels in dried fish from Nigerian markets. In another study by Okekearu, (1998) lead levels were measured in Lagos metropolis. A total of 72 different food samples were collected and analyzed for lead from high (29), medium (18) and low (25) density areas. High values were obtained for mixed food varieties consumed locally, like *soup, jollof rice*, *Gari*, *Eba* (Cassava based) and *Amala* (Yam based). A study carried out by Sridhar, 2000 revealed that the lead levels in food varied among the communities in terms of whether they are living in high, medium or low density areas. The levels in mg/kg are as follow: smoked fish (0 to 9.7), *Gari* a popular native cassava dish (0 to 8.6), dried meat (0 to 15.1), *suya* (a meat preparation) (6.5), *Elubo* (yam flour) (0 to 12).

Another study that showed food is a source of lead poisoning in Nigeria was that of Fakayode and Olu-Owolabi's, (2003) on trace metal content and estimated daily human intake from chicken-eggs in Ibadan. A total of 151 chicken-eggs and four local chicken feeds were purchased directly from the poultry farms, at the local markets, and along the roadsides of Ibadan and were analyzed for lead and other heavy metals using carbon graphite atomic absorption spectrophotometry. The authors found strong, positive correlations between the levels of metals in the feeds and the corresponding concentration (mg/kg) of metals in the eggs. The overall average concentration of lead in eggs was 0.59 with an average estimated daily intake of 19.5 μg per person. The concentrations of lead and cadmium in the study, however, were comparatively greater than levels found in other countries. Therefore, the estimated daily intakes of lead and cadmium in this region slightly exceeded the normal reported daily intakes of lead and cadmium from eggs in some other countries.

Lead has also been reported to be present in cocoa and cocoa products produced in Nigeria. Rankin, Nriagu, Aggarwal, Arowolo, Adebayo and Flegal, (2005) have reported lead concentrations and isotopic compositions from analyses of cocoa beans, their shells, and soils from six Nigerian cocoa farms, and analyses of manufactured cocoa and chocolate products. The average lead concentration of cocoa beans was ≤ 0.5 ng/g, which is one of the lowest reported values for a natural food. In contrast, lead concentrations of manufactured cocoa and chocolate products were as high as 230 and 70ng/g respectively, which are consistent with market-based surveys that have repeatedly listed lead concentrations in chocolate products among the highest reported for all foods. One source of contamination of the finished products is tentatively attributed to atmospheric emissions of leaded gasoline.

Various studies in Nigeria have indicated that plants/vegetations have the ability to concentrate lead (Ademoroti, 1980; Sridhar, 1988). Bark of trees has also been shown to contain lead. This was noted in Kakulu's study, (2002) designed to determine trace metal concentration in roadside surface soil and tree bark in Abuja. More recent studies in Nigeria have shown the presence of high lead level in Nigerian vegetations. For instance, Eriyamremu, Asagba, Akpoborie and Ojeaburu, (2005) reported high lead concentrations in some commonly consumed vegetables in the Niger-Delta oil region of Nigeria while Akinola and Ekiyoyo, (2006) determined the level of heavy metals including lead in washed and unwashed samples of *Telfaria occidentalis* (locally called *ugwu*) and

Talinum triangulare (waterleaf) vegetables cultivated on the bank of river Ribila in Odo-nla village Ikorodu, Lagos. Lead concentrations above the acceptable unit were reported.

Automobile exhausts are believed to account for more than 80% of the air pollution in some urban centres in Nigeria. The level of lead in Nigeria's super grade gasoline is 600-800mg per liter (Onianwa, 1985; Osibanjo and Ajayi, 1989; Shy, 1980); this is much higher than those of other environmental pollution conscious countries. To further show air as a source of lead poisoning, a study was carried out among traffic wardens in Ile-ife and Lagos. It was found that the mean blood level in Lagos wardens was 18.1± 6.4ug/dl, which was significantly higher than the level of 10.2 ± 7.7ug/dl in Ife wardens (Ogunsola et al, 1994a).

Water has been incriminated as one of the leading sources of lead poisoning in Ibadan Nigeria (Omokhodion, 1994). Samples of 36 surface and ground water in Ibadan indicated varying lead levels. The surface waters intended for domestic needs showed the following lead levels in of mg/l; for high (0.41± 0.5), medium (1.25 ± 0.2) and low density (0.39 ± 0.5) areas. The study also showed that most wells had lead concentrations to be considerably higher specifically in high density communities while the presence of lead in tap water in Ibadan was found to be less than 5μg/l. Although current levels of lead in Ibadan are within acceptable limits, the increasing industrialization of the city and the presence of anthropogenic activities which have potentials for contaminating soil, air and water with lead calls for the adoption of lead pollution control strategies.

According to Nriagu, (1996), many communities in Africa consume untreated surface waters which are polluted with lead from urban and street run-offs, open drains, industrial and municipal effluents and human wastes. A study in Lagos has revealed elevated lead levels in water. The sources of lead in water are mostly from the drainage and surface run-offs. The areas where there are lead based activities contribute to the high lead levels in the final recipients such as river, stream or wells (Sridhar, 2000).

The study conducted by Orisakwe, Igwilo, Afonne, Maduabuchi, Obi and Nduka, (2006) in eastern Nigeria has shown that sachets water sold in Anambra has lead above permissible level. Lead levels ranged from 0.002 to 0.036 mg/L in the samples. Some samples (12.2%) had lead levels above the maximum contaminant level (MCL 0.015 mg/L). Elevated lead levels have also been reported in potable water supplies in

Warri, Nigeria (Nduka and Orisakwe, 2007). They found lead levels of 1.20 mg/L. This value was above the recommended standard of MCL 0.015 mg/L by the Environmental Protection Agency of America (EPA, 2007).

Soils in various locations in Nigeria have been shown to contain lead above the recommended units. Lead levels in soils vary depending on the location and nearness to lead based activities and vehicular density. A study in Ibadan by Adogame in 1997 showed that in residential areas, the lead level in mg/kg; ranged from 364.0 ± 85.2 in high density areas, 269.0 ± 133.9 in medium density areas to 307.0 ± 161.3 in low density areas. In mechanic's villages the values ranged between 292.3 and 491.2. Near petrol stations, the values ranged between 190.0 to 1029 on the top 10-cm level and 237.5 to 3,862.8 in 11 to 20-cm layer while near a lead acid battery industry, the soils showed values of 1,339 in the top 10cm layer and 6263/kg in the 11 to 20cm layer. Kakulu, (2002) recently reported that surface soil in different districts of Abuja Nigeria has elevated concentration of lead with an average of 18.0±4.0µg/g. The trend in lead levels suggested that automobile emissions were a major source of lead as the highest concentrations were recorded in the commercial areas of the city known for their high traffic densities.

The presence of high lead levels in dust has been reported in Ibadan, Nigeria. Adogame, (1997) collected a total of 35 harmattan dust samples over an 8 week's period. The mean lead values showed a range of 57.5 to 143.2mg/kg. The amount of dust was dependent on the density of the sampled areas. Lead levels were found to decrease from the high through the medium to low density areas. This phenomenon may have been accounted for by the volume of traffic and anthropogenic activities which generate lead-laden dust. Dust could be easily raised by moving vehicles and human activity when the soil is dry. In another related study by Okekearu, (1998), it was noted that indoor lead levels were 0.19-388.30mg-1kg, 18.5-398.15mg/kg, and 10.25-215mg/kg for high, medium and low density areas respectively. Nature of building, wall paintings, degree of ventilation and elevation, nearness to heavy traffic and contaminations of dust samples (with paint peelings from the walls) influenced these values.

Some cultural and religious practices have been associated with increased lead exposure in Nigeria. For instance the practice of *rubutu*, a Muslim tradition of drinking a certain kind of ink washed off from papers or slates on which Koranic passages have been written, is another source of childhood lead poisoning that has been reported in Nigeria. A study conducted by Wright et al, (2005) to determine the risk factors for lead toxicity among Nigerian children at risk of lead toxicity showed a high blood lead concentration among Muslim children involved in this practice.

Lead is featured as an ingredient in some traditional medicines and cosmetics. In particular, lead sulphide either alone or in an organic base is used in many communities as a cosmetic or eye cleaner and for the treatment of eye infections. Analyses of the lead-containing preparations sold under such colloquial names as *kohl, tiro, moju, tanjere,* etc. have been found to have lead concentration of 12-81%, and some of the lead may be absorbed into the eye or through sweaty skin (Healy *et al*, 1984). Obi *et al*, (2006) recently reported elevated lead levels in all the 25 ready-to-use herbal products purchased from two open markets in Nnewi and Owerri, Nigeria. According to them, the levels (250µg/day to 27,000µg/day) were higher than Food and Agricultural Organization/World Health Organization provisional tolerable weekly intake (PTWI) of 25µg lead/kg per body weight for humans. This portrays danger to the Nigerian public.

Paint is also a major source of lead poisoning in Nigeria. Lead-based paints, especially for exterior surfaces, are widely sold in Nigeria, and lead chromate remains unregulated in Nigeria. Prolonged exposure to the humid tropical conditions transforms the lead paint into ordinary household dust which becomes laden with lead. African cities are notoriously dusty, and extensive recycling of lead-contaminated dust particles (from any source) is a common phenomenon. The mud and dirt (which could be laden with lead) that invariably cover the hand, faces and clothes of kids and toddlers when they play outside, or even within the house, represent a serious health hazard (Nriagu et al., 1996). Irene, (2000) reported a high lead level content in water washed off painted walls in some selected primary schools in Lagos, Nigeria. Adebamowo, Agbede, Sridhar and Adebamowo, (2006) reported that 96% of paints produced in Nigeria have lead above hazardous concentration. They measured lead levels in 19 samples of locally manufactured paint purchased from the Nigerian market in February, 2005. The level of lead in the paints ranged from, 17.5g/g±62.2g/g to 515.9g/g±115.1g/g, while the median was 25.1g/g. The study concluded that paints sold in Nigeria still contain a substantial amount of lead with increased risk to the health of children, among whom domestic sources of lead exposure is more important than exposure through leaded petrol.

A recent study by Nduka et al, (2008) in eastern Nigeria estimated the extent of use of lead-based paint in buildings in eastern Nigeria. A total of 168 buildings were sampled from four cities. All the building paint flakes from the four cities were reported to have lead levels higher than the United States Environmental Protection Agency permissible level of 5 mg/kg.

2.5. Factors which influence vulnerability to lead poisoning

Various factors have been noted to increase an individual's susceptibility to lead poisoning. Age is a typical factor. Children are more vulnerable to lead poisoning. This is as a result of their biochemical and developmental characteristics. They are often active, highly mobile, have frequent hand-to-mouth practices, and have highly efficient gastrointestinal absorption of lead. The gastro intestinal absorption rate is estimated to be five to ten times higher than in adults. Older children with developmental delays may continue to be at high risk of lead exposure; this could be for example, through persistence of mouthing behaviour (Silverberg, 1997). Children's blood lead levels typically rise rapidly between six and twelve months of age and peak between eighteen and thirty-six months of age, before gradually declining (Lanphear, Dietrich and Berger, 2003).

Another key factor is socio-economic status. Socio-economic status is a powerful predictor of lead exposure. The NHANES III data found that 13% of Medicaid recipients had BLL at or above, 10u/dl, and 42% had levels at or above 5mcg/dL. In the USA, medicaid recipients are persons whose medical bills are paid by the government through the social service (Alaska Department of social services, 2004). Poor children are more likely to live in lead-contaminated environments, including older and dilapidated housing and deposits of lead from years of leaded gasoline, hazardous waste disposal, and lead-related industry (Silbergeld, 1997). Furthermore, there is accumulating evidence in both human and animal studies that socially and economically disadvantaged children may be more vulnerable to the effects of a given level of lead exposure (Lidsky and Schneider, 2003).

Nature of housing is another predictor of the level of exposure to lead poisoning. Lead-based residential paint is the most significant source of high-level lead exposure for children. Several studies have demonstrated household lead-laden dust as the major source of lead exposure for young children (Chisholm, 2001). Lead based paint can also be disturbed during renovation of older houses if lead-safe work practices are not followed (Reissman, Matte, Gurnitz, Kaufmann and Leighton, 2002).

Nutritional deficiency is a predictor of lead toxicity (Lyla, 2006). Children with iron or calcium deficiencies have been shown to have increased absorption of lead, and to be at significantly higher risk for developing elevated blood lead levels (Meyer, Pivetz, Dignam, Homa, Schoonover and Brody, 2003; Wright, Tsaih, Schwartz, Wright and Hu, 2003; Mahaffey 1995; Mahaffey, 1986). However, there is currently no solid evidence that supplementation with calcium or iron prevents elevated blood lead levels in children (Lanphear, et al, 2003).

Pregnancy has also been linked to increased susceptibility to lead poisoning (Health Canada, 2001). Pregnant women and fetuses may represent a unique population in terms of demography and exposure pathways to lead. Women can carry lead from any lifetime exposure stored in their bones for decades, or may be exposed to lead during pregnancy from environmental, occupational, or other sources (Lidsky and Schneide, 2003). During pregnancy, maternal lead may be mobilized from bone stores into the bloodstream and then cross the placenta or enter breast milk. Various reports have estimated the prevalence of elevated blood lead levels among adult women to be between three and nineteen percent (U.S. Preventive Services Task Force [USPSTF], 2006).

2.6. Consequences of lead poisoning

United States Agency for Toxic Substance and Disease Registry, (2000) described lead and the compounds which contain lead as poisonous. Although lead has been used in numerous consumer products, it is a toxic metal now known to be harmful to human health if inhaled or ingested. Lead exposure at values lower than 10µg/L has been reported to have sub-clinical effects on the central nervous system (CNS).

According to Goldstein (1990), exposure to excessive amounts of inorganic lead during toddler years may produce lasting adverse effects upon brain function. Maximal amounts of lead ingestion occur at an age when major changes are occurring in the density of synaptic connections. The developmental reorganization of synapses is, in part, mediated by protein kinase, and these enzymes are particularly sensitive to simulation by lead. By inappropriately activating specific kinase, lead poisoning may disrupt the development of neural networks without overt pathological alterations. The blood-brain barrier is another potential vulnerable site for neuro-toxic action of lead. Protein kinases appear to regulate the development of brain capillaries and the expression of the blood-brain barrier properties. Simulation of protein kinase by lead may disrupt barrier development and alter the precise regulation of the neuronal environment that is required for normal brain function. Together these findings suggest that the sensitivity of protein kinase to lead may in part underlie the brain dysfunction observed in children poisoned by lead. A prospective study has showed that asymptomatic children one to two years of age with blood lead levels lower 25ug/dl during infancy are greatly at increased risk of long lasting, if not permanent cognitive and neuro-behavioural deficit (Bellinger, Stiles and Needleman, 1992).

According to Pocock et al, (1994) the best-studied effect of lead is cognitive impairment measured by intelligent Quotient (IQ) tests. The strength of this association has been observed to be similar in many studies in several countries. As blood lead concentration increases by 10ug/dl, there is a corresponding decrease in IQ by 2 to 3 points. Canfield et al, (2003) extended the relationship between blood lead concentration and IQ to blood lead concentrations less than 10ug/dl. They observed a decrease in IQ of more than 7 points of life time average blood lead concentration. Bellinger and Needleman, (2003) subsequently reported a similarly steep slope in a reanalysis of data from their study of children whose blood lead concentration is similar to those of Canfield.

Other aspects of brain or nerve function, as well as behaviour may be affected. Teachers report that students with elevated tooth lead concentrations were more inattentive, hyperactive, disorganized and less able to follow directions (Sciarillo et al, 1992; Needleman et al 1994). Elevated bone lead concentration is associated with increased attention dysfunction, aggression and delinquency (Needleman et al, 1996).

Sub-clinical effects on both hearing (Schwatz and Otto, 1991) and balance (Bhattacharya et al, 1990) may also occur at commonly encountered blood lead concentrations.

Clinical effects of lead poisoning could include symptoms like headaches, abdominal pain, loss of appetite, constipation, clumsiness, agitation, and/or decreased activity and somnolence most especially among children with blood lead concentrations greater than 60µg/dl (AAP, 2005). These premonitory symptoms of CNS involvement may rapidly proceed to vomiting, stupor and convulsions (Chisolm and Kaplan, 1968).

Other reported clinical effects of childhood blood lead poisoning include, growth retardation (Schartz *et al*, 1986). They found that a highly significant correlation of blood lead level with growth is in agreement with nutritional deficiencies, known to enhance lead absorption. However the correlation of stature particularly height with blood lead levels in the range of 5 to 35g/dl is statistical significant.

Damage to kidney has been reported as an adverse health effect of lead poisoning. According to Mahmoud (1998), in children, the kidneys leak amino acids and other circulating substance normally reabsorbed by the kidney tubules in a syndrome called Fanconi syndrome. This nephropathic effect of lead poisoning is explained by the fact that the mitochondrion is a storage place for lead. According to recent experiments on rats it appears that lead is absorbed by endocytosis, a complex start with globulin at the level of epithelium of the proximal tubule (Diouf, 2001).

Anemia has also been linked to childhood blood lead poisoning (Alperstein, Reznik and Duggin, 1991). The US Environmental Protection Agency (EPA), (1999) suggests a threshold lead level of 20–40µg/dl for risk of childhood anemia, but there is little information linking lead levels lower than 40µg/dl to anemia. Nitin et al, 2005 examined the association between lead levels as low as 10 µg/dl and anemia in Indian children less than 3 years of age. Anemia was divided into categories of mild (hemoglobin level 10–10.9 g/dl), moderate (hemoglobin level 8–9.9 g/dl), and severe (hemoglobin level less than 8 g/dl). Lead levels less than 10 µg/dl were detected in 568 children (53%), whereas 413 (38%) had lead levels 10–19.9µg/dl and 97 (9%) had levels 20µg/dl. After adjustment for child's age, duration of breastfeeding, standard of living, parent's education, father's occupation, maternal anemia, and number of children in the immediate family, children with lead levels 10µg/dl were 1.3 times as likely to have moderate anemia as children with lead levels less than 10 μg/dl. Similarly, the odds ratio for severe anemia was 1.7

Lead poisoning is known to have effects on different organs in the body. The reproductive organs most especially in young female children have been reported to be affected by lead poisoning (YNHTI, 2007a). Various reports have suggested that relatively high exposure to lead can cause delayed puberty in girls.. The relations between blood lead concentration and pubertal development among girls has been established by Selevan, Rice, Hogan, Euling, Pfahles-Hutchens and Bethel, (2003); Wu, Buck and Mendola, 2003). Many experimental animal studies showed that lead can adversely affect the oestrus and decreased sexual hormone levels.

Although studies on the social consequences of childhood lead poisoning are few, the ones available have linked lead poisoning with some social aberrations. Nevin, (2007) linked childhood lead poisoning with criminal tendencies. This study showed a very strong association between pre-school blood lead and subsequent crime rate trends over several decades in the USA, Britain, Canada, France, Australia, Finland, Italy, West Germany, and New Zealand. The relationship was consistent with neurobehavioral damage in the first year of life and the peak age of offending for index crime, burglary, and violent crime. The impact of blood lead is also evident in age-specific arrest and incarceration trends. Regression analysis of average murder rates between 1985 and 1994 across USA cities suggests that murder could be especially associated with more severe cases of childhood lead poisoning.

If childhood lead exposure however affects cognitive function and its consequences, such as graduating from high school, then it is plausible that it will affect social function, employment, and earnings (AAP, 2005). The estimated long term dollar costs of childhood lead exposure, cost of lead – abatement programs and other preventive activities, the cost of treatment of lead poisoning and the resultant economic loss occurring from the sequeale of childhood blood lead poisoning have been calculated. Grosse, Schwatz, Matte and Jackson, (2002) estimated the economic benefit of the 25 years downward trend in childhood lead exposure in the cohort of children 2 years of age in 2000. The estimated increase in earnings for the 3.8 million children would be between $110 billion and $319 billion over their lifetimes compared with what they would have earned if they had been exposed to 1975 lead levels. Such quantification allows planning and setting priories on prevention to be done more transparently and allows comparisons of estimates.

2.7. Management of lead poisoning and the associated benefits

According to Alpert, Breault, Friend, Harris, Scherz, Semsch, Smith, Allan, Coleman and Chisolm (19), Lead poisoning in childhood must be approached as a chronic disease requiring comprehensive, long-term, medical and social management of the affected child and his/her family throughout the preschool years. This is because of the combination of poor housing containing lead paints, childhood *pica* (a practice of eating non food materials), and personal-social deprivation. New sources of lead, such as general contamination of the environment from industrial and motor car exhausts, must also be considered for control. According to them, while diagnosis and therapy are important, the pediatrician's professional responsibility to his patient and community must include prevention.

In order to demonstrate the severity of childhood lead poisoning effectively, the problem of plumbism need be defined. This involves showing that the prevalence and seriousness makes it a public health issue. To most African health officials, childhood lead poisoning is either an 'unheard of disease' or is generally regarded as inconsequential compared to the endemic communicable diseases, malnutrition and high rates of infant and maternal mortality (Nriagu, 1992). There is the need for urgent action by pediatricians, health department personnel, allied health professionals, such as medical social workers and child guidance workers, the executive, legislative, and judicial authorities of the community and the community itself to control lead poisoning (Alpert et al, 1969).

Medical management of childhood lead poisoning has been shown not to be effective. This is exemplified in an influential 1994 study. In the study 154 children 13 to 87 months old with blood lead concentrations between 25 and 55ug/dl were given chelating ethylenediaminetetraacetic acid (EDTA) and therapeutic iron when clinically indicated and then followed up for 6 months. Those whose blood lead concentrations decreased the most had improved cognitive test scores independent of whether they had been given iron or chelating therapy (Ruff, Bijur, Markowitz, Ma and Rosen, 1993). In another related study in Australia involving 375 children with longer follow up however it was found that only small inconsistent improvement occurred in the IQ of children whose blood concentration decreased the most (Tong, Baghurst, Sawyer, Burns and Mcmichael 1998).

A randomized trial involving 780 children with blood lead concentrations of 20 to 44ug/dl had showed that the use of succimer is not effective in the treatment of lead poisoning. The trial showed no benefit on cognitive or neuropsychological testing despite an abrupt but transient decrease in the treated children's blood lead concentration. The children were randomly assigned at approximately 2 years of age and followed with cognitive, neurological and behavioural test until they were approximately 5 years of age. The large size of the trial permits confident exclusion of a drug-related improvement of 2 IQ points or more. Additional follow up at 7 years of age with more sophisticated testing still showed no advantage for succimer-treated children (Dietrich, Rogan and Ware, 2004). There remains no evidence that chelating therapy will reverse cognitive impairment, as available data is consistent with a no causal association between decreasing blood lead concentrations and improved cognitive test scores (AAP, 2005).

Rabinowitz, Wetherill and Kopple, (1976) reported that no chelating agent can remove any significant amount of lead from bone, where the half life in adults is estimated at 16 to 20 years. However experimental studies in rats have shown that although lead concentrations in the soft tissues, including the brain are temporarily reduced by Dimercapto-meso-2, 3 succinic acid (DMSA), the agent has no effect on the concentration of lead in bone (Cory-slechta, 1988). In 1991 the Food and Drug administerion of USA approved the use of succimer (DMSA), for treating lead poisoning. Woolard, Calascan and Smith, (1999) has noted that DMSA does not remove lead from brain in primates that are close to man in the evolutionary line or history. It is probably the most widely used chelating agent in the management of low level increase in blood lead (Chisolm, 2001).

In children the concentration of lead in blood rebounds close to pretreatment levels after DMSA therapy, even if the child's environmental sources of lead are removed. It is also now clear that chelating agents promote the mobilization and excretion of lead primarily from blood and soft tissues. In children recent data shows that the average half life of lead in blood is from 20 to 30 months (Manton, Angle, Stanek, Reese and Kuehnemann, 2000). Bone can therefore be a source of lead in blood for years (Chisolm, 2001).

A recent study by Onunkwor, Dosumu, Odukoya, Arowolo and Ademuyiwa, (2004) in Nigeria had shown the ameliorative effects of ascorbic acid in chronic lead poisoning among petrol station attendants and auto-mechanics in Abeokuta, Nigeria. These categories of workers have been shown to be occupationally exposed to lead. In the study university students served as the control. The cases were supplemented daily with 500 mg ascorbic acid for 2 weeks. Blood and urine samples were collected from the subjects before and after ascorbic acid regimen and analyzed for lead and biochemical effects associated with lead toxicity. The 2-week ascorbic acid supplementation resulted in a significant ($p<0.05$) reduction in blood lead in the occupationally exposed subjects. The reduction in blood lead amounted to 57% in male petrol station attendants, 50% in female petrol station attendants and 44% in the auto-mechanics. Urinary excretion of lead increased remarkably in the occupationally exposed subjects ($p< 0.05$). The biochemical effects associated with the toxic effects of lead also responded positively to the ascorbic acid regimen. Plasma and urine aminolevulinic acid (ALA) were reduced significantly ($p<0.05$) by as much as 55% and 57% respectively. Plasma calcium also increased significantly ($p< 0.05$) in the subjects. Decreased levels of reduced glutathione (GSH) and hemoglobin observed in the occupationally exposed subjects were reversed by ascorbic acid. Glutathione-S-transferase (GST) and catalase (CAT) activities were however not affected. Their findings indicated that ascorbic acid may be useful as an economical and convenient prophylactic agent for lead poisoning. There is however dearth of information about the therapeutic effects of ascorbic acid on children in various part of Nigeria.

Following the limitations of medical management of childhood lead poisoning, Campbell and Osterhoudt, (2000) recommended environmental prevention efforts which focus on improvement in risk assessment, development of housing-based standards for lead-based paint hazards, and safe and cost-effective lead hazard remediation techniques. Educational efforts that address parental awareness of lead exposure pathways, hygiene, and housekeeping measures to prevent ingestion of dust and soil are needed. Blood lead screening is recommended either universally at ages 1 and 2 years or in a targeted manner where local health departments can document a low prevalence of elevated blood lead levels. There should be nutritional interventions that involve the provision of regular meals containing adequate amounts of calcium and iron to make up for iron deficiency. Lead chelation should however complement environmental, nutritional, and educational interventions, when indicated (Binns, Campbell and Brown, 2007). It should be noted that teachers have crucial roles to play in all these preventive and control efforts (YNHTI, 2007a).

2.8. Community-based and school-based interventions for the control and prevention of lead poisoning

School and community based educational interventions have been proven to lower blood lead concentrations among children. Examples included a study done by Shen, Yan, Wu and Shi (2004) in Shanghai China to evaluate the impact of parental education on blood lead levels in children with mild and moderate lead poisoning. It was a randomized controlled study of parents of 200, confirmed children that had blood lead level beyond 100ug/L who were identified and randomized into the study group comprising of 107 and the control group of 93 children. The study group was provided with educational interventional measures while control group was not contacted until the end of study. Educational intervention was undertaken by means of television programmes, a set of slides and a brochure all focused on issues regarding the harmful effects of lead poisoning, the sources of environmental lead and prevention of preventable disease. Test for blood level were repeated for children in both the study and control groups 3 months after the determination of the initial blood lead levels. It was found that the knowledge relating to health effects, sources of lead and prevention of childhood lead poisoning of participating parents of study group was improved significantly after educational intervention compared to the control group. The decrease in blood lead levels was more remarkable in the study group i.e. reduction in blood lead level was 22ug/l greater in study group. The study however recommended educational intervention for parents to be an effective approach for children with mild to moderate lead poisoning.

Parental education on lead poisoning has been recommended by Catherine, Patricia, Ruth and Phyllis (2003). They carried out a study to evaluate Phillips lead project, a 5-year study of the effectiveness of culture specific, peer education in maintaining low lead levels of children in an inner-city neighborhood in USA. Participants were randomly assigned into control and intervention group, the control group received basic lead education while the intervention group received intensive lead education. All participants received brochures on basic lead prevention strategies. Intervention participants were offered 20 bi-weekly educational sessions by peer educators from their respective ethnic group over the course of 1 year, and quarterly booster sessions for 2 years afterward. The intervention group's educational curriculum included information on lead sources (e.g., paint, dust, water, soil, and risks from home repairs and remodeling), health consequences of lead, and strategies for reducing exposure to lead, including household cleaning, hygiene, safe use of water, and nutritional recommendations. All parents received basic written lead poisoning prevention information irrespective of the group to which they were assigned. Intervention group participants also received 20 brief, face-to-face sessions for 3 years. Knowledge of lead prevention was surveyed on recruitment and several times over the next 3 years for all participants and children's blood drawn every 4 months. It was found that intensive education produced greater knowledge gains and lower lead levels in intervention participants compared to controls with lower knowledge and higher lead levels.

Another community based educational intervention that has lowered lead levels among children was a prospective educational intervention programme of the Milwaukee Health Department, (1996) in the United States of America. It was carried out with a view to evaluating the effectiveness of public health worker educational visits in the homes of children with lead levels 20-24 μg/dL, samples of dust, water and soil in children's homes were monitored for lead levels. Families were also provided educational interventions. Follow-up measures included examination of the environment and the tracking of blood lead levels as the main measure of effectiveness. Blood lead levels declined on average to 5.1μg/dl, approximately two months after the intervention. A reference group of children not receiving the educational visit due to non-responsiveness or a "loss to follow up" was also studied. The study group had a decline in blood lead levels 5μg/dL less than the reference group receiving no educational home visit, with the difference between the two groups being statistically significant at 0.05 level. This study concluded that although elevated blood lead levels remained in most of the children studied, important reductions occurred with this relatively inexpensive and simple educational intervention.

Schultz, Pawel and Murphy, (1999) carried out a retrospective examination of in-home educational visits regarding the reduction of childhood lead level. A study group of children received an in-home educational visit by a paraprofessional. The educational visits focused on the following: rationale for reducing childhood lead exposure; intake of appropriate diet (nutrition); adoption of dust clean-up practices; and other behavioural changes aimed at reducing exposure to lead. An average decrease in blood lead levels (n=187) of 4.2 μg/dL (21%) was reported. A decline of, 1.2 μg/dL (6%) was identified in the reference group of 236 children who did not receive an in-home visit due to non-responsiveness or "loss to follow up". The intervention group had a decline in blood lead level of 3.1μg/dL (15%) than the reference group, with the difference between the groups being statistically significant ($p<0.001$). For the 236 children (controls) who did not receive the intervention, the average decrease in lead level was 1.1 μg /dL.

Brown, McLaine, Dixon and Simon (2006), carried out a randomized community-based trial of the effects of home visiting and comprehensive lead education on blood lead levels in children. In the study, comprehensive education and home visiting were conducted for families of children with BLLs 15 to 19μg/dl and were followed up for one year. The BLLs after one year of follow-up were compared for intervention group children, whose families received individualized education that was designed to address specific risks factors in a child's environment, and comparison group children, whose families received customary care, usually 1 or 2 educational visits. Environmental and blood samples were collected at baseline and after 1 year of follow-up for intervention group children and compared with those of comparison group children. During the follow-up period, parents of intervention group children (n=92) successfully decreased dust lead levels· Significant improvement in parent-child interaction and family housekeeping practices were also reported compared with the comparison group children (n=83). Overall geometric mean BLLs declined by 47% with no significant difference between BLL of intervention (9µg/dL) and the comparison (8.3µg/dL) group children.

Hilts, Bock, Oke, Yates and Copes, (2000) carried out a study on the effect of interventions on children's blood Lead Levels in Trail Canada, a city known for lead smelting industries for nearly a century ago. Starting from 1991, the Trail Community Lead Task Force carried out blood lead screening, case management, educational programs (targeted at early childhood groups and the general community), community dust abatement, exposure pathways studies, and remedial trials. Average blood lead levels of children tested for the first time declined at an average rate of 0.6µg/dl/year from 1989 through 1996, while blood lead levels in Canadian children not living near point sources of lead appeared to be leveling off following the phase-out of leaded gasoline. Since there was no concurrent improvement in local environmental conditions during this time, they concluded that it is possible that the continuing decline in Trail blood lead levels has been at least partly due to community-wide intervention programs. One year follow-up of children whose families received in-home educational visits and were assisted with home-based dust control measures, revealed that the specific interventions produced average blood lead changes of +0.5 to 4.0 µg/dl, with statistically significant declines in three years out of five. Education and dust control, particularly actions targeted toward higher risk children, appear to had served as effective and appropriate interim remedial measures while major source control measures have been implemented at the smelter site.

There is a dearth of information regarding school based educational interventions aimed at preventing childhood lead poisoning in Nigeria. In her study, Irene (2001) showed that children in Nigerian school environments were unduly exposed to lead. Since the school community can reach many children's homes through school children, use of teachers for lead poisoning prevention and control education is a viable way of reaching many children and preventing childhood lead poisoning and reaching parents with lead-related educational messages. She therefore recommended that an intervention be carried out among the various segments of the society including the teachers. This study carried out in Ido LGA is also a response to this clarion call.

The Yale-New Haven Teachers Institute (YNHTI) in the USA has utilized teachers to teach students on lead poisoning using the childhood blood lead prevention curriculum developed by the institute. The goal of the initiative was to challenge teachers and students to become part of the solution to the problems and not part of the problem of preventing lead poisoning in children (YNHTI, 2007a)

According to Williamson, (2004) teacher training is very important for the teaching of any subject. For teaching information and skills related to health issues, teacher training is even more essential. Since most young children attend school at least up to primary education, school-based programmes constitute logical opportunities for reaching them. Teachers are often the main adults other than parents and other family members with whom children interact on a daily basis. This accounts for why teachers are involved in health and social problems like HIV/AIDS (O'Donoghue, 1996) and domestic violence (Dreyer, 2001).

Training has been proven to be a viable means of educational intervention for capacity building in health education (Oshiname, 1990). His study focused on the health education approach to the training of Patent Medicine Vendors (PMVs) in Igbo-Ora, Oyo state Nigeria. He observed an overall significant increase in knowledge among the experimental group from 43.2% at pre-test to 71.6 % at post- test. The difference in the mean knowledge scores at pre%-and-post%-test among the control group was not statistically significant. Whereas at pre-test, there was no significant difference between the mean score of the experimental and control groups, the difference in their mean score of post-test was found to be significant. This intervention was highly participatory (Oshiname and Brieger, 1999). It featured the input of the PMVs in the planning, implementation and evaluation of the programme. A major strength of the programme was the use of androgogical methods since the PMVs were all adults.

Several studies in Africa have shown the positive effects of involving teachers in HIV/AIDS education. In Nigeria, guidelines for comprehensive sexuality education have been developed and used by The Association for Reproductive and Family Health (ARFH) in training teachers in Oyo State to teach reproductive health in secondary schools (Irvin, 2000). A project in Ghana called Strengthening HIV/AIDS Partnership in Education (SHAPE) has included teacher training as a key component of its efforts to improve HIV/AIDS education in schools (World Education/Ghana, 2003). Likewise in Uganda, as part of the multi-sectoral, highly publicized AIDS prevention programme, teachers were trained to teach sexuality education with results indicating substantial increases in abstinence among youths in schools where teachers were trained (AMREF, 2001).

In Zimbabwe, a mandatory AIDS education curriculum was integrated into related subject areas in all primary and secondary schools. The project employed a training-of-trainers approach where national, regional and district education officers and teachers received AIDS education training who then trained other trainers at the next level, through five stages until all the local-level teachers were finally reached (O'Donoghue, 1996).

The increasing involvement of teachers in the prevention and control of public health problems is an indicator of their pivotal roles in upgrading pupils' or students' knowledge and skills in school settings. Lead poisoning is a silent epidemic in Nigeria; there is therefore the need for the training of teachers as advocates for lead poisoning prevention and control programmes in Nigerian schools.

2.9. Conceptual frame work

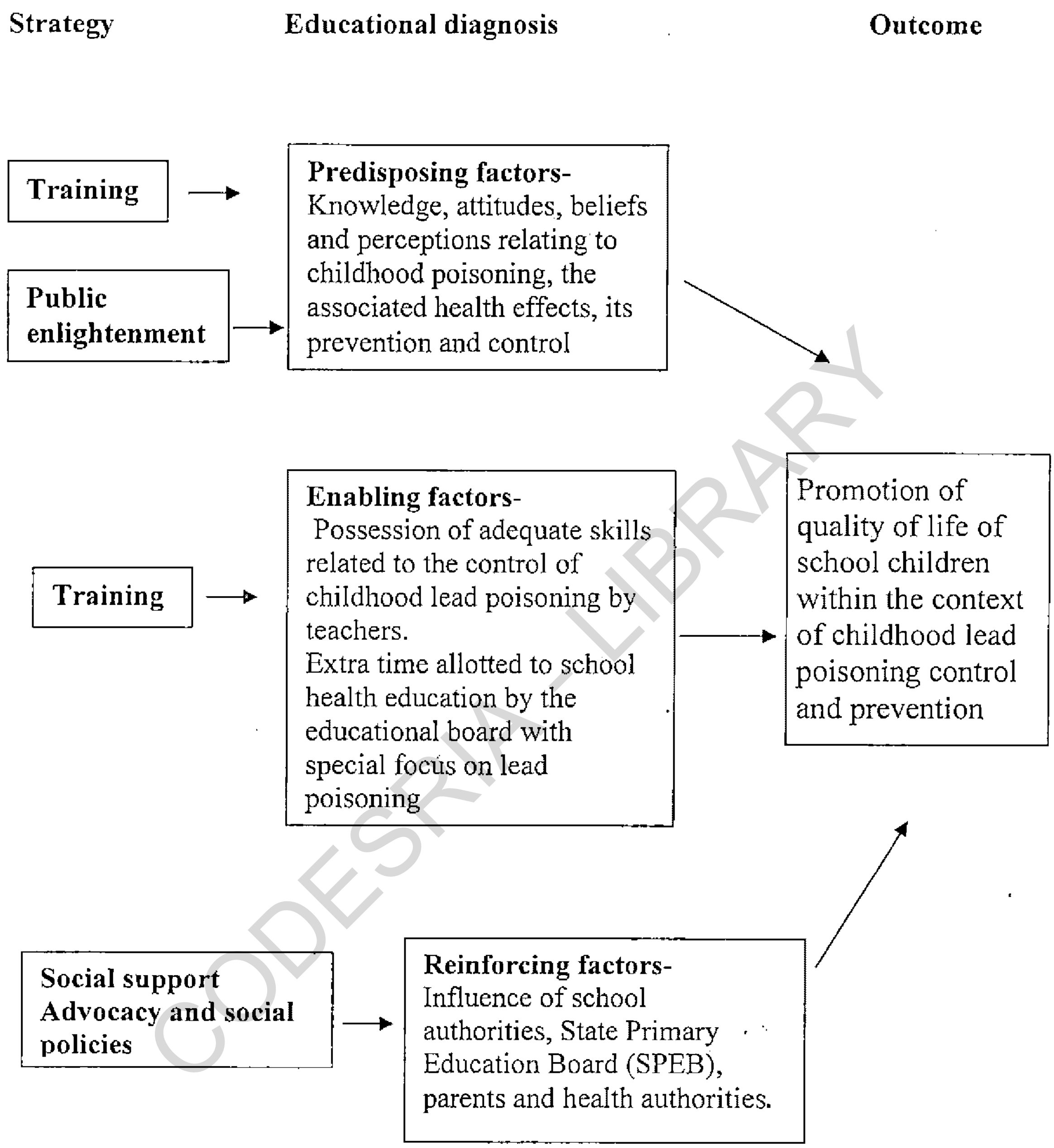
Two theoretical models were selected to guide this study. These were the PRECEDE framework and the Health Belief Model (HBM). These models will be described one by one.

The PRECEDE framework: Green and Kreuter were involved in the development of the PRECEDE framework (U.S. Department of Health and Human Services, 2005). The PRECEDE stands for Predisposing, Reinforcing and Enabling Causes in Educational Diagnosis and Evaluation.. It is used as a planning model which is useful in the design of training needs assessment in terms of the diagnosis of behavioural antecedents. According to the model behavioural antecedents could be categorized into three types as follow: predisposing, enabling and reinforcing factors. The tenets of this model were useful for the selection of some variables for study or measurement in this study. The basic elements of each type are summarized as follow:-

- The **Predisposing factors:** These include antecedent factors that provide the rational or motivation for behaviour to occur. In the context of childhood lead poisoning, the predisposing factors include the beliefs, knowledge, attitude, values, norms, and practices of teachers related to childhood lead poisoning, its harmful effects and its prevention. This component of the PRECEDE was used to guide the framing of some of questionnaires. Questions which probed into predisposing factors included those relating to, awareness, knowledge, and perception of lead and lead poisoning.
- The **Enabling factors:** These are factors which relate to the presence or absence of resources such as money, time, adequate skills, training materials e.t.c. which can influence or enable a motivation to be realized. Questions derived from the enabling factors included those related to teachers' level of confidence in performing lead poisoning prevention and control tasks.
- The **Reinforcing factors:** The reinforcing factors are factors which are due to the influence of significance others. These include Influence of school authorities, parents and health authorities and other significant others.

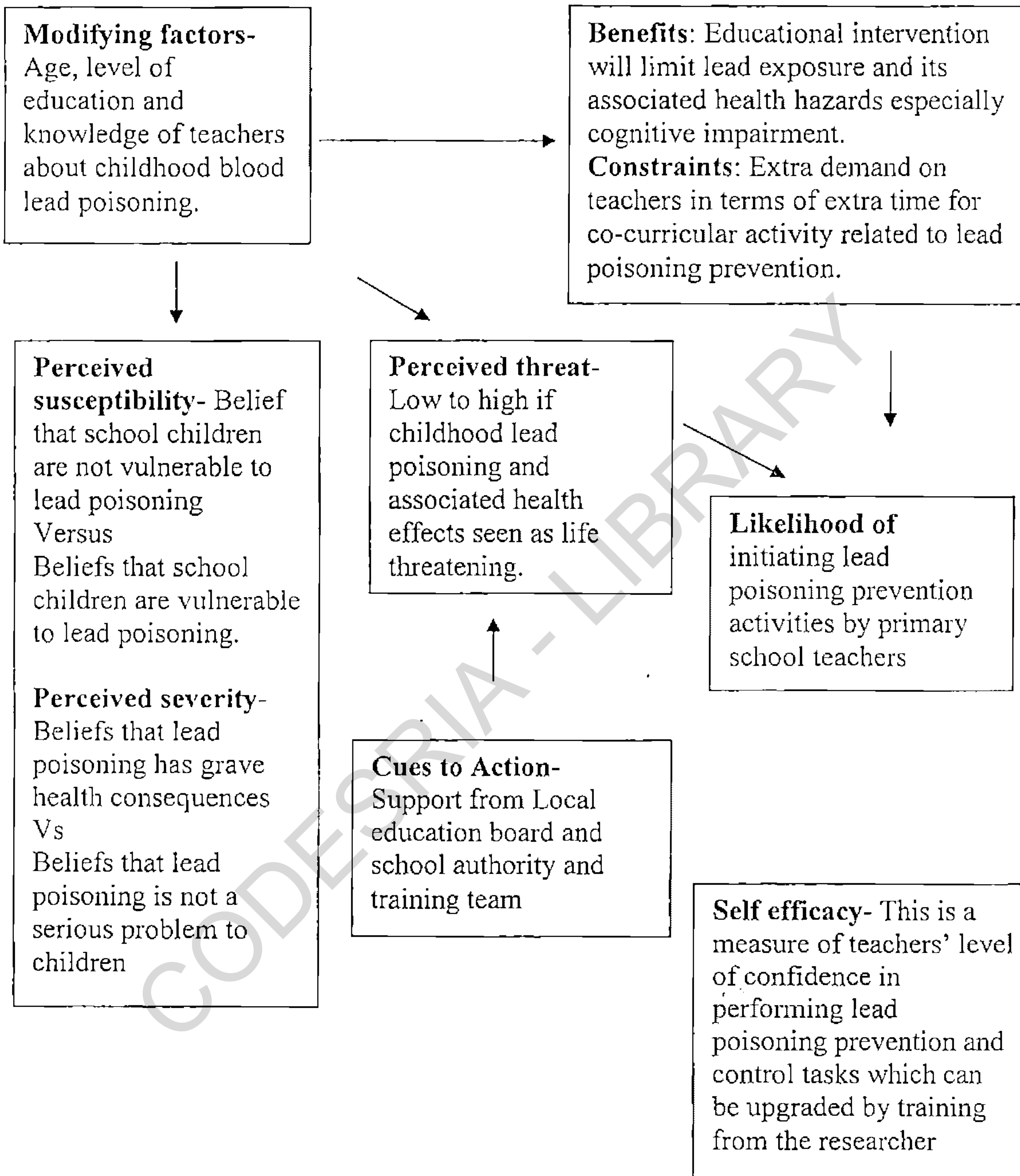
The details of the application of the PRECEDE model are highlighted in figure 1 below.

Figure 2.1- PRECEDE framework applied to the diagnosis of teachers training needs related to childhood lead poisoning.



This model was helpful in determining the perception of vulnerability and seriousness of children to lead poisoning, their sources of information about lead and lead poisoning and the characteristics of teachers which could influence the knowledge, perception and their level of confidence in the initiation of lead preventive activities (lead education). The details of the application of the model are presented in figure 2.2. It was necessary to use two theoretical models because no one model or framework can capture the various dimensions of socio-behavioural phenomena. The careful choice of the HBM and PRECEDE model ensured that the strength inherent in one model are used to make up for the weakness of the other.

Figure 2.2- The Health Belief Model applied to the uptake of preventive health behaviour related to lead education among primary school teachers



CHAPTER THREE

3.0. METHODOLOGY

3.1. Introduction

This chapter describes the research process. The steps taken are sequentially presented based on their order of execution. Four main phases were involved in the research intervention. These were the pre-planning, planning, implementation and the evaluation phases.

3.2.0 Pre-planning phase

This included a rapid community diagnosis, study design, establishment of rapport with educational authorities, recruitment of trainees and training assessment. The rapid community diagnosis yielded much of the information for describing the study area and study population presented here.

3.2.1 Description of study area and study population

The study was carried out in Ido LGA, Oyo State. Ido LGA came into being in May, 1989. The LGA with its headquarters at Ido was carved out of the former Akinyele LGA. The area was formerly known as Akinyele west LGA during the second republic before it was merged again with Akinyele LGA by the Buhari/Idiagbon regime in 1984. Ido LGA is located in the rainforest belt of south western Nigeria. As a result of intensive peasant farming activities and deforestation over the years, the vegetation is fast giving way to guinea savannah. The area generally presents an undulating topography. Few of the roads in the LGA are paved. The roads leading to most rural areas in the LGA are not paved. There are 10 political wards in Ido LGA. Ido LGA consists of rural, semi-urban and urban towns. Based on the 1990 Census, Ido LGA has a total population of about 154,170. The LGA is predominantly inhabited by the Yorubas (Ido LGA Information Unit, 2008).

Ido local government covers the area spanning Apata, Ijokodo, Omi-Ado, and Akufo. It shares boundaries with Oluyole, Ibarapa East, Akinyele LGSs, in Oyo state. It also shares boundary with Odeda LGA in Ogun state. Ido LGA formerly had six wards which have been increased to ten for election purposes. The major towns within the LGA are Ijokodo, Apete, Bakatari, Apata, Omi Adio and important villages such as Ogunwande, Dada, Oderemi, Odetola, Odufemi and Alagbaa. The main occupation of the people is farming, few people are involved in white collar jobs in the LGA. The people grow a wide variety of crops such as the following; grape, garden egg, orange, pineapple, plantain, carrot Cashew and pawpaw. In fact Ido local government area can be aptly referred to as the fruit bowl of the state. A few industries are located in the LGA, these included the following; Nigeria wire and cable industries limited, sawn mills and the Nigeria Mining Corporation (Ido LGA Information Department, 2008).

There are three grade 'C' customary courts in the LGA and these are located in Akufo, Omi-Ado and Ido respectively for dispensation of justice based on the traditional laws and customs. There are 75 public primary schools and 24 secondary schools in Ido LGA. The names, locations and characteristics of the 75 public primary schools in the LGA are presented in appendix 1. The ages of the primary schools ranged from 1-97 years. The oldest primary school is Baptist primary school Oganla established in 1910. The mean age of the schools is 47.0±25.0. The rapid community diagnosis revealed that the painted walls of the selected schools were powdery or characterized by paint flakes. No chemical analysis was carried out on the powdery walls or flakes with a view to detecting the presence of lead. There are 92 registered private nursery and primary schools and eight registered secondary schools in the LGA. There are altogether 21 health centres in the LGA; only four of them are however functional (State Primary Education Board Ido, 2008).

3.2.2. Study population

The study population consisted of teachers of public primary schools in Ido local Government Area. Overall there were 589 teachers in the LGA as at the time of this study, comprising of 226 males and 363 females (State Primary Education Board Ido, 2008).

3.2.3. Study design

The study was an intervention study, with a quasi-experimental design. There were two study arms or groups- the experimental and the control group. The experimental group consisted of the primary school teachers in Ido LGA nominated by the head teachers of schools that consented to be involved in the study. The LGA was purposively selected. The investigator had participated in a 12 months mandatory concurrent field work programme of the Department of health promotion and education in Ido LGA. During the period he noted the problems, needs, characteristics and peculiarities of the primary school systems. Most of the primary schools were built and painted many years ago. Several of them were noted to be potential sources of lead poisoning with pupils being at high risk of lead poisoning. Egbeda LGA and the primary school teachers were also purposively selected. Egbeda shares the similar characteristics, problems and needs with Ido LGA. In addition it is reasonably far away from Ido LGA. This situation was advantageous in helping to reduce diffusion of information from the experimental group. The experimental group (n=27) received training intervention while the control group (n=30) did not receive training or any other educational intervention until after been administered a post-test. Both groups were however subjected to a pre-and-post-training assessment. After the training intervention, the trained group (i.e. the experimental group) was provided with similar support to design and implement a similar training programme for their peers (n= 80) in the participating schools. This was done using the same training curriculum which was used for training them by the investigator. The trainees-led training intervention was aimed at upgrading their peers' knowledge, skills and perceptions relating to lead poisoning control and prevention in primary school settings (details of the study design is presented in figures 3.1 and 3.2).

3.2.4. Identification and establishment of rapport with educational authorities and trainees.

It was necessary as a first step to establish cooperation with the authorities of Ido public primary school system. The investigator therefore identified and linked up with the Ido Local Government Primary Education Board (SPEB). The Board was informed about the objectives, design and nature of the training intervention. Official permission to carry out the study was sought and obtained. The SPEB through its secretary summoned all the Head teachers of the primary schools in the LGA to a meeting to intimate them about the study. At the meeting, the investigator briefed the Head teachers about the objectives, design, and nature of the training intervention and the pivotal role of the Head teachers in the successful implementation of the intervention. They were also informed about the inclusion criteria for participating in the study by schools and teachers. The Head teachers promised to support the investigator. The procedure adopted in Ido was replicated with Egbeda LGA Local Education Board. The government officials and the head teachers were also briefed about the purpose, objectives, design and their role as the control group of the study. They were informed that there would not be a training intervention or any educational interventions until after the intervention in the selected experimental group of schools in Ido LGA.

3.2.5.0. Sampling procedure and sample size

The list of public primary schools in Ido LGA was used for the selection of schools to be involved in the study. The steps involved in the selection were as follows:

(i). Categorization of the schools into two – those established before year 2000 (n= 66) and those established after year 2000 (n= 9). Those established before year 2000 were assumed to be more likely to be sources of lead poisoning because of the age and powdery nature of the painted walls. They were therefore listed to constitute the sampling frame from which the experimental schools would be selected. All nine schools established after year 2000 were excluded from the study.

(ii). The 66 eligible schools were then stratified into three based on their rural, semi-urban and urban locations.

(iii). Five schools were selected from each of the locations by balloting. Fifteen schools were selected in Ido LGA to participate in the study (see appendix 2). Similar steps were used to select schools in Egbeda LGA. The schools selected in Egbeda LGA are contained in appendix 3. Altogether 30 schools were therefore involved in the study.

3.2.5.1. Recruitment of trainees and the control participants.

The investigator visited the head teachers of each of the 15 schools selected in Ido LGA and briefed them about the next series of the activities which involved the following: nomination of two teachers to participate in the training, diagnosis of the nominated teachers' training needs, training intervention and assessment of the immediate outcome of the training intervention. The teachers nominated were told that they would be expected to training their peers in their respective schools after their own training. They were informed that the participation in the programme was voluntary. Where feasible, each head teacher was requested to nominate one male and one female teacher. The names and sex differentiation of the 30 teachers nominated to constitute the experimental group/trainees are presented in appendix 4. The procedure adopted in selecting the experimental group of teachers was also used to select 30 teachers to serve as the control group in Egbeda LGA.

3.2.6.0. Methods and Instrument for Data Collection

The method used for the diagnosis of the participants' training needs was interview by means of a questionnaire that played a dual role of needs assessment and pre-post-test questionnaire.

The questionnaire was developed after a thorough review of the literature. It consisted of five sections- section A, B, C, D and E. Section A focused on demographic information, while section B- contained questions relating to awareness and knowledge of lead and lead poisoning. Section C contained questions for documenting perceptions relating to childhood lead poisoning and section D contained questions assessing participants' self-efficacy in performing lead poisoning control and prevention tasks. Lastly section E focused on school health programming. The questionnaire included a 74-point knowledge scale, with a point allotted to each correct response (see appendices 5 and 6 for questionnaire and knowledge scale respectively).

3.2.6.1. Validity and reliability of instrument

(a). Validity

In order to ensure the validity of the instrument, the semi-structured questionnaire (i.e. pre-and post-test instrument), was first reviewed by experts in the Faculty of Public

Health, University of Ibadan. The experts consisted of specialists in; Health Promotion and Education, Occupational health and Environmental health. Their inputs were used to develop the instrument.

(b) Reliability

The questionnaire was pre-tested for reliability on eight teachers of public primary schools in Ido LGA that were not involved in the study. The responses coded, entered and analyzed with the SPSS software. The reliability of the questionnaire was assessed using the Cronbach's Alpha statistics. A coefficient of 0.8 was obtained, which indicated that the instrument was reliable. The outcome of the pre-test was also used to correct and modify questions, which were not clear to participants. Such included questions that assessed the roles of teachers and parents in the prevention of lead poisoning

3.2.7. Training needs assessment and pre-test (Data collection instrument)

The investigator in collaboration with the Executive Secretary of Ido Local Education Board and the head teachers of participating schools designed a timetable for facilitating the conduct of the pre-test (training needs assessment). The validated instrument (appendix 5) was used to conduct the pre-test. A copy of the timetable was made available to the head teachers of each participating school. Head teachers were requested to ensure that the teachers nominated for the training were available (as contained in the time table) to participate in the pre-test. Starting with Community primary school Ido on the 1st of April, 2008, the investigator administered the pre-test to all the experimental schools in Ido LGA to administer the pre-test, until all the schools were reached on the 8th of April 2008. Following which schools in the control group were also visited to administer the pre-test from 10th of April to 18th. A briefing explaining the purpose of the pre-test, the voluntary nature of participation and confidentiality of their responses was done before administering the pre-test questionnaire on each of the nominated teachers in both the experimental and control groups. The teachers were informed that the exercise was not an examination, but that the results would be used to design and develop a training curriculum for training them. Thirty teachers participated in the pre-test in the experimental group while another 30 were involved among the controls. The completed questionnaire were edited and the responses were coded and entered into a computer. The data were analyzed using descriptive and t-test statistics. The needs assessment results, hereafter referred to as the pre-test results are contained in chapter four.

3.3. Planning phase

A three man training committee comprising of the Executive secretary of the Ido LGA primary Education Board, the investigator and a representative of the trainees in person of Mr. Ajao from N.U.D primary school was constituted. It had the responsibility of planning for the training intervention. A critical appraisal of the pre-test results, with special emphasis on the experimental group's result was done. The experimental group's areas of knowledge and knowledge gaps on lead and lead poisoning were noted and teased out. The results of the pre-test were used to formulate the curricular objectives.

The appropriate androgogical training methods and materials for facilitating the implementation of the curriculum (i.e. the training) were selected. These methods included a combination of largely active training methods such as group discussion, role play, brainstorming and lectures to make the training participatory. Recapitulatory questions for monitoring and assessing participants' comprehension were framed (see appendix 9 for the training curriculum). The head teachers' concern that the primary school teachers could not afford to be away for a whole week to participate in the training intervention was taken into consideration. The curriculum was implemented over four days. The time-table for the four day training intervention is shown in appendix 7.

The training committee decided that:

- the training should hold from 26th to 30th of April, 2008 with a break on the 29th to observe the National public holiday
- the training programme should last from 9.00 a.m. through 4.00 p.m. daily
- the LGA Education Board Secretariat's hall should be used as the venue for the training programme because of its centrality, easy accessibility and size.

The plans for delivering the various sessions were written and the training materials/ handouts were developed from existing literatures. The training materials were given to the trainees and made ready for the training programme.

Anticipated barriers to attendance were identified and addressed. These included issues relating to transport allowance, feeding and provision of training materials. In addition, communication with the trainees and the educational authorities on the venue, date, time and duration of the training were made. Personal visits to the participating schools were made to share the training schedule and logistics issues with the head teachers and the trainees. A co-facilitator to help with the training was recruited and trained with the curriculum earlier developed. She was a Master of Public Health (MPH) student in the second year of her programme. Invitations were extended to the Head of Department, Health Promotion and Education University of Ibadan, the LGA Primary Health Care Coordinator, the Supervisory Counsellor for Health and Education respectively to attend the opening ceremony.

3.4.0. Implementation phase

3.4.1. Implementation Design

The training programme took place from 26th to 30th May, 2008 at the Ido LGA Primary Education Board secretariat. The participants on arrival were registered and given training materials, which included training manuals, writing pads, programme schedule, power-point handout and biro. The opening ceremony commenced around 9.00 am and was declared opened by the representative of the Ido LGA Primary Education Board in person of Mr. A.O. Ayansola. He is the Head of Planning, research and evaluation unit of SPEB Ido. The training programme commenced around 9.30 am with the introduction of the trainer (Principal investigator) and Miss Chika Onyema the Co-facilitator. The participants introduced themselves and were given orientation on their roles and responsibilities as trainees. This was followed by the formulation of ground rules to guide the conduct of trainees during the process. Two committees were formed among the trainees. These were the evaluation and welfare committees. Members of the evaluation committee were Mr. Bolarinwa I.O. from Hope Central primary school 1, Comrade Salako M.A. from St Peters primary school Apete and Mrs. O.O. Olatunji from I.D.C primary school Abaoko. The welfare committee members were Mr. Dominic Adeyemi from I.D.C primary school Erinkojaobe and Mrs Idowu F.O. from N.U.D primary school Ido.

The trainees were involved in fixing a convenient resumption, break and closing times to allow for programme ownership. They unanimously voted to start each day's programme at 9.00 am, a break from 12.30pm to 1.30pm and close at 4.00 pm. Therefore, the initial time schedule drawn up by the trainer was modified to suit their needs. There were three training sessions and one break time each day and each session lasted for an average of 2hours 30 minutes.

Each day's session started with recapitulation of the previous lessons followed by the preview of the day's lessons. Presentation of lessons progressed from simple to complex using a variety of teaching methods and facilitated by means of various teaching aids. Methods of teaching employed included lectures, group discussion, participatory teaching, questions and answers, as well as assignments (see appendix 11 for a cross-section of trainees during a typical training session and appendix 10 for the picture of trainees involved in role modeling session). Training materials used included, pictures, power-point slides, pamphlets and brochures. The trainees were provided with well prepared easy to read lecture note to enable them understand basic facts discussed during each session. There was recapitulation to round up the presentation for each lesson delivered. Energizers such as songs and exercises were used intermittently to keep the trainees alert while there were rewards in the forms of claps and praises for every contributions made by the trainees. An atmosphere of mutual respect and tolerance was promoted throughout the training.

The content elements of the curriculum included the following: introduction to lead poisoning, history and sources of lead, risk factors for lead poisoning, portal of entry of lead into the body, childhood lead exposure, screening for lead poisoning, safe lead level, sign and symptoms of lead poisoning, health effects on children, roles of nutrition in the prevention of lead poisoning, and roles of teachers, parents and the government in lead poisoning prevention and control. At the end of each training section, the training committee met to evaluate each day's work and the inputs were used by investigator to improve the quality of subsequent sessions.

On the last day of the training, the first session was used for revision of all the topics covered during the training programme. The next session was used for the post-test and evaluation of the training programme by the trainees with the aid of an evaluation form. Throughout the training programme, 14 schools were represented by two teachers each with the exception of I.D.C Primary school Erinkojaobe which had only (1) one representative. Altogether 27 trainees attended the training programme.

3.4.2. Trainees' follow up actions and activities

The follow up action plan and activities to cascade down the training received were jointly developed, adopted and implemented by the trainees after the training programme. Activities carried out by the trained teachers included the following:

- **Debriefing head teachers about outcome of the training-** A report was written by each team from various school about the nature and outcome of the training received. Each team distributed copies of its report to the following: Executive secretary of Ido LGA Primary Education Board, Head teachers, the trainer and Parent Teachers Association. This was submitted in the first and second week of June.
- **Assessment of the training needs of other teachers-** The pre-and-post-test instrument earlier used to assess the trained teachers needs was used by them to collect baseline information from their colleagues who did not participate in the Ido training.
- **Training design for other teachers-** The training materials and curriculum (training manual, fact sheets and power point slides) used by the investigator were used by the trained teachers to train their peers.
- **Training implementation for the peers-** The training sessions were carried out in the various schools during periods that were conducive to the teachers, the school authorities and the pupils. This was between the third week of June and first week of August. A total of 80 teachers from the 14 schools in the experimental group agreed to participate in the training programme organized by the trained teachers. Implementation of the training was done by each team of teachers from each of the experimental schools. A post-test was administered in each of the schools at the end of the training. The researcher's contributions in this phase were supervisory visits to the various schools and provision of the pre-and-post-test questionnaire and training materials, analysis of the pre-test data,

analysis of the post-test data and comparative analysis of the results of the pre-and-post-tests.

- **Dissemination**: The outcome of the training of their peers was communicated to parents, Education board and the trainer (see appendix 8 for a sample of the follow up action plan and activities).

3.5.0. Evaluation phase

Two forms of evaluation were conducted; these were outcome and impact evaluation.

3.5.1. The outcome evaluation

The outcome evaluation measured the immediate outcome or beneficial effects of the training programme/study as measured by the immediate effects on experimental and control participants' knowledge, perceptions and self-efficacy. The questionnaire used at the pre-intervention phase was used at the end of the training programme. In addition, the main study group (teachers trained in Ido) filled the evaluation form to assess the training programme. The trainees were requested to assess the following aspects of the training: objectives, content of training, training methods, involvement of trainees, relevance of the training, transferability of knowledge and skill, language used, length of training, training climate and principles. The pre-post-test questionnaire was administered on both the experimental and control groups before and after the training programme.

The data generated at the pre-and-post-tests were then subjected to the following analyses using t-test statistics.

- Pre-test comparison of the experimental and control group's mean knowledge scores;
- Pre-test and post-test comparison of the experimental group's mean knowledge scores;
- Pre and Post-test comparison of the control group's mean knowledge scores;
- Post-test comparison of the experimental and control group's mean knowledge scores;

Descriptive and chi-square statistics were employed in determining the effects of the training programme on participants' perceptions regarding lead and lead poisoning and their self-efficacy in performing lead poisoning and control tasks. The proportion of participants that expressed themselves to be very confident in performing these tasks were compared among the experimental and control groups at pre-test and post-test.

3.5.2. Impact evaluation

The impact of the training intervention/study measured the ability of the trained teachers to replicate and cascade down the training received to their peers. Indicators used to assess the impact of the training in terms of effects of training on the peers included the following; mean knowledge scores, proportion of peers with the right and wrong perceptions regarding lead and lead poisoning and the proportion of participants were very confident in performing certain tasks. The same questionnaire used for the experimental group was administered on the peers at pre-test and post-test using the same procedure as above.

3.6. Data analysis

The quantitative data collected were collated, screened, coded and entered into the computer using the Statistical Package for Social Science (SPSS) version 14 and Epi info version 6. The knowledge section comprised of 74 items which were assigned a score of one point for every correct answer and 0-point for every wrong answer, altogether making up a 74-point knowledge scale. The open ended sections of the questionnaire were however coded accordingly. The Statistical Package for Social Sciences (SPSS) version 11.0 and Epi info version 6 were used to facilitate the analysis of the data. The maximum score a trainee could have was 74 points (see appendix 6 for the knowledge scale). Data were analyzed using t-test, ANOVA and chi-square statistics. With reference to the chi-square, t-test and ANOVA statistics used in this study, the P-value were set at 0.05.

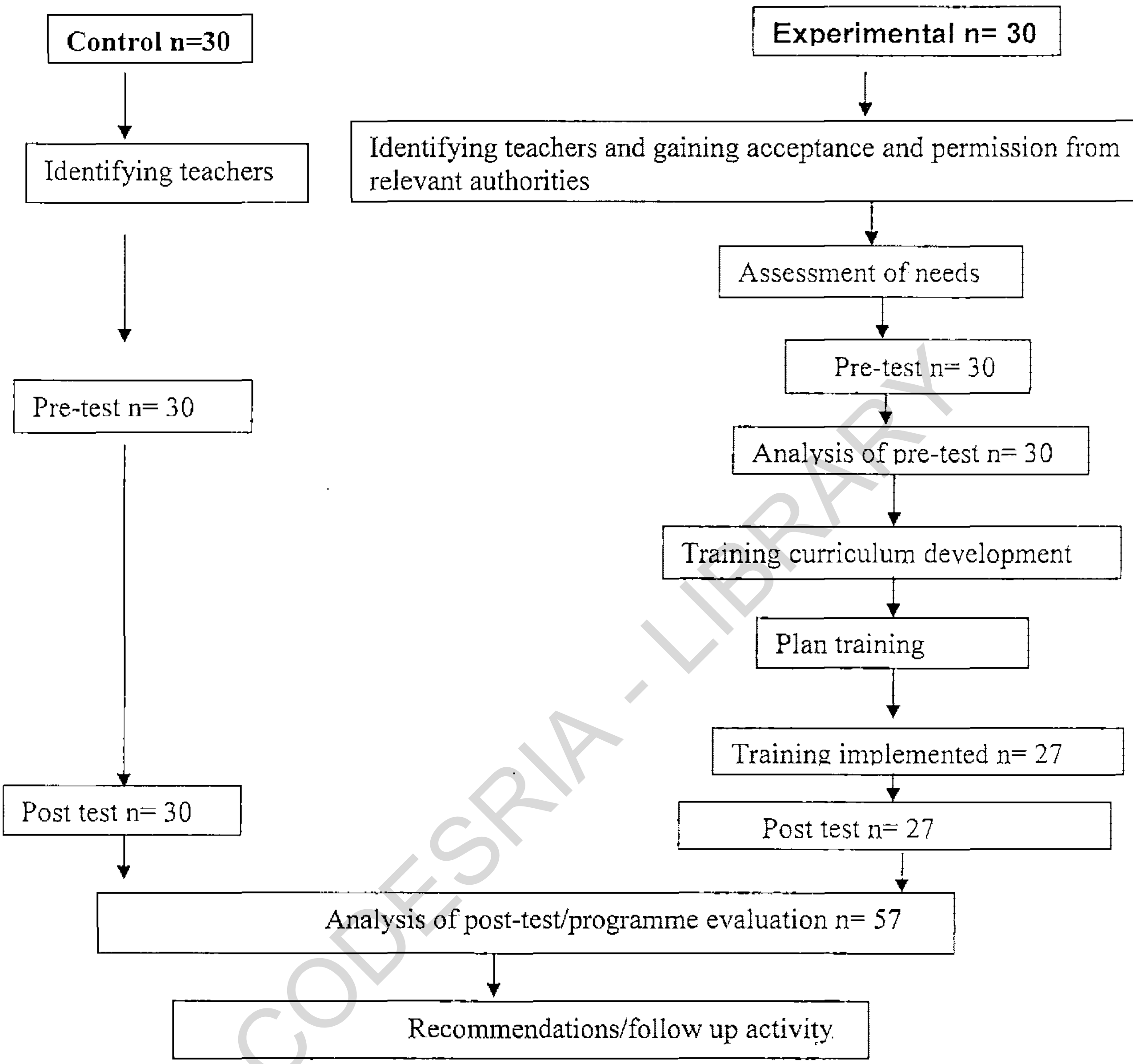
3.7. Ethical consideration

Permission and approval to carry out the intervention study was sought from Ido and Egbeda local Government Primary Education Boards (SPEB), Head teachers of the selected primary schools and the teachers after a full disclosure of the nature, purpose, time and benefits of the proposed study. The trainees were informed they could withdraw from the study without any sanctions. Only teachers who provided consent to be involved in the study were enrolled. The teachers were given assurance of confidentiality and the liberty to voluntarily participate in the study. The control group received educational interventions in form of lectures and handout after the post-test had been administered.

3.8. Limitation of Study

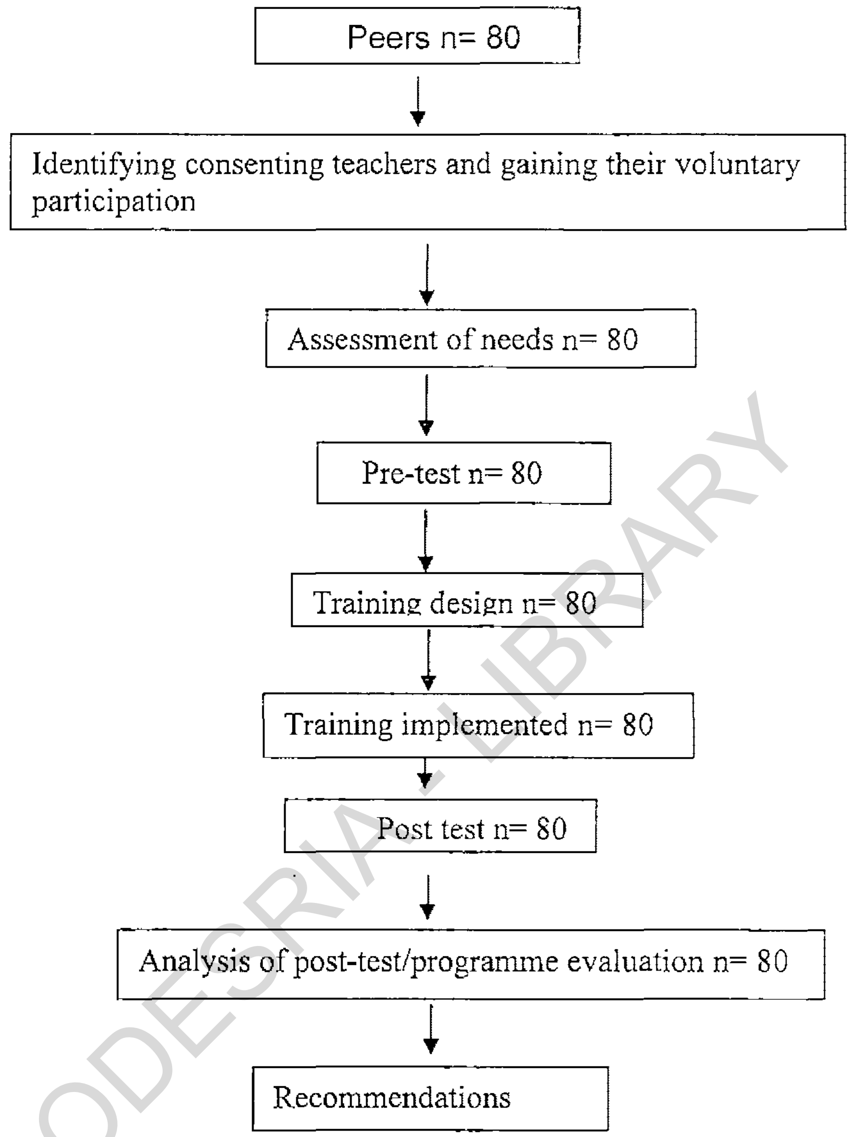
The training could not hold as scheduled because of the nationwide teachers' industrial action. Repeated visits were paid to the schools and regular telephone discussions were held with each of the trainees to sustain their interest in the programme until the strike was called off. The teachers could not be released to spend more than one week outside their classrooms to participate in the training as this would paralyze teaching activities. Training was therefore designed to focus on essential details and highly andragogical techniques were used to facilitate the completion of course curriculum within one week. The sample size for this study was not calculated using statistical methods because no similar study had ever been conducted in Nigeria.

Figure 3.1- Flow schedule for the study design



Adapted from Oshiname (1990); A health education approach to the training of patent medicine vendors in Igbo-ora. An MPH dissertation submitted to the University of Ibadan.

Figure 3.2- Flow schedule for the study design at follow up



CHAPTER 4

4.0. RESULTS

4.1. Socio-demographic characteristics:

The socio-demographic characteristics of the participants are presented in table 4.1. A majority (66.6%) of participants in the experimental group were females. There were also more females (56.7%) than males among the control group. The difference was not significant. The ages of the experimental group ranged from 30 to 60 years with a mean age of 42.4±6.1. The control group's age range was 25 to 54 with a mean age of 41.0±6.5. More of the participants were within the 45-49 years age bracket among the experimental (29.6%) and control group (40%) groups. There was no significant difference in the ages of both the experimental and control group. A majority of experimental group (88.9%) and all the participants in the control (100%) were married with no significant difference. A majority (70.1%) of the experimental group consisted of NCE holders; among the control NCE holders also accounted for a great proportion (73.3%), with no significant difference. The details of the socio-demographic information of the participants are contained in table 1.

Table 4.1- Socio-demographic characteristic of experimental and control groups at pre-test.

Characteristic	Experimental (N=27)		Control (N =30)		P-value
	No	%	No	%	
Sex::					
Male	9	33.3	13	43.3	0.462
Female	18	66.7	17	56.7	(> 0.05)
Age group:					
< 45	16	59.3	17	56.7	0.551
> 45	11	40.7	13	4 3.3	(> 0.05)
Marital status:					
Never married	1	3.7	0	0	0.22
Married	24	88.9	30	100	(>0.05)
Widowed	2	7.40	0	0	
Educational qualification:					
NCE	19	70.1	22	73.3	
HND	1	3.7	0	0	0.502
B.Sc.	6	22.2	8	26.6	(> 0.05)
PGDE	1	3.7	0	0	

4.2.1 Awareness and knowledge about lead and lead poisoning at pre-test:

Only 41.0% in the experimental group and exactly 50.0% in the control group had ever heard about lead at pre-test. Participants' sources of information about lead in both experimental and control groups are presented in figure 4.1. The school constituted the major source of information for the experimental group (22.2%) and the control group (23.3%). Other mentioned sources of information were Newspaper (experimental- 7.4%; control- 16.7%), Books (experimental- 7.4%; control- 6.7%), Radio (experimental- 3.7%; control- 13.3%) and television (experimental- 7.4%; control- 16.7%). Regarding the sources of information about the health effects of lead, the school topped the list in both the experimental (25.9%) and control (26.7%) groups. Other sources were newspaper (experimental- 11.1%, control- 13.3% group), books (experimental- 7.4%; control group- 10.0%) and Radio (experimental- 7.4%; control 13.3%). Participants' general knowledge regarding lead and lead poisoning at pre-test is shown in table 4.2. The asterisked responses are the correct responses. The table indicates that only 10 (37.0%) participants in the experimental group and 15 (50.0%) in the control group were aware that lead is a metal, with no significant difference. Eleven participants (40.7%) in the experimental group and eight participants (26.7%) in the control group were aware that lead can harm people of any age, with no significant difference. Five participants in the experimental group (18.5%) and six in the control group were aware that a pregnant woman with lead in her body can pass it to the unborn baby, with no significant difference. Other responses to questions regarding lead and lead poisoning at pre-test are as shown in table 4.2.

Participants were requested to mention the limit of blood lead concentration permissible by the World Health Organization for children and pregnant women. None in both the experimental and the control group could accurately state the accepted level which is 10μg/dl. Rather two participants each in the experimental and control groups erroneously mentioned 20μg/dl while most people (92.6%) in the experimental group as well as a most members of the control group (90.0%) indicated they did not know the permissible limit. Table 4.3 shows participants' knowledge of the symptoms which are suggestive of childhood lead poisoning at pre-test. Six (22.2%) participants in the experimental group and five (16.7%) in the control group accurately mentioned "headache" as a symptom of lead poisoning. "Restlessness" was accurately mentioned by

29.6% of the experimental and 26.7% of the control group as a possible symptom of lead poisoning in children. The differences were not significant

Participants' knowledge relating to the screening and treatment of childhood lead poisoning at pre-test as shown in table 4.4 indicates that only 37.0% in the experimental group and 33.3% in the control knew that lead poisoning could be detected by screening children's blood, the difference was however not significant. Two participants in the experimental group were aware that the treatment for lead poisoning is by using chelating agents. None of the participants in the control group was aware of the use of chelating agents (see table 4.4 for details). The difference was not significant.

Table 5 shows participants' listed sources of lead in a primary school environment at pre-test. Three participants (11.1%) in the experimental group and one in the control group (3.3%) listed food as a source of lead in a primary school environment. Other sources listed were; air (experimental- 7.4%; control- 10%), car (experimental- 0.0%; control 16.7%). The other details are presented in table 4.5. The experimental and control groups' knowledge of the various sources of vulnerability to lead are presented in table 4.6. Twelve participants of the experimental group and 36.7% of the control group were aware that some paints used in Nigeria for painting houses contain lead, with no significant difference. Few of the experimental (37.0%) and control (30.0%) groups correctly noted that the liquid used by carpenters for polishing furniture contains lead, the difference was not significant. The details about other sources of vulnerability to lead as noted by the participants in the two groups are highlighted in table 4.7. Participants' knowledge of the components of a car that contains or can release lead is shown in table 4.8. Sixteen participants (59.3%) in the experimental and 53.3% in the control groups had the knowledge that a car battery contains or can release some lead, the difference was not significant. Table 4.9 shows participants knowledge of practices which make children to be vulnerable to lead poisoning. Seven (25.9%) participants in the experimental group and 23.3% in the control group knew that children fed with food bought along the road can ingest lead, the difference was not significant (see table 4.9 for details). Figure 4.2 presents the knowledge of participants regarding the presence of lead in the petrol sold in Nigeria. Only 33.3% of the participants in the experimental group and 30.0% in the control group knew that lead is present in the petrol sold in Nigeria at pre-test. The difference was not significant. Participants' knowledge of the practices that can prevent lead poisoning is highlighted in table 4.10. A few participants (14.8%) in the experimental group and 10.0% in the control group knew that making sure everyone takes off their shoes when entering the house can prevent lead poisoning, the difference was not significant. Eight participants in the experimental group (33.3%) and eight in the control group knew that discouraging children from carrying food around the house could help prevent lead poisoning with no significant difference (see other details in table 4.10).

Table 4.11 shows participants' knowledge relating to nutrition and lead poisoning at pre-test. Seven participants in the experimental group (29.6%) and four in the control group (13.3%) were aware that human body does not need any amount of lead to function well with the difference not significant. Six participants in the experimental group (22.2%) and three in the control group (10.0%) knew that a diet high in iron could help decrease a child's chances of getting lead poisoning (see table for details). Table 4.12 below highlights participants' knowledge of the possible physical and social consequences of childhood lead poisoning at pre-test. Seven participants in the experimental group (25.9%) and seven in the control group (23.3%) knew that lead poisoning could cause kidney problems, with no significant difference. Six participants in the experimental group (22.2%) and two in the control (6.7%) knew lead can cause delayed puberty in girls, with no significant difference. Eight participants in the experimental group (29.6%) and five in the control group (16.7%) knew that lead poisoning can cause behavioural problems in children. The difference was not significant. Those that knew that children who have lead in their body find it difficult to pay attention among the experimental and control groups were 25.9% and 20.0% respectively with no significant difference.

The experimental and control groups' overall mean knowledge scores, mean scores by sex and by education at pre-test are presented in Table 4.13. No significant differences were observed on comparing the overall mean knowledge scores and mean knowledge scores by sex in the experimental and control group using the student T-test. Similarly no significant difference was observed on comparing the experimental group's mean knowledge scores by level of education (see table 4.13).

Figure 4.1- Level of awareness about lead among the experimental and control groups

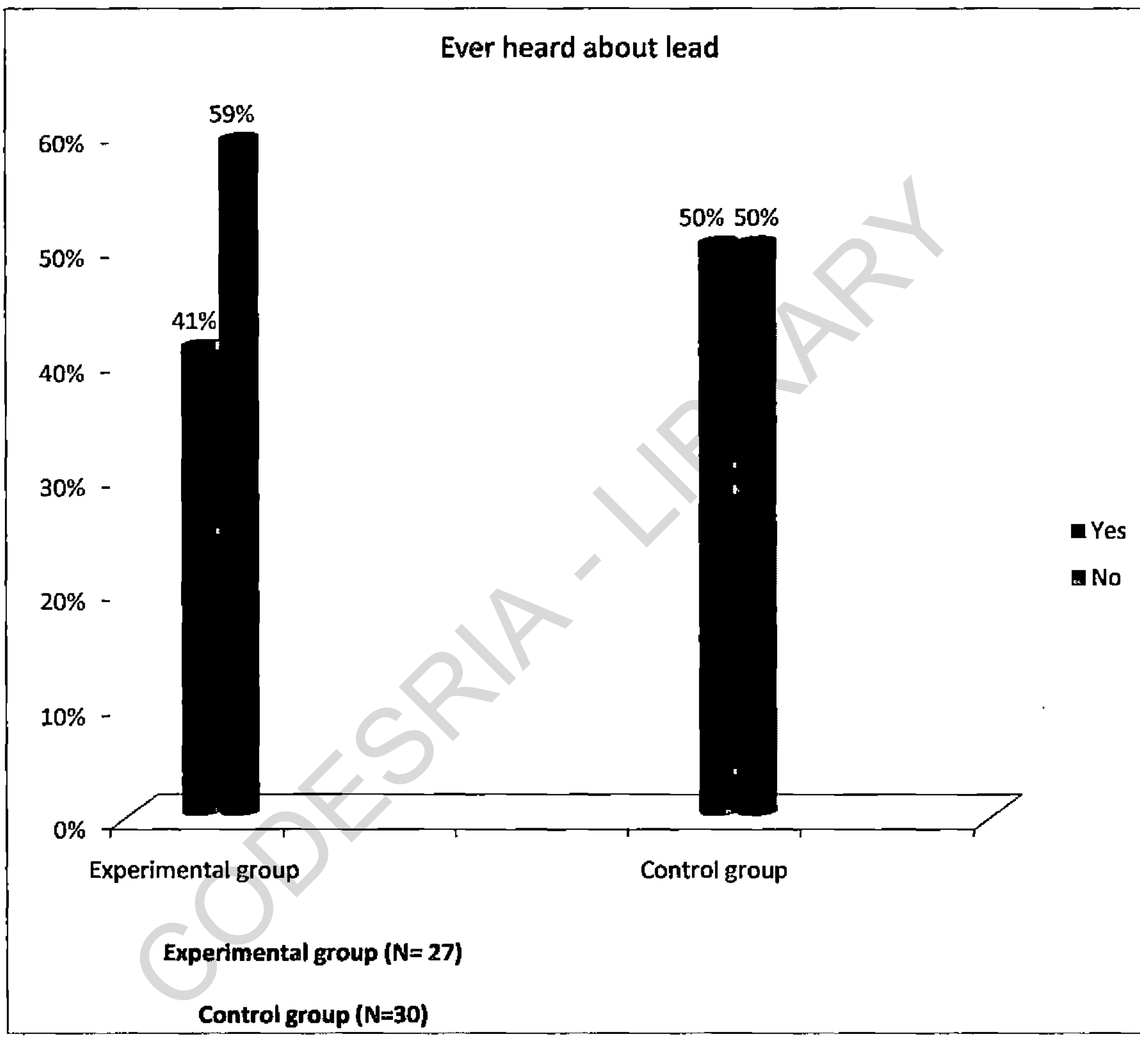


Figure 4.2- Sources of information about lead among the experimental and control group at pre-test

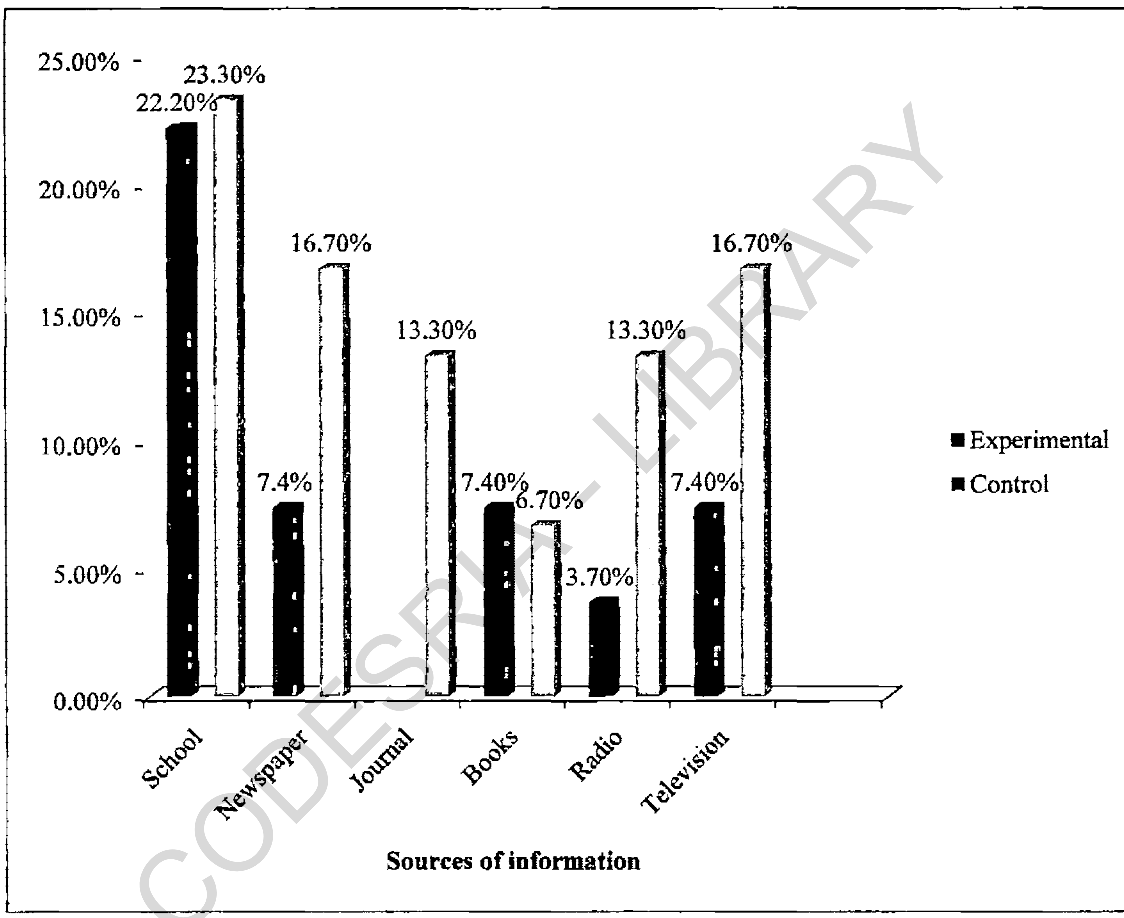


Table 4.2- . Experimental and control groups' general knowledge of lead and lead poisoning at pre-test

Statement	Experimental (N=27)		Control (N=30)		P value
	No	%	No	%	
Lead is a metal:					
True *	10	37.0	15	50.0	0.98
False	17	63.0	15	50.0	(> 0.05)
A pregnant woman with Lead in her body can pass it to the unborn baby:					
True *	5	18.5	6	20.0	0.90
False	22	81.5	24	80.0	(> 0.05)
Only children between the ages of 1-6 years are most likely to ingest Lead:					
True *	1	3.7	4	13.3	0.41
False	26	96.3	26	86.7	(> 0.05)
Older children get Lead poisoning more often than younger children:					
True	20	74.1	25	83.3	0.59
False *	7	25.9	5	16.7	(> 0.05)
No amount of Lead in the body is safe for children and adults:					
True *	8	29.6	7	23.3	0.59
False	19	70.4	23	80.0	(> 0.05)
Lead can harm people of any age:					
True *	11	40.7	6	20.0	0.15
False	16	59.3	24	80.0	(> 0.05)
Lead poisoning can cause digestive problems:					
True *	14	51.9	10	33.3	0.25
False	13	48.1	20	66.7	(> 0.05)
A child can look fine or well yet he/she has been harmed by Lead:					
True *	8	29.6	3	10.0	0.23
False	19	70.4	27	90.0	(> 0.05)

* Correct responses

Table 4.3- Knowledge of the symptoms suggestive of childhood lead poisoning among experimental and control groups at pre-test.

Symptoms suggestive of lead poisoning			Experimental (N=27)		Control (N=30)		P-value
			No	%	No	%	
Headache:							
	Yes	*	6	22.2	5	16.7	0.59
	No		21	77.8	25	83.3	(> 0.05)
Restlessness:	Yes	*	8	29.6	8	26.7	0.98
	No		19	70.4	22	73.3	(> 0.05)
Sleeplessness:	Yes	*	7	25.9	7	23.3	0.59
	No		20	74.1	23	76.7	(> 0.05)
Constipation:	Yes	*	9	33.3	8	26.7	0.24
	No		18	66.7	22	73.3	(> 0.05)
Stomach ache:							
	Yes	*	12	44.4	5	16.7	0.02
	No		15	55.6	25	83.3	(< 0.05)

* Correct responses

Table 4.4- Knowledge relating to screening and treatment of childhood lead poisoning among the experimental and control groups at pre-test

Statement		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
Feeling a child's body temperature:						
	Correct	19	70.4	28	93.3	0.05
	Incorrect *	8	29.6	2	6.7	
Screening for Lead in the child's blood:						
	Correct *	10	37.0	5	16.7	0.14
	Incorrect	17	63.0	25	83.3	(> 0.05)
Testing their urine for lead:						
	Correct	26	96.3	27	90.0	0.68
	Incorrect *	1	3.7	3	10.0	(> 0.05)
The treatment for Lead poisoning is by using chelating agents:						
	Correct *	2	7.4	0	0.0	0.23
	Incorrect	24	92.6	30	100	(> 0.05)

* Correct responses

Table 4.5- Experimental and control groups' level of awareness/knowledge of possible sources of lead poisoning in a school environment at pre-test.

Source		Experimental (N=27)		Control(N=30)	
		No	%	No	%
Laboratory materials	*	0	0	1	3.3
Pencil		2	7.4	0	0
Air	*	2	7.4	3	10.0
Soil	*	1	3.7	1	3.3
Food	*	3	11.1	1	3.3
Water	*	2	7.4	0	0
Lead base paint	*	0	0	1	3.3
Furniture	*	1	3.7	0	0
Dust	*	2	7.4	1	3.3
Play ground materials	*	1	3.7	0	0
Battery	*	0	0	1	3.3
Cars	*	0	0	5	16.7
Burning of school refuse	*	0	0	4	13.3
Mechanic workshop around the school	*	0	0	1	3.3

* Correct responses

Table 4.6- Experimental and control groups' knowledge relating to factors and practices which may enhance children's vulnerability to lead poisoning at pre-test

Statements	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Some paints used for houses in Nigeria contain lead:					
Correct *	12	7.4	11	36.7	0.42
Incorrect	15	92.6	19	63.3	(> 0.05)
Newly painted houses readily make children to get Lead than older ones:					
Correct	26	96.3	19	63.3	0.74
Incorrect *	1	3.7	11	36.7	(> 0.05)
Asbestos used for ceiling houses contains Lead:					
Correct	25	92.6	23	76.7	0.24
Incorrect *	2	7.4	7	23.3	(> 0.05)
Children cannot get exposed to Lead when they inhale dust which contains Lead:					
Correct	25	92.6	23	76.7	0.92
Incorrect *	2	7.4	7	23.3	(> 0.05)
Artisans who repair houses can unknowingly take Lead home to children:					
Correct *	10	37.0	5	16.7	0.04
Incorrect	17	63.0	25	83.3	(> 0.05)
The liquid used by carpenters for polishing furniture contains Lead:					
Correct *	10	37.0	9	30.0	0.40
Incorrect	17	63.0	21	70.0	(> 0.05)
Children cannot be poisoned by playing with toys or old furniture which may have lead paint:					
Correct	17	63.0	26	86.7	0.77
Incorrect *	10	37.0	4	13.3	(> 0.05)

* Correct responses

Table 4.7- Experimental and control groups' knowledge relating to categories of workers that can unknowingly take lead home from their work places at pre-test.

Category			Experimental (N=27)		Control (N=30)		P-value
			No	%	No	%	
Plumber:							
	True	*	8	29.6	5	16.7	0.07
	False		19	70.4	25	83.3	(> 0.05)
Brewery workers:							
	True		27	100	24	86.7	0.59
	False	*	0	0.0	6	13.3	(> 0.05)
Farmers:							
	True	*	3	11.1	5	16.7	0.27
	False		24	88.9	25	83.3	(> 0.05)
Mechanics:							
	True	*	3	11.1	6	20.0	0.57
	False		24	88.9	24	80.0	(> 0.05)
Battery chargers:							
	True	*	15	55.6	13	43.3	0.51
	False		12	44.4	17	56.7	(> 0.05)
Painters:							
	Correct	*	12	44.4	12	40.0	0.94
	Incorrect		15	55.6	18	60.0	(> 0.05)

* Correct responses

Table 4.8- Experimental and control groups' knowledge relating to the components of a car, that contain (or can release) lead at pre-test.

Component		Experimental (N=27)		Control (N= 30)		P-value
		No	%	No	%	
Air conditioner:						
Yes		2	7.4	2	6.7	0.378
No	*	25	92.8	28	93.3	(> 0.05)
Exhaust from car:						
Yes	*	12	44.4	9	30.0	0.273
No		15	55.6	21	70.0	(> 0.05)
Engine oil:						
Yes		4	14.8	6	20.0	0.358
No	*	23	85.2	24	80.0	(> 0.05)
Car battery:						
Yes	*	16	59.3	16	53.3	0.356
No		11	40.7	14	46.7	(> 0.05)
Car brake fluid:						
Yes		3	11.1	6	20.0	0.734
No	*	24	88.9	24	80.0	(> 0.05)

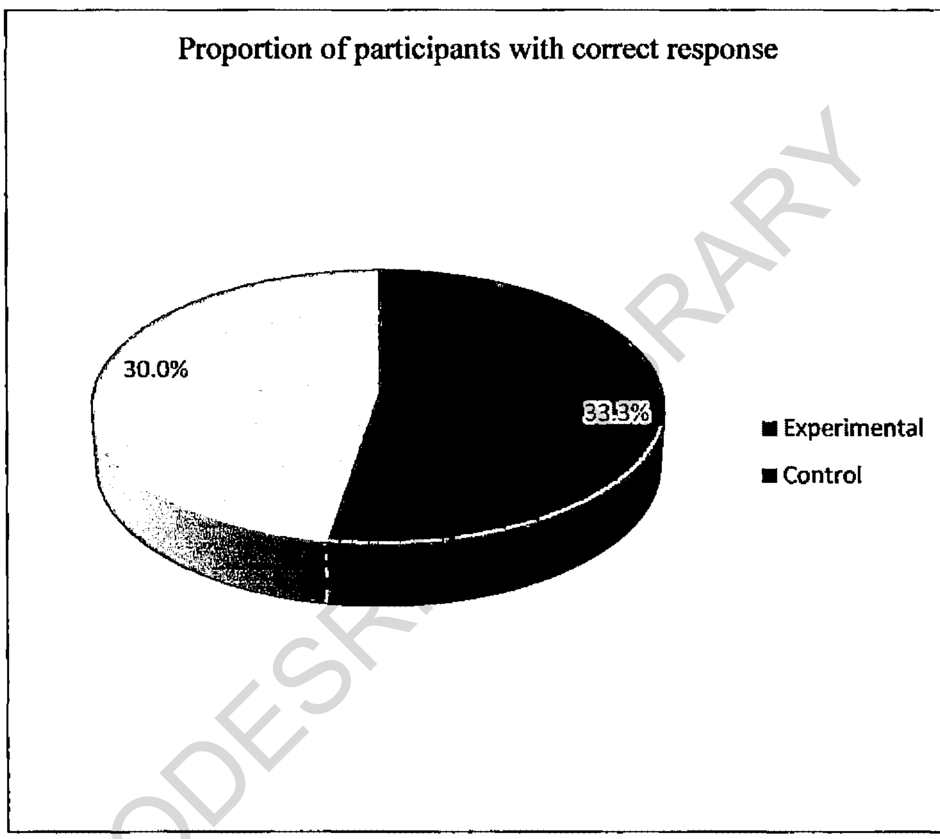
* Correct responses

Table 4.9- Experimental and control groups' knowledge of practices by which children can be exposed to lead poisoning at pre-test

Statements	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
It is not possible for children to ingest Lead when they put their hands stained with soil or dust into their mouths:					
True	18	66.7	27	90.0	0.138
False *	9	33.3	3	10.0	(>0.05)
A child can ingest Lead after touching a powdery wall and then eat with the stained hands:	14	51.9	6	20.0	0.050
True *	13	48.1	24	80.0	
False					
Children fed with food bought along the road cannot ingest lead:					
True	20	74.1	23	76.7	0.812
False *	7	25.9	7	23.3	(>0.05)
It is possible for children to ingest Lead from pipe borne water:					
True *	13	48.1	3	10.0	0.040
False	14	51.9	27	90.0	(>0.05)
Using some potteries or ceramics to cook for children to eat can make them ingest Lead:					
True *	14	51.9	6	20.0	0.988
False	13	48.1	24	80.0	(>0.05)
Drinking the ink washed off a wooden plate which contains Koranic verses can make children ingest Lead:					
True *	12	44.4	4	13.3	0.252
False	15	55.6	26	86.7	(>0.05)

* Correct responses

Figure 4.3- Experimental and control groups' knowledge relating to whether lead is present in the petrol sold in Nigeria at pre-test.



N (experimental group) = 27

N (Control) = 30

Table 4.10- Experimental and control groups' knowledge relating to practices for preventing childhood lead poisoning at pre-test

Practices relating to Lead poisoning prevention	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Boiling removes Lead from water:					
Yes	24	88.9	28	93.3	0.901
No *	3	11.1	2	6.7	(> 0.05)
Cleaning window sills, furniture and floor in home or schools with soap and water:					
Yes *	8	29.6	6	20.0	0.812
No	19	70.4	24	80.0	(> 0.05)
Sweeping home and school always:					
Yes	20	74.1	27	90.0	0.386
No *	7	25.9	3	10.0	(> 0.05)
Encouraging children to play on fields with grass:					
Yes *	6	22.2	4	13.3	0.904
No	19	77.8	26	86.7	(> 0.05)
Drinking warm tap water:					
Yes	20		25		0.509
No *	7	25.9	5	16.7	(> 0.05)
Drinking cold tap water:					
Yes *	3	11.1	2	6.7	0.901
No	24	88.9	28	93.3	(> 0.05)

* Correct responses

Table 4.10- Contd.

Practice	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Washing children's hands after outdoor games play:					
Yes *	9	33.3	9	30.0	0.05
No	18	66.7	21	70.0	(< 0.05)
Making sure everyone takes off their shoes when entering the house:					
Yes *	4	14.8	3	10.0	0.569
No	23	85.2	27	90.0	(> 0.05)
Not mopping floors with detergent regularly:					
Yes	20	74.1	21	70.0	0.558
No *	7	25.9	9	30.0	(> 0.05)
Discouraging children from carrying food around the house:					
Yes *	8	29.6	8	26.7	0.962
No	19	70.4	22	73.3	(> 0.05)
Not allowing children to eat food containing iron:	16	5	24	80.0	0.398
Yes	11	40.7	6	20.0	(> 0.05)
No *					
Not giving children 2-3 cups of milk to drink daily:					
Yes	18	66.7	22	73.3	0.988
No *	9	33.3	8	26.7	(> 0.05)
Not allowing children to eat food, which has calcium every day:					
Yes	13	48.3	23	76.7	0.252
No	14	51.7	7	23.3	(> 0.05)

* Correct responses

Table 4.11- Experimental and control groups' knowledge relating to nutrition and lead poisoning at pre-test.

Statements about Lead.	Experimental (N=27) No	Experimental (N=27) %	Control (N=30) N0	Control (N=30) %	P-value
The human body needs small amount of lead to function well:					
Yes	18	74.1	26	86.7	0.218
No *	7	25.9	4	13.3	(> 0.05)
A diet with high amount of iron will help decrease a child's chances of getting Lead poisoning:					
Yes *	6	22.2	3	10.0	0.845
No	21	77.8	27	90.0	(> 0.05)
A diet with enough calcium helps prevent Lead poisoning in children:					
Yes *	9	33.3	4	13.3	0.400
No	18	66.7	26	86.7	(> 0.05)

* Correct responses

Table 4.11- Experimental and control groups' knowledge relating to nutrition and lead poisoning at pre-test.

Statements about Lead.		Experimental (N=27)		Control (N=30)		P-value
		No	%	N0	%	
The human body needs small amount of lead to function well:						
Yes		18	74.1	26	86.7	0.218
No	*	7	25.9	4	13.3	(> 0.05)
A diet with high amount of iron will help decrease a child's chances of getting Lead poisoning:						
Yes	*	6	22.2	3	10.0	0.845
No		21	77.8	27	90.0	(> 0.05)
A diet with enough calcium helps prevent Lead poisoning in children:						
Yes	*	9	33.3	4	13.3	0.400
No		18	66.7	26	86.7	(> 0.05)

* Correct responses

Table 4.12- Experimental and control groups' knowledge of physical and social consequences of childhood lead poisoning at pre-test

Consequence	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Poor thinking processes:					
Yes *	4	14.8	6	20.0	0.868
No	26	95.2	24	80.0	(> 0.05)
Inability to learn well:					
Yes *	8	29.6	5	16.7	0.592
No	19	70.4	25	83.3	(> 0.05)
Anemia (or shortage of blood):	4	14.8	5	16.7	0.632
Yes *	23	95.2	25	83.3	(> 0.05)
No					
Weak bone formation:					
Yes *	7	25.9	7	23.3	0.935
No	20	74.1	23	76.7	((> 0.05)
Not growing well or growth retardation:					
Yes *	7	25.9	3	10.0	0.218
No	20	74.1	27	90.0	(> 0.05)
Delayed puberty in girls:					
Yes *	6	22.2	2	6.7	0.191
No	21	77.8	28	93.3	(> 0.05)
Kidney problems:					
Yes *	7	25.9	7	23.3	0.935
No	20	74.1	23	76.7	(> 0.05)
Hypertension:					
Yes *	4	14.8	4	13.3	
No	23	95.2	26	86.7	0.825 (> 0.05)

*Correct responses

Table 4.12- Contd.

Consequence	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Sickle cell (Sickler):					
Yes	20	74.1	22	73.2	0.386
No *	7	25.9	8	26.7	(> 0.05)
Brain damage:					
Yes *	5	18.5	5	16.7	0.845
No	22	91.5	25	93.3	(> 0.05)
Damages to the nerves:					
Yes *	10	37.0	5	16.7	0.825
No	17	63.0	25	93.3	(> 0.05)
Lead poisoning can cause behavioural problems in children:					
Yes *	8	29.6	5	16.7	0.592
No	19	70.4	25	83.3	(> 0.05)
Children who have Lead in their body find it difficult to pay attention:	7	25.9	6	20.0	0.828
Yes *	20	74.1	24	80.0	(> 0.05)
No					
Children aged between 6 months and 6 years should never be tested for Lead until they are 8 years old:					
Yes	23	85.2	24	80.0	0.632
No *	4	14.8	6	20.0	(> 0.05)

* Correct responses

Table 4.13- Comparison of mean knowledge scores of the experimental and control groups at pre-test.

Test period	N	Mean	SD	t-value	P- value
Overall mean scores:					
Pre-test (Experimental group)	27	20.2	16.2	1.362	>0.05
Pre-test (Control group)	30	14.6	14.4		
Experimental groups mean scores by sex:					
Pre-test (Male Experimental group)	9	18.9	17.1	0.287	>0.05
Pre-test (Female Experimental group)	18	20.8	16.3		
Control groups mean scores by sex:					
Pre-test (Male control group)	13	16.9	15.2	0.7519	>0.05
Pre-test (Female control group)	17	12.8	11.0		
Control groups mean knowledge scores at pretest by level of education:					
NCE	22	15.4	15.1	0.48	>0.05
B.Sc./B.Ed.	8	12.5	11.9		
Experimental groups mean knowledge scores at pre-test by education:				F-value	P-value
NCE	19	16.2	15.9		
HND	1	48.0	0.0		
B.Sc./B.Ed.	6	26.5	13.4	2.02	>0.05
PGDE	1	31.0	0.0		

4.2.2 Participants' perceptions relating to lead and lead poisoning at pre-test:

Table 1.44 shows participants' perception relating to lead poisoning in their LGAs at pre-test. Twelve participants (44.4%) in the experimental group compared with 33.3% in the control group perceived school children in their LGA to be exposed to lead poisoning with no significant difference. Few (33.3%) of the participants in the experimental group and 20.0% in the control group were not sure whether lead poisoning constitute a serious health problem among children in Nigeria. The difference was not statistically significant. Less than half of participants in the experimental group (48.1%) and 43.3% control were of the perception that parents, teachers and government cannot work together to prevent lead poisoning because such a cooperative effort cannot work in Nigeria; the difference was however not significant. Details of other perceptions of the participants regarding lead poisoning in their respective LGAs are as shown in table 4.14.

Participants' perception regarding the roles of teachers in lead poisoning prevention among children at pre-test are presented in table 4.15. Twelve participants in the experimental group (44.4%) compared to 36.7% in the control group were of the opinion that teachers should educate children about lead poisoning. Only one participant each in the experimental (3.7%) and control (3.3%) group respectively were of the perception that teachers role in lead poisoning prevention among pupils should include watching over pupils (see table for details).

Perceptions regarding the roles of parents in lead poisoning prevention at pre-test among the experimental and control groups are shown in table 4.16. A total of 25.9% in the experimental group compared to 20.0% in the control group were of the view that parents should build good habits and safe surroundings for children in order to prevent childhood lead poisoning. Only one participant in the experimental group (3.7%) compared to 10.0% in the control group were of the perception that parents should educate children about the dangers of lead. Few participants (3.7%) in the experimental group and none in the control group were of the view that parents should be involved in advocating for lead poisoning prevention and control group by forming a workgroup (see table for details).

Table 4.17 highlights participants' perceptions regarding the roles of the government in lead poisoning prevention at pre-test. More than half in the experimental group (55.6%) and 33.3% in the control group were of the perception that government should expand services that promote primary lead poisoning prevention programmes (see the table for details).

Table 4.14- Experimental and control groups' perceptions relating to childhood lead poisoning at pre-test

Perception	Pre-test (N=80)		Post-test (N=80)		X^2	P-value
	No	%	No	%		
School children in this Local Government Area are not exposed to Lead poisoning:						
Agree	15	55.6	20	66.7	1.46	> 0.05
Disagree	12	44.4	10	33.3		
Lead poisoning is not a serious health problem among children in Nigeria:						
Agree	18	66.7	24	80.0	1.45	> 0.05
Disagree	9	33.3	6	20.0		
Lead poisoning is more serious in adults than children:						
Agree	22	81.5	26	86.7	0.34	> 0.05
Disagree	5	18.5	4	13.3		
Lead poisoning cannot occur in any of the primary schools in this LGA:						
Agree	10	37.0	19	63.4	4.10	> 0.05
Disagree	17	63.0	11	36.6		
Parents have no role to play in the prevention of Lead poisoning:						
Agree	11	29.6	17	56.7	5.11	> 0.05
Disagree	19	70.4	13	43.3		
Teachers have no role to play in the prevention of Lead poisoning:						
Agree	8	29.6	16	53.3	4.25	> 0.05
Disagree	19	66.7	14	46.7		
Only the government can prevent Lead poisoning:						
Agree	10	37.0	17	56.7	3.38	> 0.05
Disagree	17	63.0	13	43.3		
Parents, teachers and government cannot work together to prevent lead poisoning because such a cooperative effort cannot work in Nigeria:						
Agree	14	51.9	17	56.7	2.64	> 0.05
Disagree	13	48.1	13	43.3		
Only Doctors can help prevent lead poisoning:						
Agree	11	40.7	19	63.3	3.58	> 0.05
Disagree	16	59.3	11	36.7		
Lead poisoning can be prevented through immunization						
Agree	18	66.7	26	86.7	3.23	> 0.05
Disagree	9	33.3	4	13.3		

Table 4.15- Experimental and control groups' perceptions relating to the roles of teachers in lead poisoning prevention among children at pre-test.

Perceived roles of teachers	Experimental (N=27)		Control (N=30)	
	No	%	No	%
Teachers should educate children	12	44.4	11	36.7
Send educative messages on lead poisoning home to parents	1	3.7	0	0
Teachers should watch over pupils in school	1	3.7	1	3.3

Table 4.16- Experimental and control groups' perceptions relating to the roles of parents in lead poisoning prevention among children at pre-test

Perceived roles of parents	Experimental (N=27)		Control(N=30)	
	No	%	No	%
Build good habits and safe surroundings	7	25.9	6	20.0
Educate children about the dangers of lead	1	3.7	3	10.0
Advocating for lead prevention and control programme by forming workgroup	3	11.1	0	0
Monitoring their children	3	11.1	0	0
Immunization	1	3.7	0	0
Feeding children with good and balanced diet	0	0	3	10.0

Table 4.17- Experimental and control groups' perceptions relating to the roles of government in lead poisoning prevention among school children at pre-test.

Perceived roles of government	Experimental (N=27)		Control(N=30)	
	No	%	No	%
Minimize the further entry of lead into the environment through regulations	1	3.7	1	3.3
Expand services that promote primary lead poisoning prevention and develop systems that enable clinicians and parents to learn about such services	15	55.6	10	33.3
Develop and implement strategies to encourage the safe elimination of lead hazards in properties	1	3.7	0	0
Identify all children with excess lead exposure, and prevent further exposure	1	3.7	0	0
Promote and fund additional research	1	3.7	0	0
Immunize children	0		2	6.7
Set up committee on lead poisoning	0		1	3.3

4.2.3 Participants' level of confidence in performing lead poisoning prevention and control tasks at pre-test:

Table 4.18 shows participants' level of confidence in performing tasks related to lead poisoning prevention and control programme at pre-test. There was no significant difference between the experimental and control groups level of confidence in educating parents about ways of preventing lead poisoning as six participants in the experimental group (22.2%) compared with eight in the control group (26.3%) perceived themselves very confident in educating parents about ways of preventing lead poisoning. Participants who perceived themselves very confident in counselling parents that lead poisoning can be treated among the experimental and control groups were 29.6% and 33.3% respectively with no significant difference. The details about other participants including those not confident or confident are contained in the table.

Table 4.18- Experimental and control groups' level of confidence relating to lead poisoning prevention and control at pre-test.

Tasks and level of confidence executing it	Experimental (N=27)		Control (N=30)		X^2	P-value
	No	%	No	%		
Educating parents about ways of preventing Lead poisoning:						
Not confident	17	63.0	18	60.0		
Confident	4	14.8	4	13.3		
Very confident	6	22.2	8	26.7	0.16	> 0.05
Counselling parents that childhood Lead poisoning can be treated:						
Not confident	19	70.4	19	63.3		
Confident	0	0	1	3.3		
Very confident	8	29.6	10	33.3	1.07	> 0.05
Telling School authority to be doing something to prevent Lead poisoning:						
Not confident	17	63.0	17	56.7		
Confident	4	14.8	5	16.7		
Very confident	6	22.2	8	26.7	0.24	> 0.05
Educating pupils about the sources of Lead poisoning:						
Not confident	18	66.7	17	56.7		
Confident	2	7.4	4	13.3		
Very confident	7	25.9	9	30.0	0.79	> 0.05

Table 4.18- Contd.

Task	Experimental (N=27)		Control (N=30)		X^2	P-value
	No	%	No	%		
Discussing the consequences of Lead poisoning on children with parents of pupils:						
Not confident	18	66.7	19	63.3		
Confident	2	7.4	3	10.0		
Very confident	7	25.9	8	26.7	0.14	> 0.05
Telling parents about the kind of food that can help prevent Lead poisoning:						
Not confident	19	70.4	20	66.7		
Confident	1	3.7	3	10.0		
Very confident	7	25.9	7	23.3	0.87	> 0.05
Telling parents about facilities where cases of Lead poisoning can be treated:						
Not confident	16	59.3	20	66.7		
Confident	4	14.8	2	6.7		
Very confident	7	25.9	8	26.7	1.02	> 0.05
Telling parents about health facilities where they can take the children for blood lead test:						
Not confident	17	63.0	18	60.0		
Confident	2	7.4	4	13.3		
Very confident	8	29.6	8	26.7	0.54	> 0.05

4.2.4 School health services participants would or would not be promoting at pre-test:

Table 4.19 shows school health services participants would or would not be promoting at pre-test. All the 27 participants in the experimental group (100%) and 27 in the control group (90.0%) would be promoting routine school health services like first aid. Most participants (96.3%) in the experimental group as well as most (93.3%) participants in the control group representing would be promoting health education to pupils. Twenty-two participants in the experimental group (81.5%) and 90.0% in the control would be promoting school policies related to health generally. Only one participant each in the experimental and control groups would be promoting school policies on lead in particular.

Table 4.19- School health services which experimental and control groups would or would not be promoting at pre-test.

School health programming activities	Experimental (N=27)		Control (N=30)	
	No	%	No	%
Routine health service like e.g. first aid:				
Yes	27	100	27	90.0
No	0	0	2	6.7
Not sure	0	0	1	3.3
Health education to pupils on personal hygiene:				
Yes	26	96.3	28	93.3
No	1	3.7	1	3.3
Not sure	0	0	1	3.3
School policies or guidelines related to health generally:				
Yes	22	81.5	27	90.0
No	3	11.1	2	6.7
Not sure	2	7.4	1	3.3
School policies on lead in particular:				
Yes	1	3.7	1	3.3
No	21	77.8	26	86.7
Not sure	5	18.5	3	10.0
School environmental sanitation activities:				
Yes	23	85.2	26	86.7
No	3	11.1	2	6.7
Not sure	1	3.7	2	6.7
Physical inspection of the personal hygiene of pupils:				
Yes	26	96.3	27	90.0
No	1	3.7	2	6.7
Not sure	0	0	1	3.3
Parents Teachers Association meet regularly to discuss health issues:				
Yes	21	77.8	22	73.3
No	4	14.8	6	20.0
Not sure	2	7.4	2	6.7

4.3.1 Participants' level of knowledge about lead and lead poisoning at post-test

Table 4.20 indicates participants' general knowledge regarding lead and lead poisoning at post-test. All the 27 participants in the experimental (100%) and 40.0% in the control group knew lead is a metal with a significant difference. All the 27 participants in the experimental group (100%) compared to 33.3% in the control were aware that a pregnant woman with lead in her body can pass it to her unborn child. The difference was significant. Among the experimental group 96.3% knew lead is not safe for both adults and children while in the control group only 23.3% were aware of this. The difference was significant (see table for details).

Participants' knowledge about the tolerable limit of blood lead set by WHO was also tested at post-test. The result (not graphically presented) showed that all the participants in the experimental group (100%) could accurately state the limit, while in the control group none could state it. The experimental and control groups' knowledge of the symptoms of lead poisoning in children is highlighted in table 4.21. All the 27 participants in the experimental group knew that the symptoms could be headache, restlessness, sleeplessness, constipation and stomach ache. These symptoms were only mentioned by 26.7%, 40.0%, 33.3% and 23.3% respectively among the control group. The differences were significant (see table for details). Table 4.22 presents participant's knowledge of the screening and treatment of lead poisoning at post-test. Twenty-six of those in the experimental group (96.3%) compared to 30.0% in the control group knew that feeling a child's body temperature is not a means of knowing if a child is having lead in his/her blood. The difference was significant. All the 27 participants in the experimental group (100%) compared to 26.7% in the control group were aware that screening for lead involves the screening of children's blood, with a significant difference. Most participants in the experimental group (92.6%) compared to only one participant in the control group knew that the treatment for lead poisoning is by using chelating agents. The difference was significant.

Table 4.23 contains participants' knowledge of the possible sources of lead in a primary school environment at post-test. Fourteen participants in the experimental group (51.9%) compared to only one (3.3%) in the control group correctly listed lead based paints. Slightly above half (51.9%) of the participants in the experimental group compared to only two in the control group listed dust as a source of lead in the school environment. Other sources listed by the experimental group included the following: water (37.0%); soil (40.7%) and food (37.0%). The sources of lead listed by the control group were water (3.3%) and food (3.3%).

Participants' knowledge of the sources of lead in the general environment at post-test is shown in table 4.24. Most participants in the experimental group (96.3%) compared to (30.0%) in the control group knew that paints used for some houses in Nigeria contains some lead which can make children vulnerable to lead poisoning. The difference was significant. Many (88.9%) participants among the experimental group compared to 50.0% in the control group knew that newly painted houses release less lead than older ones, with a significant difference. All the 27 participants in the experimental group 100% each compared to 30.0% in the control group knew that artisans that work with lead can unknowingly take lead home to children, the difference was significant (see table 4.24 for details). Table 4.25 shows Participants' knowledge of some categories of workers that can take lead home from their workplaces at post-test. Among the experimental group, all the 27 participants (100%) compared to 23.3% in the control group knew plumbers can unknowingly take lead home from their workplace, with a significant difference. All the participants in the experimental group (100%) knew mechanics and battery chargers can unknowingly take lead home from their workplace compared to 46.7% and 56.7% that mentioned mechanics and battery chargers respectively in the control group representing respectively. The differences were significant. Table 4.27 depicts participants' knowledge of ways by which children can be exposed to lead at post-test. All the 27 participants in the experimental group (100%) and only 20.0% in the control group knew it is possible for children to ingest lead when they put their hands stained with soil or dust into their mouth, with a significant difference. All the 27 participants in the experimental group (100%) compared to 30.0% in the control group knew a child could ingest lead after touching a powdery painted wall and then eat with the stained hands. The difference was significant. Figure 4.4 shows that all the 27 participants in the experimental group compared with 36.7% in the control group were aware that the petrol sold in Nigeria contains some lead.

Twenty-two participants (81.5%) in the experimental group compared to 30.0% in the control group knew that children fed with food bought along the road could ingest lead, with a significant difference. Table 4.28 presents participants' knowledge of practices for preventing childhood lead poisoning at post-test. All the 27 participants in the experimental group (100%) compared to 10.0% in the control group knew that boiling cannot remove lead from water (see table 4.28 for details). The difference was significant. Participants' knowledge relating to nutrition and lead poisoning at post-test is shown in table 4.29. A majority (96.3%) of participants compared to13.3% in the control group knew that the human body does not need any amount of lead to function well, with a significant difference. All the 27 participants in the experimental group (100%) compared to 16.7% in the control group knew a diet with high amount of iron will help decrease a child's chances of getting lead poisoning. The difference was significant. Participants' knowledge that a diet with enough calcium helps prevent lead poisoning was high among the experimental group (100%) compared with those in the control group (23.3%). The difference was significant.

Knowledge of participants regarding the physical and social consequences of childhood lead poisoning at post-test is shown in table 4.30. All the 27 participants in the experimental group (100%) knew that childhood lead poisoning could cause poor thinking processes, inability to learn well, anemia and weak bone formation in children. Few participants in the control group knew lead poisoning could cause poor thinking processes (40.0%); inability to learn well (43.3%); anemia (36.7%); and weak bone formation (36.7%). The differences were however significant. Table 4.31 presents the comparison of pre-test and post-test mean knowledge scores of the experimental and control group. At pre-test the experimental group's mean knowledge score was 20.2±16.2; this rose to 71.8±3.1 at post-test with a significant difference. The mean knowledge score of the control was 14.6±14.4 at pre-test and 19.2±17.8 at post-test with no significant difference. Table 4.32 shows the comparison of the experimental group's mean knowledge score by sex at post-test. The mean knowledge score of males was 72.0±3.3 while that of the females was 71.6±3.1. There was therefore no significant difference in the mean scores. Other mean knowledge scores comparison among the experimental and control groups are presented in tables 4.31 and 4.32.

Table 4.20- Experimental and control groups' general knowledge about lead and lead poisoning at post-test

Statement	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Lead is a metal:					
True *	27	100	12	40.0	< 0.05
False	0	0	18	60.0	
A pregnant woman with Lead in her body can pass it to the unborn baby:					
True *	27	100	10	33.3	< 0.05
False	0	0	20	66.7	
Only children between the ages of 1 -6 years are most likely to ingest Lead:					
True *	24	88.9	3	10.0	< 0.05
False	3	11.1	27	90.0	
Older children get Lead poisoning more often than younger children:					
True	2	7.4	23	76.7	< 0.05
False *	25	92.6	7	23.3	
No amount of Lead in the body is safe for children and adults:					
True *	26	96.3	7	23.3	< 0.05
False	1	3.7	23	76.7	
Lead can harm people of any age:					
True *	27	100	8	26.7	< 0.05
False	0	0	22	73.3	
Lead poisoning can cause digestive problems:					
True *	26	96.3	11	36.7	< 0.05
False	1	3.7	19	63.3	
A child can look fine or well yet he/she has been harmed by Lead:					
Correct *	26	96.3	8	26.7	< 0.05
Incorrect	1	3.7	22	73.3	

* Correct responses

Table 4.21- Knowledge of the symptoms suggestive of childhood lead poisoning among experimental and control groups at post-test

Symptoms			Experimental (N=27)		Control (N=30)		P-value
			No	%	No	%	
Headache:	Yes	*	27	100	8	26.7	
	No		0	0	22	73.3	< 0.05
Restlessness:	Yes	*	27	100	12	40.0	
	No		0	0	18	60.0	< 0.05
Sleeplessness:	Yes	*	27	100	10	33.3	
	No		0	0	20	66.7	< 0.05
Constipation:	Yes	*	27	100	7	23.3	
	No		0	0	23	76.7	< 0.05
Stomach ache:	Yes	*	27	100	7	13.3	
	No		0	0	23	86.7	< 0.05

* Correct responses

Table 4.22- Knowledge of screening and treatment of lead poisoning in children among the experimental and control groups at post-test.

Statement		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
Feeling a child's body temperature						
	Correct	1	3.7	21	70.0	< 0.05
	Incorrect *	26	96.3	9	30.0	
Screening for Lead in the child's blood						
	Correct *	27	100	8	26.7	< 0.05
	Incorrect	0	0	22	73.3	
Testing their urine for lead						
	Correct	1	3.7	25	83.3	< 0.05
	Incorrect *	26	96.3	5	16.7	
The treatment for Lead poisoning is by using chelating agents						
	Correct *	25	92.6	1	3.3	< 0.05
	Incorrect	2	7.4	29	96.7	

* Correct responses

Table 4.23- Experimental and control groups' awareness/knowledge of the sources of lead poisoning in a school environment at post-test.

Sources		Experimental (N=27)		Control (N=30)	
		No	%	No	%
Art supplies	*	4	14.8	0	0
Lead photography supplies	*	2	7.4	0	0
Pottery glazes	*	2	7.4	0	0
Laboratory materials	*	8	29.6	0	0
Air	*	6	22.2	2	6.7
Soil	*	11	40.7	0	0
Toys	*	4	14.8	0	0
Food	*	10	37.0	1	3.3
Dirty environment		0	0	1	3.3
Water	*	10	37.0	1	3.3
Lead base paint	*	14	51.9	1	3.3
Furniture	*	6	22.2	0	0
Dust	*	14	51.9	2	6.7
Play ground materials	*	4	14.8	0	0
Ceramics	*	2	7.4	1	3.3
Battery	*	1	3.7	2	6.7
Cars	*	0	0	1	3.3
Burning of school refuse		0	0	3	10.0
Mechanic workshop around the school	*	2	7.4	0	0
Odour from Toilet		0	0	1	3.3
Eating non food material	*	0	0	1	6.7

* Correct responses

Table 4.24- Experimental and control groups' knowledge relating to factors and practices which may enhance children vulnerability to lead poisoning at post-test.

Statements		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
Some paints used for houses in Nigeria contain:						
Correct	*	26	96.3	9	30.0	
Incorrect		1	3.7	21	70.0	< 0.05
Newly painted houses readily make children to get Lead than older ones:						
Correct		3	11.1	15	50.0	< 0.05
Incorrect	*	24	88.9	15	50.0	
Asbestos used for ceiling houses contains Lead:						
Correct	*	1	3.7	4	13.3	< 0.05
Incorrect		26	96.3	26	86.7	
Children cannot get exposed to Lead when they inhale dust which contains Lead:						
Correct		3	11.1	20	66.7	< 0.05
Incorrect	*	24	88.9	10	33.3	
Artisans who repair houses can unknowingly take Lead home to children:						
Correct	*	27	100	9	30.0	< 0.05
Incorrect		0	0	21	70.0	
The liquid used by carpenters for polishing furniture contains Lead:						
Correct	*	27	100	9	30.0	< 0.05
Incorrect		0	0	21	70.0	
Children cannot be poisoned by playing with toys or old furniture which may have lead paint:						
Correct		1	3.7	26	86.7	< 0.05
Incorrect	*	26	96.3	4	13.3	

* Correct responses

Table 4.25- Experimental and control groups' knowledge relating to categories workers that can unknowingly take lead home from their work places at post-test

Category			Experimental (N=27)		Control (N=30)		P-value
			No	%	No	%	
Plumber:							
	True	*	27	100	7	23.3	< 0.05
	False		0	0	23	76.7	
Brewery workers:							
	True		1	3.7	25	83.3	< 0.05
	False	*	26	96.3	5	16.7	
Farmers:							
	True	*	27	100	5	16.7	< 0.05
	False		0	0	25	83.3	
Mechanics:							
	True	*	27	100	14	46.7	< 0.05
	False		0	0	16	53.3	
Battery chargers:							
	True	*	27	100	17	56.7	< 0.05
	False		0	0	13	43.3	
Painters:							
	Correct	*	27	100	15	50.0	< 0.05
	Incorrect		0	0	15	50.0	

* Correct responses

Table 4.26- Experimental and control groups' knowledge relating to the components of a car, that contains (or can release) lead at post-test.

Component		Experimental (N=27)		Control (N=30)		P- value
		No	%	No	%	
Air conditioner:						
	Yes	0	0	4	13.3	< 0.05
	No *	27	100	26	86.7	
Exhaust from car:						
	Yes *	25	92.6	9	30.0	< 0.05
	No	2	7.4	21	70.0	
Engine oil:						
	Yes	2	7.4	5	16.7	< 0.05
	No *	25	92.6	25	83.3	
Car battery:						
	Yes *	26	96.3	16	53.3	< 0.05
	No	1	3.7	14	46.7	
Car brake fluid:						
	Yes	3	11.1	7	23.3	< 0.05
	No *	24	88.9	23	76.7	

* Correct responses

Table 4.27- Experimental and control groups' knowledge of practices by which children can be exposed to lead poisoning at post-test.

Statements about exposure to lead poisoning		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
It is not possible for children to ingest Lead when they put their hands stained with soil or dust into their mouths:						
True		0	0	24	80.0	< 0.05
False	*	27	100	6	20.0	
A child can ingest Lead after touching a powdery wall and then eat with the stained hands:						
True	*	27	100	9	30.0	< 0.05
False		0	0	21	70.0	
Children fed with food bought along the road cannot ingest lead:						
True		5	18.5	21	70.0	< 0.05
False	*	22	81.5	9	30.0	
It is possible for children to ingest lead from pipe borne water:						
True	*	27	100	9	30.0	< 0.05
False		0	0	21	70.0	
Using some potteries or ceramics to cook for children to eat can make them ingest Lead:						
True	*	27	100	13	43.3	< 0.05
False		0	0	17	56.7	
Drinking the ink washed off a wooden plate which contains Koranic verses can make children ingest Lead:						
True	*	27	100	6	20.0	< 0.05
False		0	0	24	80.0	

* Correct responses

Figure 8- Experimental and control groups' knowledge relating to the presence of lead in the petrol sold in Nigeria at post-test.

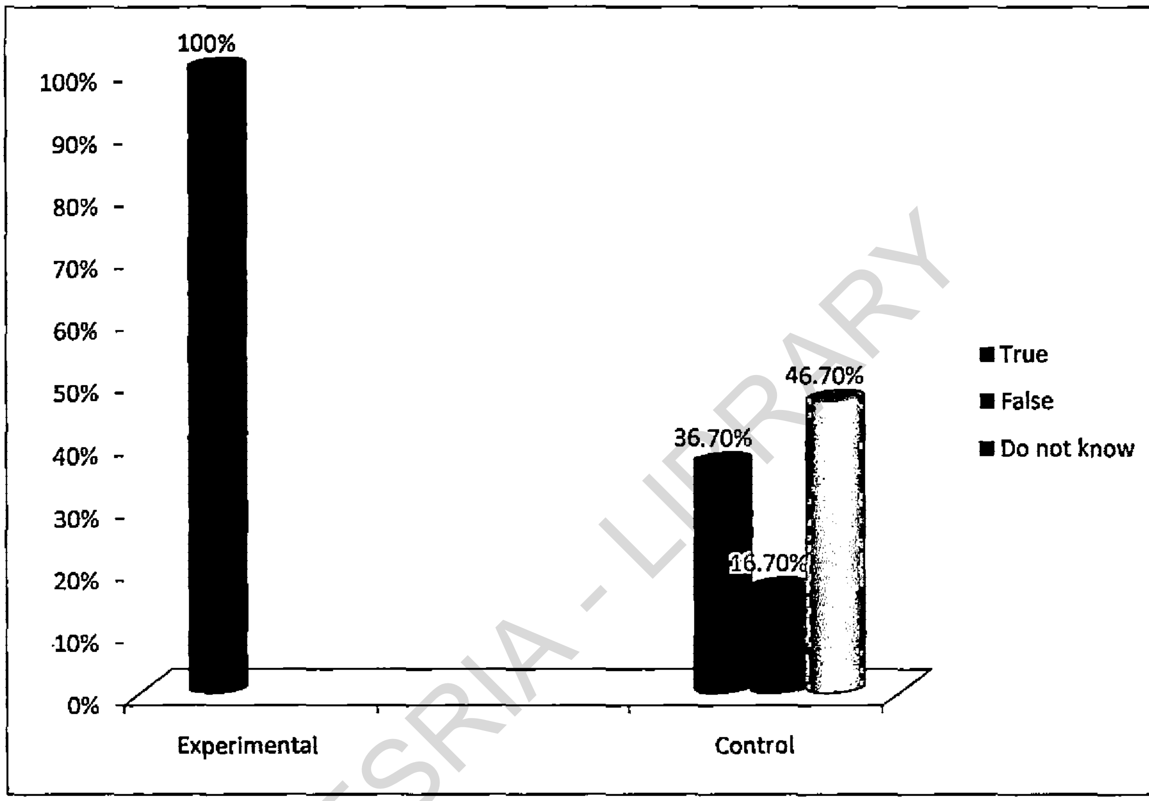


Table 4.28- Experimental and control groups' knowledge of practices for preventing childhood lead poisoning at post-test.

Practices	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Boiling removes Lead from water:					
Yes	0	0	27	90.0	< 0.05
No *	27	100	3	10.0	
Cleaning window sills, furniture and floor in home or schools with soap and water:					
Yes *	27	100	6	20.0	< 0.05
No	0	0	24	80.0	
Sweeping home and school always:					
Yes	27	100	24	80.0	< 0.05
No *	0	0	6	20.0	
Encouraging children to play on fields with grass:	27	100	23	76.7	< 0.05
Yes *	0	0	7	23.3	
No					
Drinking warm tap water:					
Yes	27	100	24	66.3	< 0.05
No *	0	0	6	36.7	
Drinking cold tap water:					
Yes *	27	100	2	6.7	< 0.05
No	0	0	28	93.3	
Washing children's hands after outdoor games play:	27	100	14	46.7	< 0.05
Yes *	0	0	16	53.3	
No					

* Correct responses

Table 4.28- Contd.

Practice	Experimental (N=27)		Control (N=30)		P-value
	No	%	No	%	
Making sure that everyone takes off their shoes when entering the house:					
Yes *	27	100	6	20.0	< 0.05
No	0	0	24	80.0	
Not mopping floors with detergent regularly:	0	0	21	70.0	< 0.05
Yes	27	100	9	30.0	
No *					
Discouraging children from carrying food around the house:					
Yes *	27	100	10	33.3	< 0.05
No	0	0	20	66.7	
Not allowing children to eat food containing iron:					
Yes	0	0	19	63.3	< 0.05
No *	27	100	11	36.7	
Not giving children 2-3 cups of milk to drink daily:					
Yes	0	0	10	33.3	< 0.05
No *	27	100	20	66.7	
Not allowing children to eat food, which has calcium every day:					
Yes	0	0	19	63.3	< 0.05
No *	27	100	11	36.7	

* Correct responses

Table 4.29- Experimental and control groups' knowledge relating to nutrition and lead poisoning at post-test.

Statements		Experimental (N=27) No	Experimental (N=27) %	Control (N=30) No	Control (N=30) %	P-value
The human body needs small amount of Lead to function well:						
Yes		1	3.7	24	80.0	< 0.05
No	*	26	96.3	6	20.0	
A diet with high amount of iron will help decrease a child's chances of getting Lead poisoning:						
Yes	*	27	100	5	16.7	< 0.05
No		0	0	25	83.3	
A diet with enough calcium helps prevent lead poisoning in children:						
Yes	*	27	100	7	23.3	< 0.05
No		0	0	23	76.7	

* Correct responses

Table 4.30- Experimental and control groups' knowledge of physical and social consequences of childhood lead poisoning at post-test.

Consequences		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
Poor thinking processes:						
Yes	*	27	100	12	40.0	< 0.05
No		0	0	18	60.0	
Inability to learn well:						
Yes	*	27	100	13	43.3	< 0.05
No		0	0	17	56.7	
Anemia (or shortage of blood):						
Yes	*	27	100	10	36.7	< 0.05
No		0	0	20	63.3	
Weak bone formation:						
Yes	*	27	100	11	36.7	< 0.05
No		0	0	19	63.3	
Not growing well or growth retardation:						
Yes	*	27	100	7	23.3	< 0.05
No		0	0	23	76.7	
Delayed puberty in girls:						
Yes	*	27	100	5	16.7	< 0.05
No		0	0	25	83.3	
Kidney problems:						
Yes	*	27	100	10	33.3	< 0.05
No		0	0	20	66.7	

* Correct responses

Table 4.30- Experimental and control groups' knowledge of physical and social consequences of childhood lead poisoning at post-test.

Consequences		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
Poor thinking processes:						
Yes	*	27	100	12	40.0	< 0.05
No		0	0	18	60.0	
Inability to learn well:						
Yes	*	27	100	13	43.3	< 0.05
No		0	0	17	56.7	
Anemia (or shortage of blood):						
Yes	*	27	100	10	36.7	< 0.05
No		0	0	20	63.3	
Weak bone formation:						
Yes	*	27	100	11	36.7	< 0.05
No		0	0	19	63.3	
Not growing well or growth retardation:						
Yes	*	27	100	7	23.3	< 0.05
No		0	0	23	76.7	
Delayed puberty in girls:						
Yes	*	27	100	5	16.7	< 0.05
No		0	0	25	83.3	
Kidney problems:						
Yes	*	27	100	10	33.3	< 0.05
No		0	0	20	66.7	

* Correct responses

Table 4.30- Contd.

Consequences		Experimental (N=27)		Control (N=30)		P-value
		No	%	No	%	
Hypertension:						
Yes	*	27	100	5	16.7	< 0.05
No		0	0	25		
Sickle cell (Sickler):						
Yes		1	3.7	21		< 0.05
No	*	26	96.3	9	30.0	
Brain damage:						
Yes	*	27	100	8	26.7	< 0.05
No		0	0	22		
Damages to the nerves:						
Yes	*	27	100	8	26.7	< 0.05
No		0	0	22		
Lead poisoning can cause behavioural problems in children:						
Yes	*	27	100	6	20.0	< 0.05
No		0	0	24		
Children who have Lead in their body find it difficult to pay attention:		27	100	11	36.7	< 0.05
Yes	*	0	0	19		
No						
Children aged between 6 months and 6 years should never be tested for Lead until they are 8 years old:						
Yes		0	0	21	30.0	< 0.05
No	*	27	100	9		

* Correct responses

Table 4.31- Comparison of mean knowledge score of the experimental and control groups at pre-and-post-test.

Test period	N	Mean	SD	t-value	P-value
Overall mean scores:					
Pre-test (Experimental)	27	20.2	16.2	16.167	< 0.05
Post-test (Experimental)	27	71.8	3.1		
Pre-test (Control)	30	14.6	14.4	1.0951	>0.05
Post-test (Control)	30	19.2	17.8		

Table 4.32- Comparison of mean knowledge scores of experimental and control groups at post-test

Test period	N	Mean	SD	t-value	P- value
Post-test (Experimental group)	27	71.8	3.1		
Post-test (Control group)	30	19.2	17.8	15.05	< 0.05
Experimental group's mean scores by sex:					
Post-test (Male Experimental group)	9	72.0	3.3		
Post-test (Female Experimental group)	18	71.6	3.1	0.279	> 0.05
Control groups mean scores by sex:					
Post-test (Male control group)	13	21.7	18.8		> 0.05
Post-test (Female control group)	17	17.0	15.1	0.725	
Control groups mean scores by education					
Post-test (B.Sc./B.Ed.)	22	16.9	14.2		
Post-test (PGDE)	8	25.5	16.3	1.164	> 0.05
Experimental groups mean knowledge scores by education:				F-value	P-value
Post-test (NCE)	19	71.3	3.6		
Post-test (HND)	1	74.0	0.0		
Post-test (B.Sc./B.Ed.)	6	72.7	0.8	0.6	>0.05
Post-test (PGDE)	1	74.0	0.0		

4.3.2 Participants' perceptions relating to lead and lead poisoning at post-test

Participants' perceptions relating to lead poisoning in their LGAs at post-test is shown in table 4.33. All the 27 participants in the experimental group compared with 10 in the control group were of the perception that children in Ido LGA were exposed to lead; the difference was however statistically significant. All the participants in the experimental group and only five in the control group were of the perception that only government could help prevent lead poisoning, with a significant difference. All the participants in the experimental group (100%) and only 12 (40.0%) in the control group disagreed with the perception that teachers have no role to play in lead poisoning prevention and control. The difference between the two groups was significantly different. All the other details relating to perceptions about childhood lead poisoning are contained in table 4.33.

The perceptions of participants relating to the roles of teachers in lead poisoning prevention at post-test are shown in table 4.34. Twenty-four participants in the experimental group (88.9%) and 11 in the control group (36.7%) were of the view that teachers should educate children regarding lead. Twenty-three participants in the experimental group (85.1%) and only three (10.0%) in the control group were of the view that teachers should send educative messages on lead poisoning to parents at home. Ten participants in the experimental group (37.0%) were of the perception that teachers should be involved in advocating for lead poisoning prevention and control programme. while in the control group no one had this view. Participants' perceptions relating to the roles of parents in lead poisoning prevention among children at post-test are shown in table 4.35. Almost all the participants in the experimental group (92.6%) and only eight in the control group (26.7%) were of the perception that parents have a role in cultivating good habits and ensuring safe surroundings for children. A majority (70.4%) of participants in the experimental group with no one in the control were of the perception that parents' role should include taking their children to health facilities for blood lead testing (see table 4.35 for details).

Table 4.36 shows participants' perceptions regarding the roles of government in lead poisoning prevention among school children at post test. Nineteen (70.4%) participants in the experimental group and only three (10.0%) in the control group were of the view that government should minimize further entry of lead into the environment.

The proportion of those with the perception that government should identify all children with excess lead exposure and prevent further exposure was (77.7%) among the experimental group, none in the control group had this perception. Other perceptions of participants regarding the roles of government in lead poisoning prevention and control among school children are presented in table 4.36.

Table 4.33- Experimental and control groups' perceptions relating to childhood lead poisoning at post-test

Perception	Pre-test (N=80)		Post-test (N=80)		X^2	P-value
	No	%	No	%		
School children in this Local Government Area are not exposed to Lead poisoning:						
Agree	0	0	17	63.3	27.7	< 0.05
Disagree	27	100	11	36.7		
Lead poisoning is not a serious health problem among children in Nigeria:						
Agree	0	0	25	83.7	40.0	< 0.05
Disagree	27	100	5	16.7		
Lead poisoning is more serious in adults than children:	0	0	23	76.7	34.7	< 0.05
Agree	27	100	7	23.3		
Disagree						
Lead poisoning cannot occur in any of the primary schools in this LGA:						
Agree	0	0	22	73.3	32.2	< 0.05
Disagree	27	100	8	26.7		
Parents have no role to play in the prevention of Lead poisoning:						
Agree	0	0	17	56.7	21.8	< 0.05
Disagree	27	100	13	43.3		
Teachers have no role to play in the prevention of Lead poisoning:						
Agree	0	0	18	60.0	23.6	< 0.05
Disagree	27	100	12	40.0		
Only the government can prevent Lead poisoning:	0	0	19	63.3		
Agree	27	100	11	36.7	25.6	< 0.05
Disagree						
Parentsand government cannot work together to prevent lead poisoning because such a cooperative effort cannot work in Nigeria:						
Agree	0	0	18	60.0	23.6	< 0.05
Disagree	27	100	12	40.0		
Only Doctors can help prevent lead poisoning:						
Agree	0	0	12	40.0	23.6	< 0.05
Disagree	27	100	18	60.0		
Lead poisoning can be prevented through immunization						
Agree	0	0	25	83.3	40.0	< 0.05
Disagree	27	100	5	16.7		

Table 4.34- Experimental and control groups' perceptions relating to the roles of teachers in lead poisoning prevention among school children at post-test.

Perceptions of the roles of teachers	Experimental (N=27)		Control (N=30)	
	No	%	No	%
Teachers should educate children	24	88.9	11	36.7
Send educative messages on lead poisoning home to parents	23	85.1	3	10.0
Teachers should identify children that are displaying symptoms of lead poisoning	16	59.2	0	0
Teachers should educate school authorities	17	63.0	1	3.3
Teachers should watch over pupils in school	5	18.5	2	6.7
Advocate for lead poisoning prevention programmes	10	37.0	0	0

Table 4.35- Experimental and control groups' perceptions relating to the roles of parents in lead poisoning prevention among school children at post-test.

Perceptions of the roles of parents	Experimental (N=27)		Control (N=30)	
	No	%	No	%
Build good habits and safe surroundings	25	92.6	8	26.7
Educate children about the dangers of lead	14	51.9	4	13.3
Take children for lead test	19	70.4	0	0
Taken basic steps to decrease their exposure to lead if their job involves working with lead or lead products	9	33.3	0	0
Advocating for lead prevention and control programme by forming workgroup	4	14.8	0	0
Monitoring their children	2	7.4	0	0
Immunization	0	0	0	0
Feeding children with good and balanced food	19	70.4	1	3.3

Table 4.36- Experimental and control groups' perceptions relating to the roles of government in Lead poisoning prevention among school children at post-test.

Perceptions of the roles of governments	Experimental (N=27)		Control (N=30)	
	No	%	No	%
Minimize the further entry of lead into the environment through regulations	19	70.4	3	10.0
Expand services that promote primary lead poisoning prevention and develop systems that enable clinicians and parents to learn about such services	17	63.0	10	33.3
Develop and implement strategies to encourage the safe elimination of lead hazards in buildings	10	37.0	0	0
Identify all children with excess lead exposure, and prevent further exposure	21	77.7	0	0
Formulate jurisdictional policies that mandate ensuring lead safety in housing and enforce these mandates	3	11.1	0	0
Develop and apply systematic approaches to prevent exposure to even small amounts of lead in food or consumer products	7	25.9	0	0
Promote implementation of state and local primary prevention plans that target areas, populations, and activities of highest risk	4	14.8	0	0
Expand the availability and promote the use of early enrichment programs for all children from families.	7	25.9	0	0
Promote and fund additional research	8	29.6	0	0

4.3.3 Participants' level of confidence in performing lead poisoning prevention and control tasks at post-test:

Participants' level of confidence in performing lead poisoning prevention and control tasks at post-test is shown in table 4.37. All the 27 participants in the experimental group (100%) perceived themselves very confident in educating parents of pupils about ways of preventing lead poisoning, counselling parents that childhood lead poisoning can be treated and telling school authority to take actions aimed at preventing lead poisoning among school children. This was not the case among the control group as few people had the same level of confidence as the experimental. The differences between the experimental and control groups; levels of confidence were however significant. All the 27 participants in the experimental group (100%) said they would be very confident in telling parents about the kinds of food that can help prevent lead poisoning; only 16.7% in the control group had this level of confidence with a significant difference (see table 4.37 for details).

Table 4.37- Experimental and control groups' level of confidence relating to lead poisoning prevention and control tasks at post-test.

Task and perceived level of confidence of executing it.	Experimental (N=27)		Control (N=30)		X^2	P-value
	No	%	No	%		
Educating parents about ways of preventing Lead poisoning:						
Not confident	0	0	20	66.7		
Confident	0	0	2	6.7		
Very confident	27	100	8	26.7	32.2	< 0.05
Counselling parents that childhood Lead poisoning can be treated:						
Not confident	0	0	20	66.7		
Confident	0	0	2	6.7		
Very confident	27	100	8	26.7	32.2	< 0.05
Telling School authority take actions to prevent Lead poisoning:						
Not confident	0	0	18	60.0		
Confident	0	0	5	16.7		
Very confident	27	100	7	23.3	34.7	< 0.05
Educating pupils about the sources of Lead poisoning:						
Not confident	0	0	17	56.7		
Confident	0	0	8	26.7		
Very confident	27	100	5	16.7	40.0	< 0.05
Discussing the consequences of Lead poisoning on children with parents of pupils:						
Not confident	0	0	20	66.7		
Confident	0	0	3	10.0		
Very confident	27	100	7	23.3	34.7	< 0.05

Table 4.37- Contd.

Task and perceived level of confidence of executing it.	Experimental (N=27)		Control (N=30)		X^2	P-value
	No	%	No	%		
Telling parents about the kind of food that can help prevent Lead poisoning:						
Not confident	0	0	18	60.0		
Confident	0	0	7	23.3		
Very confident	27	100	5	16.7	40.7	< 0.05
Telling parents about facilities where cases of Lead poisoning can be treated:						
Not confident	0	0	18	60.0		
Confident	0	0	6	20.0		
Very confident	27	100	6	20.0	37.3	< 0.05
Telling parents about health facilities where they can take the children for blood Lead test:						
Not confident	0	0	19	63.3		
Confident	0	0	4	13.3		
Very confident	27	100	7	23.3	34.7	< 0.05

4.3.4 School health services participants would or would not be promoting at post-test:

Table 4.38 shows the school health services participants would or would not be promoting at post-test. Twenty-six participants in the experimental group (96.3%) and only one in the control group (3.3%) would be involved in promoting school health policies generally. Most participants in the experimental group (96.3%) and only one in the control group would be promoting school health policies relating to lead control in particular (see table 4.38 for further details).

Table 4.38- School health services experimental and control groups' would or would not be promoting at post-test.

Health service	Experimental (N=27)		Control (N=30)	
	No	%	No	%
Routine health service like e.g. first aid:				
Yes	26	96.3	27	90.0
No	1	3.7	2	6.7
Not sure	0	0	1	3.3
Health education to pupils on personal hygiene:				
Yes	27	100	28	93.3
No	0	0	1	3.3
Not sure	0	0	1	3.3
School policies or guidelines related to health generally:				
Yes	26	96.3	27	90.0
No	1	3.7	2	6.7
Not sure	0	0	1	3.3
School policies on lead in particular:				
Yes	26	96.3	1	3.3
No	0	0	26	86.7
Not sure	1	3.7	3	10.0
School environmental sanitation activities:				
Yes	27	100	26	86.7
No	0	0	2	6.7
Not sure	0	0	2	6.7
Physical inspection of the personal hygiene of pupil's hair, nail:				
Yes	25	92.6	27	90.0
No	2	7.4	2	6.7
Not sure	0	0	1	3.3
Parents Teachers Association meet regularly to discuss health issues:				
Yes	24	88.9	22	73.3
No	1	3.7	6	20.0
Not sure	2	7.4	2	6.7

4.4.1 The pre-test and post-test results of the trained peers:

At the end of the training programme for teachers in Ido (i.e. the experimental group), the trained teachers were requested to plan and implement a similar training programme in their various schools targeted at their peers or colleagues who could not be invited to participate in the Ido training due to logistic considerations. They were asked to use the same curriculum including the training methods and materials used for the training. The results presented in tables 4.39 to 4.57 are in respect of their peers or colleagues trained by them.

4.4.2 Socio-demographic characteristics:

Table 4.39 shows the socio-demographic characteristics of the participants. There were 20 males and 60 females. Their age ranged from 25- 60 years with a mean age of 40.5±5.8 years. Most (97.5%) participants were married and two (2.5%) were widowed. Majority of the participants (72.5%) had NCE as their highest level of educational qualification; 23.7% had B.Sc./B.A and only three of them had Grade 2 certificate.

Table 4.39- Socio-demographic characteristics of the trained peers.

Characteristics	The peers (N=80)	
	No	%
Sex		
Male	20	25.0
Female	60	75.0
Age group		
25-29	2	2.5
30-34	6	7.5
35-39	30	37.5
40-44	22	27.5
45-49	15	18.7
50-54	4	5.0
55-60	1	1.3
Marital status		
Married	78	97.5
Widowed	2	2.5
Educational qualification		
Grade 2	3	3.8
NCE	58	72.5
B.Sc./BEd/BA	19	23.7

4.4.3 Awareness and knowledge about lead and lead poisoning

Only 42% of the participants at pre-test had ever heard about lead. Participants' major source of information about lead was the school (21.3%). Other reported sources of information included colleagues that attended the first phase of the training (10%) in Ido town and the radio (6.3%). Regarding the sources of information about the health effects of lead, the school (22.2%) topped the list at pre-test. The other sources mentioned included newspaper (7.4%) and books (7.4%).

The trained peers' general knowledge regarding lead and lead poisoning at pre-and-post-test is shown in table 4.40. Few (27.5%) participants at pre-test and a majority (98.7%) at post-test knew lead is a metal. The difference was significant. At pre-test 13 participants (16.2%) said that no amount of lead in the body was safe for children and adults. This significantly increased to 91.2% at post-test (see table 4.40 for details).

Participants were asked about the WHO permissible limit of blood lead concentration for children and pregnant women at pre- and post-tests. At pre-test, only three participants (3.7%) could state it as 10μg/dl. The number that could state it correctly at post-test rose significantly to 89.9%. Table 4.41 shows the trained peers' knowledge of symptoms which are suggestive of childhood lead poisoning at pre-test and post. Few participants at pre-test (20.0%) knew that headache is a symptom which could be associated with lead poisoning. At post-test all the participants (100%) were aware of this (see table 4.41 for details). The difference was significant. The trained peers' knowledge relating to screening and treatment of childhood lead poisoning at pre- and post-tests is highlighted in table 4.42. The result showed that only 23.7% were aware that screening for childhood lead poisoning involved screening for lead in a child's blood at pre-test. At post-test however this increased significantly, as most of them (97.5%) stated it correctly.

At pre-test only 7.5% could correctly state that chelating agents are used for the treatment of lead poisoning in children; this rose significantly to 91.2% at post-test (see table 4.42 for details). The sources of lead poisoning listed by the peers in a primary school environment at pre-and-post-tests are presented in table 4.43. At pre-test pencil (11.3%) and food (11.3%) topped the list. At post-test mention of pencil and food increased to 23.7% and 37.5% respectively. That water could be a source of lead increased from 7.5% at pre-test to 51.3% at post-test (see table 4.43 for details).

Table 4.44 shows trained peer's knowledge relating to ways by which children can or cannot get lead at pre-and-post-tests. At pre-test 23.7% knew that children could get lead poisoning when they inhale dust containing lead. This increased significantly to 83.7% at post-test. Eighteen participants at pre-test (22.5%) and 78 (97.5%) at post-test knew that artisans who repair, renovate or reconstruct houses could unknowingly take lead home in their hands, shoes and clothes. The difference was significant. Table 4.45 shows trained peer's knowledge of categories of workers that can unknowingly take lead home from their workplaces. Nineteen participants (23.7%) at pre-test and 75 (93.7%) at post-test knew that plumbers could take lead home from their workplaces, with a significant increase (see details of about other categories of workers that can unknowingly take lead home from their workplaces at pre-and-post-tests in table 4.45).

Participants' knowledge of the components of a car that contains or can release lead is shown in table 4.46. The table shows that 25 (31.3%) participants at pre-test and 71 (88.7%) at post-test were aware that a car battery contains or can release some lead. The difference was significant. Twenty four participants (30.0%) at pre-test compared with 67 (83.7%) at post-test stated that the exhaust from a car contains some lead, with a significant difference. Table 4.47 highlights participants' knowledge of practices that make children vulnerable to lead poisoning. At pre-test 16 participants (20.0%) knew that a child can ingest lead after eating with hands stained by touching powdery painted wall. Their knowledge about this rose significantly to 100% at post-test. Ten (12.5%) participants stated at pre-test that children fed with food bought along the road could ingest lead. Participants who were aware of this rose significantly to77.5% at post-test (see table 4.47 for details).

Participants' responses to whether the petrol sold in Nigeria contains lead or not showed that, only 13.8% of the participants at pre-test knew that the petrol sold in Nigeria contains lead. After the training, knowledge about this increased significantly to 96.2%. Table 4.48 shows trained peers' knowledge at pre- and post-test regarding practices that can prevent lead poisoning. At pre-test, 14 participants (17.5%) knew that cleaning window sills, furniture and floor in home and schools with soap and water could prevent lead poisoning. At post-test the number of those knowledgeable increased significantly to 87.5%. At pre-test 21 participants knew that washing a child's hand after outdoor play could prevent lead poisoning. At post-test 96.2% were aware of this, with a significant difference (see details in table 4.48).

The trained peers' knowledge relating to nutrition and lead poisoning at pre-and-post-test is shown in table 4.49. Ten participants at pre-test (12.5%) were aware that the human body does not need any amount of lead to function well. At post-test, 95.0% were aware of this with a significant difference. The proportion of the peers that knew a diet high in iron will help decrease a child's chances of getting lead poisoning was 7.5% at pre-test; their knowledge about this rose significantly to 78.7% at post-test (see table 4.49 for details). Table 4.50 highlights trained peers' knowledge relating to physical and social consequences of childhood lead poisoning at pre- and post-test. Thirteen participants at pre-test (16.3%) knew that lead poisoning could cause kidney problems. This proportion rose to 97.5% at post-test with a significant difference. At pre-test 18 participants (22.5%) were aware that lead poisoning can cause behavioural problems in children. The knowledge about this however increased significantly to 91.2% at post-test (see table 4.50 for details).

The mean knowledge scores of the trained peers at pre-and-post-tests are presented in table 4.51. The results showed a mean pre-test score of 9.07±7.9. This was significantly increased to 59.8±3.7 at post-test. Males had a mean pre-test score of 10.9±9.9, which was not significantly different from that of females (8.4±6.5) (see table 4.51 for details).

Table 4.40- General knowledge of lead and lead poisoning among the peers at pre- and post-test.

Knowledge item	Pre-test (N=80)		Post-test (N=80)		P-value
	No	%	No	%	
Lead is a metal:					
True *	22	27.5	79	98.7	< 0.05
False	58	72.5	1	1.3	
A pregnant woman with Lead in her body can pass it to the unborn baby:					
True *	9	11.2	80	100	< 0.05
False	71	88.8	0	0	
Only children between the ages of 1-6 years are most likely to ingest Lead:					
True *	17	21.2	52	65.0	< 0.05
False	53	78.8	28	35.0	
Older children get Lead poisoning more often than younger children:					
True	12	15.0	18	22.5	< 0.05
False *	68	85.0	62	77.5	
No amount of Lead in the body is safe for children and adults:					
True *	13	16.2	73	91.2	< 0.05
False	67	83.8	7	18.8	
Lead can harm people of any age:					
True *	17	21.2	79	98.7	< 0.05
False	63	78.8	1	1.3	
Lead poisoning can cause digestive problems:					
True *	15	18.7	78	97.5	< 0.05
False	65	81.3	2	2.5	
A child can look fine or well yet he/she has been harmed by Lead:					
Correct *	13	16.2	69	86.2	< 0.05
Incorrect	67	83.8	11	13.8	

* Correct responses

Table 4.41- The peers' knowledge of the symptoms suggestive of childhood lead poisoning among follow up group at pre- and post-test.

Symptoms suggestive of lead poisoning	Pre-test (N=80)		Post-test (N=80)		P-value
	No	%	No	%	
Headache:					
Yes *	16	20.0	80	100	< 0.05
No	64	80.0	0	0	
Restlessness:					
Yes *	9	11.2	77	96.2	< 0.05
No	71	88.8	3	3.8	
Sleeplessness:					
Yes *	7	8.75	80	100	< 0.05
No	63	22.5	0	0	
Constipation:					
Yes *	11	13.5	80	100	< 0.05
No	69	86.5	0	0	
Stomach ache:					
Yes *	13	16.2	79	98.7	< 0.05
No	67	83.8	1	1.3	

* Correct responses

Table 4.43- Peers knowledge about sources of lead poisoning in the environment at pre-and-post-test.

Source		Pre-test(N=80)		Post-test (N=80)	
		No	%	No	%
Art supplies	*	2	2.5	0	0
Lead photographic supplies	*	0	0	24	30.0
Pottery glazes	*	1	1.3	9	11.3
Laboratory materials	*	1	1.3	19	23.7
Pencil		9	11.3	19	23.7
Air	*	1	1.3	5	6.25
Soil	*	3	3.7	20	25.0
Toys	*	1	1.3	30	37.5
Food	*	9	11.3	30	37.5
Dirty environment		2	2.5	0	0
Water	*	6	7.5	41	51.3
Lead base paint	*	4	5.0	22	27.5
Furniture	*	4	5.0	15	18.7
Dust	*	5	6.3	20	25.0
Play ground materials	*	1	1.3	0	0
Ceramics	*	1	1.3	0	0
Battery	*	2	2.5	1	1.3
Cars	*	1	1.3	0	0
Burning of school refuse	*	6	7.5	1	1.3
Odour from Toilet		2	2.5	0	0

* Correct responses

Table 4.44- Peer's knowledge relating to factors and practices which may enhance children's vulnerability to lead poisoning at pre- and- post-test.

Statements relating to sources of lead in Nigeria		Pretest(N=80)		Post- test (N=80)		P-value
		No	%	No	%	
Some paints used for houses in Nigeria contain lead:						
	Correct *	17	21.3	78	97.5	< 0.05
	Incorrect	63	78.7	2	2.5	
Newly painted houses readily make children to get Lead than older ones:						
	Correct	71	88.8	21	26.3	< 0.05
	Incorrect *	9	11.2	59	73.7	
Asbestos used for ceiling houses contains Lead:						
	Correct	78	97.5	23	28.8	< 0.05
	Incorrect *	2	2.5	57	71.2	
Children cannot get exposed to Lead when they inhale dust which contains Lead:						
	Correct	9	11.3	13	16.3	< 0.05
	Incorrect *	71	88.7	67	83.7	
Artisans who repair houses can unknowingly take lead home to children:						
	Correct *	18	22.5	78	97.5	< 0.05
	Incorrect	62	77.5	2	2.5	
The liquid used by carpenters for polishing furniture contains Lead:						
	Correct *	15	18.7	78	97.5	< 0.05
	Incorrect	75	82.3	2	2.5	
Children cannot be poisoned by playing with toys or old furniture which may have lead paint:						
	Correct	69	86.3	12	15.0	< 0.05
	Incorrect *	11	13.7	68	85.0	

* Correct responses

Table 4.45- Peers' knowledge relating to workers that can unknowingly take lead home from their work places at pre- and- post-test.

Category			Pre- test (N=80)		Post-test (N=80)		P-value
			No	%	N0	%	
Plumber:							
	True	*	19	23.7	75	93.7	
	False		61	76.3	5	6.3	< 0.05
Brewery workers							
	True		70	87.5	47	58.7	
	False	*	10	12.5	33	41.3	< 0.05
Farmers:							
	True	*	7	8.8	77	96.2	
	False		63	91.2	3	3.8	< 0.05
Mechanics:							
	True	*	20	25.0	78	97.5	
	False		60	75.0	2	2.5	< 0.05
Battery chargers:							
	True	*	17	21.3	80	100	
	False		63	78.7	0	0	< 0.05
Painters:							
	True	*	17	21.2	79	98.7	
	False		63	78.8	1	1.3	< 0.05

* Correct responses

Table 4.46- Peers knowledge relating to the components of a car that contain (or can release) lead at pre- and post-test.

Component		Pre-test (N=80)		Post-test (N=80)		P-value
		No	%	No	%	
Air conditioner:						
Yes		7	8.25	23	28.8	< 0.05
No	*	73	91.2	57	71.2	
Exhaust from car:						
Yes	*	24	30.0	67	83.7	< 0.05
No		56	70.0	13	16.3	
Engine oil:						
Yes		15	18.7	21	26.3	< 0.05
No	*	65	81.3	59	73.7	
Car battery:						
Yes	*	25	31.3	71	88.7	< 0.05
No		55	86.7	9	11.3	
Car brake fluid:						
Yes		12	15.0	25	31.3	< 0.05
No	*	68	85.0	55	68.7	

* Correct responses

Table 4.47- Peers' knowledge of practices by which children can be exposed to lead poisoning at pre- and- post-test

Statements	Pre-test (N=80)		Post-test (N=80)		P-value
	No	%	No	%	
It is not possible for children to ingest lead when they put their hands stained with soil or dust into their mouths:					
True	71	88.8	11	13.8	< 0.05
False *	9	11.2	69	86.2	
A child can ingest Lead after touching a powdery wall and then eat with the stained hands:					
True *	16	20.0	80	100	< 0.05
False	64	80.0	0	0	
Children fed with food bought along the road cannot ingest lead:					
True	70	87.5	18	22.5	< 0.05
False *	10	12.5	62	77.5	
It is possible for children to ingest Lead from pipe borne water:					
True *	5	6.25	79	98.7	< 0.05
False	75	97.5	1	1.3	
Using some potteries or ceramics to cook for children to eat can make them ingest Lead:					
True *	11	13.7	72	89.9	< 0.05
False	69	86.3	8	10.1	
Drinking the ink washed off a wooden plate which contains Koranic verses can make children ingest Lead:	10	12.5	75	93.7	< 0.05
True *	70	87.5	5	6.3	
False					

* Correct responses

Table 4.48- Peers' knowledge of practices for preventing childhood lead poisoning at pre-and-post-test

Practices relating to Lead poisoning prevention	Pre-test (N=80)		Post-test (N=80)		P-value
	No	%	No	%	
Boiling removes Lead from water:					
Yes	79	98.7	11	13.8	
No *	1	1.3	69	86.2	< 0.05
Cleaning window sills, furniture and floor in home or schools with soap and water:					
Yes *	14	17.5	70	87.5	
No	64	82.5	10	12.5	< 0.05
Sweeping home and school always:					
Yes	67	83.8	21	26.3	
No *	13	16.2	59	73.7	< 0.05
Encouraging children to play on fields with grass:					
Yes *	8	10.0	77	96.2	
No	72	90.0	3	3.8	< 0.05
Drinking warm tap water:					
Yes	71	88.7	11	13.8	
No *	9	11.3	69	86.2	< 0.05
Drinking cold tap water:					
Yes *	7	8.8	70	87.4	
No	73	91.2	10	12.6	< 0.05

* Correct responses

Table 4.48- Contd.

Practice	Pre-test (N=80)		Post-test (N=80)		P-value
	No	%	No	%	
Washing children's hands after outdoor games play:					
Yes *	21	26.3	77	96.2	
No	59	73.7	3	3.8	< 0.05
Making sure everyone takes off their shoes when entering the house:					
Yes *	7	8.8	77	96.2	
No	73	91.2	3	3.8	< 0.05
Not mopping floors with detergent regularly:					
Yes	5	6.3	21	26.3	
No *	75	93.7	58	72.4	< 0.05

* Correct responses

Table 4.49- Peers' knowledge relating to nutrition and lead poisoning at pre-and-post-test

Statements		Pre-test (N=80)		Post-test (N=80)		P-value
		No	%	No	%	
The human body needs small amount of lead to function well:						
Yes		70	87.5	4	5.0	
No	*	10	12.5	76	95.0	< 0.05
A diet with high amount of iron will help decrease a child's chances of getting lead poisoning:						
Yes	*	6	7.5	63	78.8	
No		74	92.5	17	21.2	< 0.05
A diet with enough calcium helps prevent lead poisoning in children:						
Yes	*	7	8.8	67	83.8	
No		73	91.2	13	16.2	< 0.05

* Correct responses

Table 4.50- Peers' knowledge of physical and social consequences of childhood lead poisoning at pre- and- post-test.

Consequence	Pre-test (N=80)		Post-test (N=80)		P-value
	No	%	No	%	
Poor thinking processes:					
Yes *	19	23.8	77	96.2	< 0.05
No	61	76.2	3	3.8	
Inability to learn well:					
Yes *	13	16.2	79	98.7	< 0.05
No	67	83.8	1	1.3	
Anemia (or shortage of blood):					
Yes *	9	11.3	59	73.7	< 0.05
No	71	88.7	21	26.3	
Weak bone formation:					
Yes *	9	11.3	75	93.7	< 0.05
No	71	88.7	5	6.3	
Not growing well or growth					
retardation:	12	15.0	78	97.5	< 0.05
Yes *	68	85.0	2	2.5	
No					
Delayed puberty in girls:					
Yes *	10	12.5	79	98.7	< 0.05
No	70	87.5	1	1.3	
Kidney problems					
Yes *	13	16.3	78	97.5	< 0.05
No	57	83.7	2	2.5	
Hypertension					
Yes *	5	6.3	79	98.7	< 0.05
No	75	93.7	1	1.3	
Sickle cell (Sickler)					
Yes	70	90.0	27	33.8	< 0.05
No *	10	10.0	53	66.2	
Brain damage					
Yes *	8	10.0	79	98.7	< 0.05
No	72	90.0	1	1.3	
Damages to the nerves					
Yes *	9	11.3	78	97.5	< 0.05
No	71	88.7	2	2.5	

* Correct responses

Table 4.50- Contd.

Consequence	Pre-test (N=80)		Post-test (N=80)		P-value
	No	5	No	%	
Lead poisoning can cause behavioural problems in children:					
Yes *	18	22.5	73	91.2	< 0.05
No	62	78.5	7	8.8	
Children who have Lead in their body find it difficult to pay attention:					
Yes *	18	22.5	73	91.2	< 0.05
No	62	77.5	7	8.8	
Children aged between 6 months and 6 years should never be tested for lead until they are 8 years old:	70	87.5	11	13.8	< 0.05
Yes	10	12.5	69	86.2	
No *					

* Correct responses

Table 4.51- Knowledge scores of peer group at pre-and-post-test

Test period	N	Mean	SD	t-value	P-value
Overall mean scores:					
Pre-test (Peer group)	80	9.07	7.9		
Post-test (Peer group)	80	59.7	3.6	36.3	< 0.05
Peer group's mean scores by sex:					
Pre-test (Male Peer group)	20	10.9	9.9		
Pre-test (Female Peer group)	60	8.4	6.5	0.809	> 0.05
Post-test (Male peer group)	20	59.6	3.4		
Post-test (Female peer group)	60	59.8	3.7	0.150	> 0.05
Peer group's mean knowledge scores by education:				F-value	P-value
Pre-test (Grade 2)	3	5.3	2.3		
Pre-test (NCE)	58	12.3	9.6	0.70	> 0.05
Pre-test (B.Sc./B.Ed.)	19	10.3	8.6		
Post-test (Grade 2)	3	58.3	1.1		
Post-test (NCE)	58	59.6	3.8	0.35	> 0.05
Post-test (B.Sc./B.Ed.)	19	60.1	3.2		

4.4.4 Trained peers' perceptions relating to lead and lead poisoning

Table 4.52 shows trained peers' perception relating to lead poisoning in their LGAs at pre-and- post-tests. Twelve participants were of the perception that school children in their LGA's were exposed to lead poisoning at pre-test. The proportion of those with this perception significantly increased to 87.5% at post-test. Few (25) of the trained peers at pre-test and 97.5% at post-test were of the perception that only government could help prevent lead poisoning. the difference was however significant. At pre-test. only 18 participants disagreed with the perception that teachers have no role to play in lead poisoning prevention and control. At post-test however this rose to 95.5% with a significant difference (see table 4.52 for details).

The perceptions of trained peers relating to the roles of teachers in lead poisoning prevention at pre-and-post-tests are shown in table 4.53. Twenty-three participants at pre-test (28.7%) and 75 participants at post-test (93.7%) were of the view that teachers should educate children regarding lead. Only one participant at pre-test was of the view that teachers should send educative messages on lead poisoning to parents at home. This perception increased to 71.2% at post. At pre-test, none of the trained peers was of the perception that teachers should be involved in advocating for lead poisoning prevention and control programme, while at post-test 7.5% of them had this view.

Trained peers' perceptions relating to the roles of parents in lead poisoning prevention among children at pre-and-post-tests are shown in table 4.54. Only five participants at pre-test (6.25%) and 76.2% at post-test were of the perception that parents have a role to play in cultivating good habits and ensuring safe surroundings for children. None of the trained peers was of the perception that parents' role should include taking their children for blood lead testing. The proportion of those that had this perception increased to exactly half (50.0%) at post-test (see table 4.54 for details).

Table 4.55 shows trained peers' perceptions regarding the roles of government in lead poisoning prevention among school children at pre-and-post-test. At pre-test, only two participants were of the view that government should minimize further entry of lead into the environment, while at post-test; 70.0% shared this perception. The proportion of those with the perception that government should identify all children with excess lead exposure and prevent further exposure was very few (one) at pre-test (1.25 %), this proportion increased to 60.0% at post-test. Other perceptions of trained peers regarding the roles of government in lead poisoning prevention and control among school children are presented in table 4.55.

Table 4.52- Peers' perceptions relating to childhood lead poisoning at pre-and-post-test

Perception	Pre-test (N=80)		Post-test (N=80)		X^2	P-value
	No	%	No	%		
School children in this Local Government Area are not exposed to Lead poisoning:						
Agree	67	83.8	10	12.5		
Disagree	13	16.2	70	87.5	95.0	< 0.05
Lead poisoning is not a serious health problem among children in Nigeria:						
Agree	65	71.3	7	8.8		
Disagree	15	18.7	73	91.2	91.5	< 0.05
Lead poisoning is more serious in adults than children:						
Agree	74	92.5	3	3.8	133	< 0.05
Disagree	6	7.5	77	96.2		
Lead poisoning cannot occur in any of the primary schools in this LGA:						
Agree	61	76.3	9	11.3		
Disagree	19	23.7	71	88.7	92.2	< 0.05
Parents have no role to play in the prevention of Lead poisoning:						
Agree	57	71.2	3	3.8		
Disagree	23	28.8	77	96.2	83.2	< 0.05
Teachers have no role to play in the prevention of Lead poisoning:						
Agree	62	77.5	4	5.0		
Disagree	18	22.5	76	95.5	96.4	< 0.05
Only the government can prevent Lead poisoning:	55	68.8	2	2.5		
Agree	25	31.2	78	97.5	83.2	< 0.05
Disagree						
Parents, teachers and government cannot work together to prevent lead poisoning because such a cooperative effort cannot work in Nigeria:	64	80.0	3	8.8		
Agree	16	20.0	77	91.2	98.0	< 0.05
Disagree						
Only Doctors can help prevent lead poisoning:						
Agree	64	80.0	4	5.0		
Disagree	16	20.0	76	95.5	103	< 0.05
Lead poisoning can be prevented through immunization						
Agree	73	91.2	11	13.8	114	< 0.05
Disagree	7	8.7	69	86.2		

Table 4.53- Peers' perceptions relating to the roles of teachers in lead poisoning prevention among children at pre- and- post-test

Roles	Pre-test (N=80)		Post-test (N=80)	
	No	%	No	%
Teachers should educate children	23	28.7	75	93.7
Send educative messages on lead poisoning home to parents	1	1.25	57	71.2
Teachers should identify children that are displaying symptoms of lead poisoning	1	1.25	49	61.2
Teachers should educate school authorities	1	1.25	48	60.0
Teachers should watch over pupils in school	3	3.75	12	15.0
Advocate	0	0	6	7.5

Table 4.54- Peers' perceptions relating to the roles of parents in lead poisoning prevention among children at pre- and post-test

Role	Pre-test (N=80)		Post-test (N=80)	
		%	No	%
Build good habits and safe surroundings	5	6.25		76.2
Educate children about the dangers of lead	10	12.5	60	75.0
Take children for lead test	1	1.25	61	76.2
Taken basic steps to decrease their exposure to lead if their job involves working with lead or lead products	0	0	40	50.0
Advocating for lead prevention and control programme by forming advocate group	1	1.25	21	26.2
Monitoring their children	7	8.75	17	21.2
Immunization	0	0	0	0
Feeding children with good and balanced food	0	0	19	23.7

Table 4.55- Peers' perceptions relating to the roles of government in lead poisoning prevention among school children at pre- and post-test

Role	Pre-test (N=80)		Post-test (N=80)	
	No	%	No	%
Minimize the further entry of lead into the environment through regulations	2	2.5	56	70.0
Expand services that promote primary lead poisoning prevention and develop systems that enable clinicians and parents to learn about such services	18	22.5	66	82.5
Develop and implement strategies to encourage the safe elimination of lead hazards in properties	1	1.25	15	18.7
Identify all children with excess lead exposure, and prevent further exposure	1	1.25	48	60.0
Establish jurisdictional policies that mandate ensuring lead safety in housing and enforce these mandates	0	0	10	12.5
Develop and apply systematic approaches to prevent exposure to even small amounts of lead in food or consumer products	1	1.25	15	18.7
Promote implementation of state and local primary prevention plans that target areas, populations, and activities of highest risk	1	1.25	9	11.2
Expand the availability and promote the use of early enrichment programs for all children from families.	1	1.25	9	11.2
Promote and fund additional research	0	0	12	15.0

4.4.5 Trained peers' level of confidence in performing lead poisoning prevention and control tasks:

Trained peers' level of confidence in performing tasks related to lead poisoning prevention and control programme at pre-and-post-tests is presented in table 4.56, Only seven participants at pre-test perceived themselves very confident in educating parents of pupils about ways of preventing lead poisoning. At post-test, this proportion rose significantly to 93.7%. Nine participants perceived themselves very confident in advocating for school based lead prevention intervention at pre-test. At post-test, this perception rose significantly as almost all (95.5%) of the participants perceived themselves very confident in carrying out this task. Only nine participants at pre-test said they would be very confident in telling parents about the kinds of food that can help prevent lead poisoning, while at post-test this perception rose significantly as 87.5% had this level of confidence (see table 4.56 for details).

Table 4.56- Peers' level of confidence relating to lead poisoning prevention and control at pre- and post-test

Tasks and level of confidence executing it	Pre-test (N=80)		Post-test (N=80)		X^2	P-value
	No	%	No	%		
Educating parents about ways of preventing Lead poisoning:						
Not confident	64	80.0	0	0		
Confident	9	11.2	5	6.3		
Very confident	7	8.75	75	93.7	118	< 0.05
Counselling parents that childhood Lead poisoning can be treated:						
Not confident	56	70.0	2	2.5		
Confident	19	23.7	5	6.3		
Very confident	5	6.2	73	91.2	115	< 0.05
Telling School authority to be doing something to prevent Lead poisoning:						
Not confident	57	71.2	0	0		
Confident	15	18.7	4	5.0		
Very confident	8	8.8	76	95.0	119	< 0.05
Educating pupils about the sources of Lead poisoning:						
Not confident	57	71.2	0	0		
Confident	16	20.0	5	6.2		
Very confident	7	8.8	75	93.8	120	< 0.05
Discussing the consequences of Lead poisoning on children with parents of pupils:						
Not confident	60	75.0	2	2.5		
Confident	13	16.2	5	6.3		
Very confident	7	8.75	73	91.2	113	< 0.05

Table 4.56- Peers' level of confidence relating to lead poisoning prevention and control at pre- and post-test

Tasks and level of confidence executing it	Pre-test (N=80)		Post-test (N=80)		X^2	P-value
	No	%	No	%		
Educating parents about ways of preventing Lead poisoning:						
Not confident	64	80.0	0	0		
Confident	9	11.2	5	6.3		
Very confident	7	8.75	75	93.7	118	< 0.05
Counselling parents that childhood Lead poisoning can be treated:						
Not confident	56	70.0	2	2.5		
Confident	19	23.7	5	6.3		
Very confident	5	6.2	73	91.2	115	< 0.05
Telling School authority to be doing something to prevent Lead poisoning:						
Not confident	57	71.2	0	0		
Confident	15	18.7	4	5.0		
Very confident	8	8.8	76	95.0	119	< 0.05
Educating pupils about the sources of Lead poisoning:						
Not confident	57	71.2	0	0		
Confident	16	20.0	5	6.2		
Very confident	7	8.8	75	93.8	120	< 0.05
Discussing the consequences of Lead poisoning on children with parents of pupils:						
Not confident	60	75.0	2	2.5		
Confident	13	16.2	5	6.3		
Very confident	7	8.75	73	91.2	113	< 0.05

Table 4.56- Contd.

Task and level of confidence executing it	Pre-test (N=80)		Post-test (N=80)		X^2	P- value
	No	%	No	%		
Telling parents about the kind of food that can help prevent Lead poisoning:						
Not confident	56	70.0	7	8.8		
Confident	15	18.8	3	3.8		
Very confident	9	11.2	70	87.5	90	< 0.05
Telling parents about facilities where cases of Lead poisoning can be treated:						
Not confident	58	72.5	4	5.0		
Confident	14	17.5	4	5.0		
Very confident	8	10.0	72	90.0	102	< 0.05
Telling parents about health facilities where they can take the children for blood Lead test:						
Not confident	60	75.0	1	1.3		
Confident	13	16.2	2	2.5		
Very confident	7	8.7	77	96.3	122	< 0.05

4.4.6 School health services trained peers would or would not be promoting:

Table 4.57 shows school health services participants would or would not be promoting at pre-and-post-tests. Seventy seven participants at pre-test (96.2%) and 97.5% at post-test said they would be promoting routine school health services like first aid. Most participants (93.7%) at pre-test as well as all (100%) participants at post-test would be promoting health education to pupils. Seventy three participants at pre-test (91.2%) and 88.8% at post-test would be promoting school policies related to health generally. None of the trained peers at pre-test would be promoting school policies on lead in particular. This proportion however rose to 88.8% after the training (see table 4.57 for details).

Table 4.57- School health services peers would or would not be promoting at pre-and-post-test.

School health programming activities	Pre- test (N=80)		Post-test (N=80)	
	No	%	No	%
Routine health service like e.g. first aid:				
Yes	77	96.2	78	97.5
No	1	1.3	2	2.5
Not sure	2	2.5	0	0
Health education to pupils on personal hygiene:				
Yes	75	93.7	80	100
No	3	3.8	0	0
Not sure	2	2.5	0	0
School policies or guidelines related to health generally:				
Yes	73	91.2	73	91.2
No	3	3.8	6	7.5
Not sure	4	5.0	1	1.3
School policies on lead in particular:				
Yes	0	0	71	88.8
No	72	90.0	8	7.5
Not sure	8	10.0	1	1.3
School environmental sanitation activities:				
Yes	74	92.5	78	97.5
No	2	2.5	2	2.5
Not sure	4	5.0	0	0
Physical inspection of the personal hygiene of pupils:				
Yes	76	95.0	80	100
No	3	1.3	0	0
Not sure	1	1.3	0	0
Parents Teachers Association meet regularly to discuss health issues:				
Yes	74	92.5	80	100
No	1	1.3	0	0
Not sure	5	6.2	0	0

CHAPTER FIVE

5.0. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. The socio-demographic characteristic of the participants

A large proportion of the participants were females. This reflects the observation that teaching is increasingly becoming a female dominated profession. A previous study carried out among teachers in some selected primary schools in Lagos, Nigeria by Irene (2000), showed a similar trend with this study as there were more females than males. The age structure of the experimental and control groups reflect an adult population. This strengthened the need for the adoption of the adult education approach characterized by flexibility, free and open atmosphere and mutual respect during the training intervention. The choice of teaching methods such as discussion and socratic method (question and answer) was partly done to suit the adult population instead of the monotonous use of lecture method. Oshiname, (1999) adopted the same training methods of teaching which suited his study population who were adult Patent Medicine Vendors (PMVs) in a rural setting in Oyo State.

Majority of the participants in the experimental and control groups were NCE holders. This could be explained by the national minimum qualification for teaching in primary schools is the NCE (Federal Ministry of Education (FME), 2005). There are several colleges of education that produce NCE holders annually in Nigeria. The National Teachers' Institute based in Kaduna also runs part-time NCE programmes in all the states of Nigeria. These programmes have gone a long way in ensuring that the minimum manpower need of primary schools is addressed. This requirement therefore could have accounted for a large proportion of NCE holders among the experimental, control and trained peer groups. Even the Federal Ministry of Education stated as at 2002 that the proportion of teachers with NCE in primary schools was about half of the total teachers in Nigerian primary schools (FME, 2005).

5.2. Participants' level of awareness and knowledge regarding lead and lead poisoning

In the developing countries, including Nigeria the level of awareness and knowledge about lead has been found to be very low. Nriagu and colleagues (1996) for instance noted that most health workers have never heard about lead poisoning let alone the general population. The pre-test results of this study are a confirmation of the observation by Nriagu and colleagues.

Participants in the experimental and control groups in this study displayed low levels of awareness about lead and lead poisoning at pre-test. Irene's (2000) had a similar experience. She found a low level of awareness about lead and lead poisoning among teachers in some selected primary schools in Lagos, Nigeria. This low level of awareness may be a reflection of the level of awareness about lead and lead poisoning in the general population. The findings also corroborated those of Adebamowo et al (2006) who examined the knowledge, attitudes and practices relating to lead exposure in South Western Nigeria. They found a low level of awareness about lead and lead poisoning was reported by them.

As indicated in the findings of this study, the school was the major source of information about lead and lead poisoning among the experimental and control groups. The increases in teachers' knowledge and the modification of their perceptions and attitudes as found in this study will help to facilitate school based lead and lead poisoning education in the schools. The school is a strategic setting for upgrading pupils' level of awareness and knowledge about health issues. For instance, in a study done by Harvey, James and Tony, (2000) the school was used as a channel to raise students' awareness about HIV/AIDS in South Africa. Similarly, the school was also used in Santiago, Chile to raise the level of awareness regarding fertility among students (Seidman, Pilar, Hanna, Stan and Jeannette, 1995).

Comparative analyses of the mean knowledge scores of the experimental and control groups at pre-test showed that there was no significant difference in their mean knowledge scores. This signified that the two groups were comparable at baseline in terms of knowledge about lead and lead poisoning. Shuey, Bernadette, Samuel and Henry, (1999) reported a similar trend in knowledge between their experimental and control groups' pre-test scores in a study they conducted to determine the effects of school health education among in-school adolescents on sexual abstinence in Soroti district, Uganda.

This baseline knowledge scores for the experimental and control group served as the basis for tracking any changes in knowledge in the two groups which could be attributable to the training intervention. There were some areas in which the experimental group had higher correct responses than the control and vice-versa at pre-test. This however cannot be regarded as unusual as no two groups, like individuals, are exactly alike in all respects (Oshiname, 1999). The baseline knowledge at pre-test however proved advantageous as it constituted the starting point for teaching the issues and concepts the teachers were not familiar with in terms of lead and lead poisoning. This way the training programme progressed from known to the unknown issues.

Gender and educational qualification were not determinants of the level of knowledge regarding lead and lead poisoning among the teachers at pre-test and post-test. This is evident from the comparison of the mean knowledge scores by sex and by education respectively in the experimental and control groups. The teachers in the study had almost the same highest level of education. Level of education therefore played no role in this baseline knowledge. A study conducted in Chicago, USA, however showed that educational qualification was a determinant of the level of knowledge regarding lead and lead poisoning among parents (Mehta and Helen, 1998). This can happen when the populations concerned are of different levels of education.

A comparison of the mean knowledge scores of the experimental and control groups at post-test, showed a significant difference between the experimental and control groups. It could therefore be argued that the increase in knowledge among the experimental group was because it was selectively exposed to training. Various studies (Okonofua, Coplan, Collins, Oransaye, Ogunsakin, Ogonor, Kaufman and Heggenhougen, 2003; Ajuwon et al, 2007 and Oshiname and Brieger, 1992) across the world which adopted the quasi-experimental design of this sort yielded this pattern of knowledge gain reported among the experimental and control groups at post-tests.

The comparison of the mean knowledge scores at pre-test and post-test within the experimental and control groups indicated a significant difference only in the experimental group. This is to be expected. After the pre-test, the experimental group was exposed to training and this intervention increased their knowledge about lead and lead poisoning. Similar results were obtained by, Strange, Forrest and Oakley, (2002) who conducted a study to assess the effects of a peer-led sex education training intervention on participants' knowledge and attitudes relating to sexual health issues and their perceptions of the impact of the peer education programme on them. They observed a significant difference in the pre-test and post-test scores of the experimental group only.

In this study no significant change was recorded for the control whereas both groups, experimental and control, had similar demographic characteristics and other characteristics capable of influencing knowledge acquisition. Diffusion of information from the experimental to the control group was prevented by selecting two similar settings that were reasonably far apart geographically. The two groups were also assumed to have been exposed to similar external factors that would have influenced their knowledge regarding lead and lead poisoning prior to intervention.

5.3. Participants' perceptions relating to lead and lead poisoning

Participants' perceptions relating to lead and lead poisoning were compared at baseline between the experimental and control groups. The comparison showed that the two groups had similar perceptions at baseline judging by the proportions of participants with the right and wrong perceptions at pre-test. This ensured proof of the comparability of the two groups at pre-test. Moyer and Nath, (2006) similarly had this experience. The perception that children in the two study locations were not exposed to lead poisoning by the experimental and control groups at pre-test corroborated Mahon's findings (1997) in Philadelphia USA. The respondents in her study did not perceive children to be exposed to lead poisoning in any way either.

On comparing the proportion of correct perceptions between the experimental and control groups at post-test, relating to lead poisoning it was noted that majority of the participants in the experimental group had the right perceptions as against the control group. This observation corroborated what Dreyer (2001) found in an intervention aimed at assessing the effect of training on teachers' perceptions of violence against women in

South Africa. Dreyer noted that there was a change in perception after exposure to a training intervention.

Moyer and Nath, (2006) have also noted that training is effective in influencing perceptions. The results of this study have demonstrated once again the positive effects of training on people's perception of phenomena. The significant change in perception could be explained by the tenets of the HBM. The experimental group's level of knowledge regarding lead and lead poisoning was increased significantly due to their selective exposure to the training intervention. The increase in their level of knowledge in turns had modifying effects on their perception of vulnerability, threat and severity of lead poisoning in children. The resultant effects of positive changes in perception often lead to the adoption of preventive behaviours (Rosenstock, 1991). The willingness of the experimental group to conduct a similar training programme for the benefits of their peers undoubtedly resulted from their changed perceptions during the training, relating to consequences of childhood lead poisoning and the roles which teachers can play in mitigating the impact of childhood lead poisoning in school settings. Kardamanidis, Lyle and Boreland, (2008) in their study at Broken Hill, Australia reported that the uptake of lead poisoning control and the adoption of preventive health behaviours is largely determined by perception of susceptibility, threat and severity of lead poisoning.

5.4. Participants' level of confidence in performing lead poisoning prevention and control tasks

Self-efficacy is a measure of the level of confidence in performing a particular task (Tschannen-Moran, Hoy and Hoy, 1998). The HBM explains the role of self-efficacy in the uptake of preventive health behaviour. Perceived self-efficacy is a prospective and operative construct (Bandura, 1997). Various strategies including training with special focus on role- modeling technique have been employed in the past to upgrade people's level of confidence in performing tasks (Shuguang and Van de Ven, 2003). In this study, the outcome of training intervention on participants' reported levels of confidence in performing lead poisoning prevention and control tasks were also assessed.

On comparing the level of confidence among the experimental and control groups at pre-test, it was noted that there was no significant difference in the proportion of those that perceived themselves very confident in performing these tasks at pre-test. What can be concluded from this is that the two groups were similar regarding their self-efficacy at baseline. Miles and Huberman, (1984) reported a similar development in the level of confidence between their experimental and control groups at baseline. At post-test there was a marked increase in the proportion of those that perceived themselves very confident at performing lead poisoning prevention and control tasks among the experimental group, compared to very few in the control group. Sterling et al (2000), whose work focused on lead abatement training for underserved population also noted that training intervention was effective in increasing trainees' ability to perform certain skills.

These vast changes in the proportion of those that perceived themselves very confident in performing tasks relating to the prevention and control of lead poisoning could be explained by the knowledge and skills acquired by the participants in the experimental group during the training intervention, which was facilitated by means of role-play and other active teaching methods. The role modeling technique however could be seen to be effective in enforcing skill mastery. This finding corroborated the experiences of Schwoerer, May, Hollensbe and Mencl, (2005) that training could be effective in increasing trainees' level of self-efficacy in performing tasks.

Perceived benefits of a preventive health behaviour and self-efficacy in term of level of confidence have been reported to be inextricably linked to the execution of skill related tasks as shown by Bland, Kegler, Escoffery and Malcoe (2005), in their study on "Understanding childhood lead poisoning preventive behaviour: the roles of self-efficacy, subjective norms and perceived benefits".

5.5. Impact evaluation of the training intervention

In order to measure the impact of the training intervention on the experimental group, trainees were requested right from the beginning of the training to come up with an intervention they could carry out on their own using their own resources in their various schools. The consensus of opinion among the experimental group was that they would train their peers using the curriculum used in training them. The strategy is akin to the training of trainers approach often used in health promotion and education programme (Ajuwon, 2000). If well designed trainers (in this study, the teachers that have been trained by the investigator) can carry out a stepped-down training intervention targeted at other populations as Ajuwon and his colleagues did (Ajuwon et al, 2008). The trained teachers planned and implemented the training programme between June and August, 2008. The successful execution of the training for their peers was an index of their competence or self-efficacy concerning the design and implementation of lead poisoning related control interventions. In addition, the training executed by the teachers for their peers could be said to be indicative of their acquisition of planning and implementation skills within the context of training interventions to mitigate the effects of lead poisoning in schools settings.

There were significant differences between the trained peer group's mean knowledge scores at pre-test and post-test. The significant change in the trained peer group's pre-test and post-test scores was due to the training they received from their colleagues. The pattern of increase in knowledge at post-test following the training intervention for the teachers is similar to what has been observed in previous studies. Ajuwon et al, (2008) in their study which involved a peer education approach to the promotion of the use of HIV/AIDS Voluntary Counseling and Testing centres in Ibadan Nigeria noted that the approach was effective in increasing the knowledge of others. O'Donogue, (1996) also reported similar knowledge gain among the trained peers in his training of trainers approach for teachers in Zimbabwe on the prevention of HIV/AIDS.

Regarding the impact of this training intervention on their peers' perceptions, there were significant increases in the proportions of those with the right perceptions compared with wrong ones from pre-test to post-test. Training of trainers approach has been reported to be effective in correcting misconceptions (O'Donogue, 2002; UNICEF Ghana, 2002).

There were also significant changes in the proportions of the trained peers that considered themselves very confident in performing lead poisoning prevention and control tasks. This could be explained by the ability of the trained teachers to transfer their leant skills regarding lead poisoning prevention and control to their peers. This finding corroborated what Matick-Tyndale, Wildish and Gichuru, (2007) found in their study that focused on a quasi-experimental evaluation of a national primary school HIV intervention in Kenya. They reported increased self-efficacy related to abstinence and condom use among the trained peers.

5.6. Implications of findings for Health Promotion and Education.

The implications of the findings of this study for future health promotion and education activities are presented in this sub-section. Firstly, the findings of this study have implications for public enlightenment. The level of awareness and knowledge of lead and lead poisoning was found to be very low among the study population (experimental, control and even among the trained peers) at pre-test. The proportions of wrong perceptions associated with lead and lead poisoning were also high at pre-test among all the groups. There is therefore a need for large scale public enlightenment campaigns using the multi-media approach to reach various segments of the population about lead and lead poisoning. This has been recommended by Adebamowo, (2005). In Nigerian communities teachers are often the most enlightened citizens. So what can be deduced from the teachers' misconceptions about lead is that the larger population would also be characterized by wrong perceptions of lead.

Secondly a school health programme is said to be one of the most effective and efficient strategies that a nation might use to prevent major health and social problems (WHO, 2009). Apart from the family, schools create opportunities for providing health instructions and experiences that prepare young people for their roles as healthy and productive adults (Allenswort, Lawson, Nicholson and Wyche, 1997). The Ido schools, and of course the Nigerian schools at large, are channels that can be used for the dissemination of information related to childhood lead poisoning.

Teachers can help improve pupils' knowledge about lead poisoning. The education received by pupils could be put to practical applications by the time they become adults. Schools can and invariably do–play a powerful role in influencing students' health-related behaviors. These included behavours related to lead poisoning and prevention. Appropriate school interventions can foster effective education, prevent destructive behavior, and promote enduring health practices. For many young people in their formative years, the school may, in fact, be the most nurturing and supportive environment where they acquire factual health information as well as positive behaviors (Education encyclopedia, 2009). The outcome of this study showed that before the school can be used to upgrade pupils' knowledge about lead poisoning the teachers in the schools should be empowered on lead and lead poisoning prevention and control. Therefore elements of lead poisoning prevention and control should be infused into the various components of the school health programmes in primary schools.

Although at pre-test, majority of the participants (experimental, control and trained peers) claimed that school health policies exist in their schools, none was aware of the existence of school-based policies on lead and lead poisoning. This implies that there are no guidelines of any sort by the school authorities regarding the prevention and control of lead and lead poisoning in the schools that were involved in the study. The formulation of school policies relating to childhood lead poisoning is therefore crucial. The policies that a school develops represent its values (Naidoo and Wills, 2000). The health of pupils in the schools that were involved in the study should be seen to reflect the core values in words and deeds. Policies may however be constituting a paper exercise unless they have been influenced by wide consultation within the school and community, have been clearly written and disseminated and are consistently applied (Allenswort, 2009). Within the context of lead poisoning prevention and control however, there should be adequate consultation between the schools and the community and the educational authorities to formulate specific policies aimed at reducing pupils' exposure to lead in the school environment.

Inadequate nutrition has been reported to increase the toxicity and effects of lead poisoning in children (Meyer et al, 2003; Wright et al, 2003; Mahaffey 1995; Mahaffey, 1986). This training intervention has enhanced teachers' capacity in terms of their knowledge of the role of nutrition in the amelioration of the effects of lead poisoning in children. The mid-day meal policy of the federal government if implemented well constitutes an opportunity of educating and counselling pupils about the ameliorating effects of appropriate diet on lead poisoning. The mid-day meal programme can also be used as an opportunity for reaching parents about food nutrients that help to mitigate the effects of childhood lead poisoning. According to the Nigerian National Demographic

Health Survey, 38.0% of children are stunted while 29.0% of under-five are malnourished (NPC, 2004; NDHS, 2003). These are conditions that can increase the rate of lead absorption into the body (Bruening, 1999).

School health services provided for students should be designed to appraise, protect, and promote their health (Anderson and Piran, 1999). What can be deduced from this is that school health services should entail protecting school children from lead poisoning through the elimination of sources of lead poisoning in the school environment. Findings from this study showed that first aid services constitute the main school health services available in most primary schools from which the teachers were recruited. This is an aberration. Other school health services should be included. Schools in other countries of the world such as in the USA have introduced lead poisoning prevention and control services as part of their school health services (YNHTI, 2007a). Therefore services relating to lead poisoning prevention and control, like environmental management, inspection of waters, food and food products for lead, screening, treatment and management of lead poisoned pupils should be infused into the routine school health services in Nigerian pre-and primary schools.

A majority of the participants (experimental, control and trained peers) give health education on personal hygiene to pupils. Lead poisoning education is not part of this several educational services. The health education activity is an opportunity for other health issues including lead poisoning to be discussed. According to the American National Association of State Board of Education (ANASBE), school health education is a planned and sequential curriculum taught daily in schools which addresses the physical, mental, emotional, social, and spiritual dimensions of health. It is designed to motivate and help students maintain and improve their health, prevent disease, and avoid health-related risk behaviors. A good quality curriculum allows students to develop and demonstrate increasingly sophisticated health-related knowledge, attitudes, skills, and practices (ANASBE), 2009). Elements of lead and lead poisoning prevention and control should be infused into the primary school curriculum so that pupils will also be exposed to information regarding lead and lead poisoning. Other non-teaching staffs like the gardeners, cleaners and food vendors should also be exposed to lead prevention education with a view to avoiding work practices that might expose pupils to lead and lead poisoning.

Majority of the participants in all the groups reported their willingness to be involved in environmental sanitation activities at pre-test and post-test. The school environment should be made safe for pupils with special reference to lead poisoning prevention and control. These should include the promotion of activities like planting grasses on children playground, not painting the play ground materials with lead-based paints, washing of school window sills, furniture and the classroom floors with soap and water always all of which will make the school environment safe for school children. All health promoting behaviours (Allenswort, 2009) should be backed up by evidenced based school health policies.

Another major implication of the findings of this study is the need for teacher training and development. According to the FME, (2005) the professional development of teachers has been a knotty issue in education as there appears to be very few opportunities for teachers to upgrade their skills on the job. Most teachers indicated that they had not received any training on lead poisoning prevention and control. The results of this study have attested to the importance of staff development with special reference to positive changes in perception and increases in knowledge about lead poisoning. In order to ensure effective school health programming regarding lead poisoning prevention and control, there is a need for staff developmental programmes. The training should be scaled up by either replicating the training among teachers in other schools in the LGA or made part of a continuing education for practicing teachers. Creative approaches should however be designed to overcome this. Elements of lead poisoning prevention and control should be infused into teacher training curriculum as a pre-service training.

This study has shown that the school is a viable source of information regarding lead and lead poisoning using the teachers as channels of information. Teachers could be motivated to promote school-community involvement in lead control. Schools are part of a wider community. Schools and communities should always be encouraged to respond more effectively to the health-related needs of students (Anderson and Piran, 1999) including lead poisoning. School children constitute a captive audience that can in-turn serve as channels for reaching their peers and parents with lead poisoning prevention and control information.

The training was the first major programme teachers in the study location had ever experienced on lead poisoning prevention and control. There is dearth of information relating to the use of training of trainers approach involving teachers in Nigeria. The data obtained, procedures and approaches used can thus be adopted for planning, implementing and evaluating similar lead poisoning prevention and control training programmes. The training process also helped in inculcating leadership spirit or qualities in the trainees as exemplified by their involvement in planning and organizing roles during the training programme and at follow up.

Various lessons have been learnt from the training intervention which could be employed to improve the quality of future training programmes in a rural setting. In other to make a training programme of this sort to be successful in rural settings like Ido LGA where communities are farther apart, there should be provision for transportation and feeding allowances for the participants; this has potential for increasing attendance rate.

5.7. Conclusion and Recommendations

The level of knowledge relating to lead poisoning among teachers in Ido LGA prior to training intervention was low prior to intervention. This also applied to their level of confidence in implementing lead poisoning prevention and control activities. Misconceptions relating to lead poisoning were also noticeable in all the teachers that participated in the study, prior to the intervention. The training programme was found to be effective not only in upgrading the experimental group's knowledge of lead poisoning but was also effective in modifying their perceptions and enhancing their level of confidence in designing lead poisoning-related activities.

Based on the immediate outcome evaluation involving the comparative analyses within and between groups, it could be stated that it was the implemented training programme that led to the observed changes in the knowledge, perceptions and self-confidence in the experimental group of teachers. The experimental group was able to plan and successfully implemented a training programme for their peers in their various schools. The success of the training conducted by the teachers for their peers is evident in the following outcomes: the level of knowledge of their peers regarding lead poisoning was increased; the peers' misconceptions related to lead poisoning were modified; the level of confidence of the peers in designing school based lead poisoning control activities was enhanced.

The lack of significant change in knowledge, perception and confidence in the control group of teachers is a further demonstration of the positive effects of the training intervention only on the intervention group of teachers.

Recommendations

1. The training intervention was effective in increasing the level of knowledge, correcting wrong perceptions and upgrading level of confidence of teachers in performing lead poisoning prevention and control tasks in schools. The training intervention should therefore be scaled up to include all the schools in the LGA.
2. Childhood lead poisoning prevention and control programmes should be incorporated into the school health programmes of primary schools in the LGA; this way, pupils would be involved in school-based lead poisoning prevention and control as part of curricular and co-curricular activities.
3. The study showed that the level of awareness about lead poisoning is low among the participants, which is an indication of the level in the general population. Therefore massive public enlightenment regarding lead poisoning should be carried out in Ido LGA using multi-media and multiple intervention approaches.
4. The school should be empowered to effectively carry out lead poisoning prevention and control activities. As indicated in the findings of this study, the school was the major source of information about lead and lead poisoning among the experimental and control groups. The increases in teachers' knowledge and the modification of their perception and attitudes as found in this study will help to facilitate school based lead and lead poisoning education in the schools.

5.8. Area for further research

There is dearth of information relating to parents level of knowledge, perceptions and self-efficacy needed for preventing childhood lead poisoning in the LGA. A study is needed to probe into this area. This is necessary because the success of a school-based lead poisoning prevention and control programme is a function of the involvement of parents and meaningful involvement of parents will be influenced by their level of knowledge and perceptions of the disease condition.

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Appendix 1- List, characteristics and locations of schools in Ido LGA

S/N	Name of school	Year of establishment	Age of school	No of teachers	Location
1	Nawar- Udeen primary school	1958	49	17	Ido
2	St Peter's Apete 1	1942	65	17	Apete
3	St Peter's Apete 2	1942	65	14	Apete
4	St Peter's Apete 3	1942	65	11	Apete
5	St Peter's Apete 4	1942	65	8	Apete
6	Islamic primary school 1	1955	52	18	Omi
7	Islamic primary school 2	1994	13	13	Omi
8	Islamic primary school 3	2006	1	11	Omi
9	Hope central primary school 1	1953	41	18	Omi-adio
10	Hope central primary school 2	2006	1	9	Omi-adio
11	St Peters Anglican Primary school.	1925	82	8	Erinwusi
12	C.A.C	1937	70	4	Langbin-Koguo
13	Baptist primary school	1945	62	9	Odetola
14	St John's primary school	1920	87	10	Omi-Onigbagbo
15	St Mathew's primary school	1916	91	10	Akufo
16	St Paul's primary school	1918	89	6	Iyana Ideki
17	Methodist primary school	2000	7	9	Ayegun-odan
18	Community primary school 1	1992	15	16	Ojimi
19	Community primary school 2	2006	1	14	Ojimi
20	Comm. School primary school 2	2006	1	11	Olu-Ode
21	St Andrews primary school	1931	76	21	Omi
22	Baptist primary school	1934	73	5	Ateere
23	Ido community primary school	1955	52	6	Siba

24	St John's primary school	1934	73	5	Akindele
25	Comm. Primary school	1979	28	2	Onisago
26	St Jame's school	1940	67	4	Ogundele
27	St Pauls school	1944	63	5	Araromi ido
28	St Pauls school	1953	54	4	Oladimeji
29	I.D.C. school	1941	66	28	Erinkoja-obe
30	S.D.A School	1930	77	5	Onikonko
31	St Jame's school	1951	56	20	Idi-iro
32	I.D.C School	1954	53	11	Aba-oke
33	Christ Ang School	1918	89	18	Bakatari
34	I.D.C School	1955	52	5	Onidoko
35	I.D.C School	1955	52	6	Idi-iya
36	I.D.C School	1955	52	5	Okunawo
37	St John's	1920	87	10	Omi-onigbo
38	N.U.D school	1945	62	4	Onigbinde
39	St John's	1930	77	4	Odefemi
40	I.D.C	1956	53	8	Idi-Ahun
41	C.A.C school	1959	48	4	Larayo
42	St john's	1955	52	4	Aba-oke
43	Anwar-ul-islamic school	1955	52	5	Akinware
44	I.D.C Schoool	1955	52	8	Iyana Idere
45	I.D.C School	1956	51	4	Ajubo-ido
46	St Peter's	1964	43	4	Batake
47	St Mark's	1966	41	12	Bode-igbo
48	St James's	1970	37	4	Elesin-funfun
49	I.D.C Sch	1945	62	6	Olokogbero
50	I.D.C Sch	1955	52	4	Ogunsami
51	St John's	1938	69	4	Fenwa

52	Baptist sch	1910	97	13	Oganla
53	Islamic sch	1955	52	3	Fasan
54	I.D.C Sch	1956	51	16	Awotan
55	I.D.C Sch	1952	55	4	Alajata
56	C.A.C	1950	57	6	Okulu
57	A.D.S sch	1955	52	6	Idi-amu
58	I.D.C Sch	1955	52	5	Seeni
59	I.D.C Sch	1955	52	4	Tola
60	St James's	1938	69	5	Agelu
61	I.D.C Sch	1955	52	2	Aba-Eemo
62	St James's	1956	51	6	Ilaju
63	Comm. Sch	1979	28	14	Lasokun
64	Comm. Sch	1980	27	2	Onifuufu
65	Comm. Sch	1985	22	12	Akufo F/S
66	Comm. Sch	1987	20	11	Olomiloro
67	Comm. Sch	1992	15	6	Alakasa
68	Comm. Sch 1	1992	15	19	Oluode
69	Comm sch	1999	8	9	Bako
70	Methodist sch	2000	7	9	Ayegun Odan
71	Comm. Sch	1999	8	2	Oloruntedo
72	Comm. Sch	2000	7	6	Adejare
73	Comm. Sch	1999	8	3	Abule- Ayo
74	Comm. Sch	2000	7	17	Gbekuba
75	Comm sch	2001	6	4	Tola Omuremi

52	Baptist sch	1910	97	13	Oganla
53	Islamic sch	1955	52	3	Fasan
54	I.D.C Sch	1956	51	16	Awotan
55	I.D.C Sch	1952	55	4	Alajata
56	C.A.C	1950	57	6	Okulu
57	A.D.S sch	1955	52	6	Idi-amu
58	I.D.C Sch	1955	52	5	Seeni
59	I.D.C Sch	1955	52	4	Tola
60	St James's	1938	69	5	Agelu
61	I.D.C Sch	1955	52	2	Aba-Eemo
62	St James's	1956	51	6	Ilaju
63	Comm. Sch	1979	28	14	Lasokun
64	Comm. Sch	1980	27	2	Onifuufu
65	Comm. Sch	1985	22	12	Akufo F/S
66	Comm. Sch	1987	20	11	Olomiloro
67	Comm. Sch	1992	15	6	Alakasa
68	Comm. Sch 1	1992	15	19	Oluode
69	Comm sch	1999	8	9	Bako
70	Methodist sch	2000	7	9	Ayegun Odan
71	Comm. Sch	1999	8	2	Oloruntedo
72	Comm. Sch	2000	7	6	Adejare
73	Comm. Sch	1999	8	3	Abule- Ayo
74	Comm. Sch	2000	7	17	Gbekuba
75	Comm sch	2001	6	4	Tola Omuremi

Appendix 2- List of schools selected as experimental group in Ido LGA

SN	Rural schools	Semi-urban schools	Urban schools
1.	St Mathew Primary school Akufo	Community Primary school 2 Ojimi	St Peters Primary school 1
2.	Baptist Primary school Onikede	Community Primary school Akufo Farm settlement	St Peters Primary school 2
3.	Nawair Udeen Primary school Ido	Hope Central Primary school 1	St Peters Primary school 3
4.	I.D.C. Erinkojaobe	Hope Central Primary school 2	St peters Primary school 4
5.	I.D.C. Abaoko	Islamic Mission Primary school 2	I.D.C. Awotan

Appendix 3- List of schools selected as control group in Egbeda LGA

SN	Rural schools	Semi-urban schools	Urban schools
1.	I.D.C Primary school Bodunde	Ayepe Community Primary school 1	Primary school 1 Olubadan
2.	Nawar-udeen Primary school Baale Egbeda	Ayepe Community Primary school 2	Primary school 2 Olubadan
3.	St Paul's Anglican school Egbeda	Ayepe Community Primary school 3	Primary school 3 Olubadan
4.	St John's Primary school Oluwo	Community Primary school 1 Efun Ola-Ogun	Community Central Primary school 1 Olode
5.	Adewolu/Ifesowapo Community Primary school	Community Primary school 2 Efun Ola-Ogun	Community Central Primary school 2 Olode

Appendix 4- Names of the 30 teachers nominated to constitute the experimental group

SN	Name	Sex	Name of school
1.	Orokunle Sunday O.	Male	Community Primary school Farm settlement Akufo
2.	Ola O.S.	Male	Ido Community school Awotan
3.	Adewunmi M.T.	Female	St Peters School 3 Apete
4.	Fakunle M. O.	Female	St Peters School 3 Apete
5.	Ogunfowora B.O.	Female	Community Primary school Farm settlement Akufo
6.	Dominic Adeyemi	Male	Ido community primary school Erinkojaobe
7.	Ogunjimi F.O.	Female	Hope central school 2 Omi Adio
8.	Olatunji A.P	Male	Hope central school 2 Omi Adio
9.	Comm. Salako	Female	St Peters School 1 Apete
10.	Lawal J.O.	Female	St. Mathew Primary school Akufo
11.	Olayinka E.A.	Female	St. Mathew Primary school Akufo
12.	Morakinyo J.O.	Male	Baptist School Onikede
13.	Samson G.	Female	St Peters School 2 Apete
14.	Ajao D.O.	Male	Nawar udeen Primary school Ido
15.	Olatunji O.O.	Female	Ido community school Abaoko
16.	Akinrinola A.G.	Female	Ido community school Abaoko
17.	Com. Ganiyu A.T.	Male	St Peters School 4 Apete
18.	Olatayo Basira.A.	Female	St Peters School 4 Apete
19.	Mr. Olateju J.O.	Male	Hope central primary school 1
20.	Orisasona D.F.	Female	St Peters School 1 Apete
21.	Bolarinwa I.O.	Female	Hope central School 1 Omi Adio
22.	Ogunsile C.M.	Female	St Peters School 2 Apete
23.	Ermis O.L.	Female	Islamic School 2 Omi Adio
24.	Adeoti M.B.	Female	Ido Community Primary school Awotan
25.	Idowu Foluke	Female	Nawar udeen Primary school Ido
26.	Olatunji Bamidele	Male	Islamic School 2 Omi Adio
27.	Akinola R.F.	Female	Baptist School Onikede
28.	Oguntunde L.O.	Male	Community primary school 2 Ojimi
29.	Adebanji Oluremi	Female	Community primary school 2 Ojimi
30.	Ogunwale F.O.	Female	Ido community primary school Erinkojaobe

Appendix 5 – Sample of pre-and-post-test questionnaire

OUTCOME OF TRAINING INTERVENTION ON TEACHERS' KNOWLEDGE, PERCEPTION AND SELF-EFFICACY FOR PREVENTING CHILDHOOD LEAD POISONING IN IDO LGA, OYO STATE.

Introduction

I am **Karunwi Abayomi** a postgraduate student of public health at the University of Ibadan. I am carrying out a study which focuses on teachers' perception relating to lead and Lead poisoning. I would like to assure you most sincerely that whatsoever you put down in this questionnaire will be kept confidential. Let me stress that this is not an examination or a test. Your participation in this study is not compulsory either, one can even withdraw from participating anytime without any penalties.

Your school authority and the Oyo state Ministry of education or anyone else will not be allowed to have access to your completed questionnaire. Feel free to complete this questionnaire as honestly as possible. If any question is not clear to you please feel free to let me know.

Thank you.

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For office use only

Registration code
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For most of the questions in this section, please tick (√) the appropriate alternative response(s); in some cases simply supply the needed information in the blank spaces provided.

SECTION A

Socio-Demographic information

1. Age (in years) as at last birthday ________________
2. Sex (1) Male ☐ (2) Female ☐
3. Marital Status (1) Married ☐ (2) Never married ☐ (3) Divorced ☐ (4) Widowed ☐
4. Highest educational qualification (1) Grade 1 ☐ (2) Grade 2 ☐ (3) NCE ☐ (4) OND ☐ (5) HND ☐ (6) B.SC/BA/BEd ☐ (7) PGDE ☐ (8)Others ________
5. Field of specialization(subject majored in) ________________________________
6. How many years of teaching experience do you have? __________

7a. What class do you teach now? _________ 7b. Estimated average age of class taught ____________

8. List the subjects which you currently teach at your school (1) ________ (2) ________ (3) ________ (4) ________ (5) ________ (6) ________ (7) ________ (8) ________ (9) ________ (10) ________
9. Does your school have a PTA? (1) Yes ☐ (2) No ☐ (If No go to question 11)
10. If yes is it functional (i.e. meet regularly) (1) Yes ☐ (2) No ☐

SECTION B

Level of Awareness about Lead and Lead poisoning.

(Tick (√) the appropriate response or simply supply the needed information in the spaces provided (tick √ all that are your sources)

11. Have you ever heard about "Lead"? (1) Yes ☐ (2) No ☐ (if No go to question 15)

12. If yes to question 11 above, from which of the following have you ever heard about "Lead" (tick (√ or fill) all that are your sources)

SN	Sources of information	(tick (√ or fill)
a.	While in School as a student	
b.	Newspaper	
c.	Journal	
d.	Books	
e.	Radio	
f.	TV	
g.	Training workshop organized by a trainer from UCH College of medicine University of Ibadan	
h.	Others(specify)	

13. If Yes to question 12 above from which of the following sources have you ever heard that Lead can affect people's health? (Tick (√) all that applies)

SN	Sources of information	(tick (√ or fill)
a.	While in School as a student	
b.	Newspaper	
c.	Journal	
d.	Books	
e.	Radio	
f.	TV	
g.	Training programme organized by a trainer from UCH College of medicine University of Ibadan	
h.	Others (specify)	

14. Have you ever attended a training workshop or seminar on Lead poisoning apart from the one you just participated in? (1) Yes ☐ (2) No ☐

SECTION C

Knowledge about Lead

15. The table below contains a list of statements about lead. For each tick (√) whether it is True, False or whether you are not sure/ do not know:

SN	Statement	Tick (√)		
		True	False	Not sure/ do not kn
a.	Lead is a metal			
b.	A pregnant woman with Lead in her body can pass it to the unborn baby.			
c.	Only children between the ages of 1 -6 years are most likely to ingest Lead			
d.	Older children get Lead poisoning more often than younger children			
e.	No amount of Lead in the body is safe for children and adults			
f.	Lead can harm people of any age			
g.	Lead poisoning can cause digestive problems			
h.	A child can look fine yet he/she has been harmed by lead			

16. Which of the following is the limit of the blood Lead concentration allowed by the World Health Organization (Tick (√) only one)

a. 9 μg/dl ☐
b. 10 μg/dl ☐
c. 20 μg/dl ☐
d. 15 μg/dl ☐
e. I do not know ☐

17. Which of the symptoms in the table below may be suggestive of lead poisoning in a child of primary school age? (For each symptom tick (√) Yes, No or Do not know)

SN	Symptoms	Tick (√)		
		Yes	No	Do not know
a.	Headache			
b.	Irritability(restlessness)			
c.	Sleeplessness			
d.	Constipation			
e.	Stomach ache			

18. The table below contains statements about the **screening and treatment** of Lead poisoning in children. (For each symptom tick (√) correct or Incorrect or whether you do not know)

SN	Statement	Tick (√)		
		Correct	Incorrect	Do not know
a.	The only way of knowing if a child is suffering from Lead poisoning is by feeling a child's body temperature.			
b.	The Only way of knowing if a child is suffering from Lead poisoning is by screening for Lead in the child's blood			
c.	The test for identifying cases of Lead poisoning in children is by testing their urine			
d.	The treatment for Lead poisoning is by using chelating agents			

19. List four possible sources of Lead poisoning in a primary school environment.

(1) ______

(2) ______

(3) ______

(4) ______

20. The table below contains statements relating to sources of Lead (For each tick (√) which is correct, incorrect or whether you do not know

SN	Statement about Lead	Tick (√)		
		Correct	Incorrect	Do not know
a.	Some kinds of paints used for houses in Nigeria contain Lead			
b.	Newly painted houses readily make children to get Lead than older ones.			
c.	Asbestos used for ceiling houses contains Lead.			
d.	Children cannot get exposed to Lead when they inhale dust which contains Lead.			
e.	Artisans who repair, renovate or reconstruct houses can unknowingly take Lead home in their hands, shoes and cloth to children.			
f.	The liquid used by carpenters for polishing furniture contains Lead			
g.	Children cannot be poisoned by playing with toys or old furniture which may have lead paint			

21. Which of the categories of workers listed in the table below can unknowingly take Lead home from their workplaces. For each tick (√) whether **True, False** or **do not know**

SN	Categories of worker	Tick (√)		
		True	False	Do not know
a.	Plumbers			
b.	Brewery workers			
c.	Farmers			
d.	Mechanics			
e.	Battery chargers			
f.	Painters			

22. Which component (s) of a car can release (or contain) some Lead? Tick (√) all that you consider correct.

a. Air conditioner ☐
b. Exhaust from car ☐
c. Engine oil ☐
d. Car battery ☐
e. Car brake fluid ☐

23. For each of the following statements in the table below Tick (√) whether it is True, False or Do not know.

SN	Statement	Tick (√)		
		True	False	Do not know
a.	It is not possible for children to ingest Lead when they put their hands stained with soil or dust into their mouths because Lead is not found in soil			
b.	A child can ingest Lead after touching a powdery wall and then eat with the stained hands			
c.	Children fed with food bought along the road cannot ingest lead			
d.	It is possible for children to ingest Lead from pipe borne water			
e.	The petrol sold in Nigeria contain some Lead			
f.	Using some potteries or ceramics to cook for children to eat can make them ingest Lead			
g.	Drinking the ink washed from a wooden plate which contains some Koranic verses (a practice called rubutu allo) can make children ingest Lead			

24. The table below contains some practices. For each tick (√) whether it can help to prevent lead poisoning in children or whether it cannot or whether you are not sure.

SN	Practice	Tick (√)		
		Can prevent Lead poisoning	Cannot prevent Lead poisoning	Not sure
a.	Boiling removes Lead from water			
b.	Cleaning window sills, furniture and floor in home or schools with soap and water			
c.	Sweeping home and school always			
d.	Encouraging children to play on fields with grass			
e.	Drinking warm tap water			
f.	Drinking cold tap water			
g.	Washing children's hands after outdoor games play			
h.	Making sure that everyone takes off their shoes when entering the house			
i.	Not mopping floors with detergent regularly			
j.	Discouraging children from carrying food around the house			
k.	Not allowing children to eat food containing iron			
l.	Not giving children 2-3 cups of milk to drink daily			
m.	Not allowing children to eat food, which has calcium every day.			

25. The table below contains statements about Lead. For each statement tick (√) Yes, No or whether you are not sure.

SN	Statement	Tick (√)		
		Yes	No	Not sure
a.	The human body needs small amount of Lead to function well			
b.	A diet with high amount of iron will help decrease a child's chances of getting Lead poisoning			
c.	A diet with enough calcium helps prevent Lead poisoning in children			

26. Which health problems in the table below can Lead poisoning cause in Children? (For each problem tick (√) Yes or No or whether you are not sure)

SN	Health problem	Tick (√)		
		Yes	No	Not sure
a.	Poor thinking processes			
b.	Inability to learn well			
c.	Anemia (or shortage of blood)			
d.	Weak bone formation			
e.	Not growing well or growth retardation			
f.	Delayed puberty in girls			
h.	Kidney problems			
i.	Hypertension			
j.	Sickle cell disease (Sickler)			
k.	Brain damage			
l.	Damage to the nerves			
m.	Lead poisoning can cause behavioural problems in children			
n.	Children who have lead in their body find it difficult to pay attention			
o.	Children aged between 6 months and 6 years should never be tested for Lead until they are 8 years old			

SECTION D: Perceptions relating to Lead

27. The table below contains statements on perceptions relating to Lead poisoning. For each indicate by ticking √ Agree or Disagree or Not sure as applicable

SN	Statement	Tick (√)		
		Agree	Disagree	Undecided
a.	School children in Oyo State especially those in the rural areas of Ido Local Government Area are not exposed to Lead poisoning			
b.	Lead poisoning is not a serious health problem among children in Nigeria because I've never heard about it myself			
c.	Lead poisoning is more serious in adults than children			
d.	Lead poisoning cannot occur in any of the primary schools in Ido LGA			
e.	Parents have no role to play in the control and prevention of Lead poisoning			
f.	Teachers have no role to play in the control and prevention of Lead poisoning			
g.	Only the government can help prevent Lead poisoning			
h.	Parents, teachers and government cannot work together to prevent Lead poisoning because such a cooperative effort cannot work in Nigeria			
i.	Only Doctors can prevent Lead poisoning			
j.	Lead poisoning can be prevented through immunization.			

28. List four **roles** of teachers in Lead poisoning prevention among school children?

(1)____________________________________

(2)____________________________________

(3)____________________________________

(4)____________________________________

29. List four **roles** of the parents in Lead poisoning prevention among school children?

(1) ______________________________

(2) ______________________________

(3) ______________________________

(4) ______________________________

30. List four roles of the government in lead poisoning prevention among schoolchildren?

(1) ______________________________

(2) ______________________________

(3) ______________________________

(4) ______________________________

SECTION E: Self-efficacy and Practices

31. The table below contains a list of some tasks for teachers on the prevention and control of lead poisoning; for each indicate by ticking (√) your level of confidence performing it.

SN	Task	Tick (√)		
		Not confident	Somehow or Confident	Very confident
a.	Educating parents about ways of preventing Lead poisoning			
b.	Counselling parents that childhood Lead poisoning can be treated.			
c.	Telling School authority to be doing something to prevent Lead poisoning			
d.	Educating pupils about the sources of Lead poisoning			
e.	Discussing the consequences of Lead poisoning on children with parents of pupils			

SN	TASK	Tick (√)		
		Not confident	Somehow or Confident	Very confident
f.	Telling parents about the kind of food that can help prevent Lead poisoning			
g.	Telling parents about facilities where cases of Lead poisoning can be treated			
h.	Telling parents about health facilities where they can take the children for blood Lead test			

SECTION F: School health Programming

32. The table below contains statements about the school health programming available in your school. Please tick (√) Yes for the ones you will be promoting on getting back to your school and, No for those you will not be able to promote.

SN	Statement	Tick (√)		
		Yes	No	Not sure
a.	Routine health service like e.g. first aid			
b.	Health education to pupils on personal hygiene			
c.	School policies or guidelines related to health generally			
d.	School policies on **lead** in particular			
e.	School environmental sanitation activities			
f.	Physical inspection of the personal hygiene of pupil's hair, nail.			
g.	Parents Teachers Association meets regularly to discuss health issues			

Appendix 6- Knowledge scale

Question	Variable tested	Scores assigned
15.	General knowledge of lead	8
16.	Blood lead level permissible by WHO	1
17.	Symptoms suggestive of lead poisoning in a child	5
18.	Screening and treatment of lead poisoning in children	4
19.	Sources of lead in a primary school environment	4
20.	Practices and conditions that can enhance vulnerability of children to lead poisoning	7
21.	Categories of workers that can take lead home to their children	6
22.	Component of a car that contain or can release lead	2
23.	Practices that can expose children to lead poisoning	7
24.	Practices for preventing childhood lead poisoning	13
25.	Nutrition and lead poisoning	3
26.	Physical and social consequences of lead poisoning	14
	Maximum score obtainable	**74**

Appendix 7- Time table

	Time			
	9.00- 11.00	11.30- 1.30	1.30-2.30	2.30-4.30
MON 26TH	Opening ceremony Introduction, History of lead and lead poisoning	Sources of lead,	L U N C H	Risk factors for lead poisoning Portal of entry of lead into the body and childhood lead exposure
TUE 27TH	Screening for lead poisoning, safe lead level, signs and symptoms of lead poisoning	Health effects of lead poisoning, , management and treatment of childhood lead poisoning	B	Roles of nutrition in the prevention of lead poisoning
WED 28TH	Prevention of lead poisoning.	Role of teachers and parents in the prevention of childhood lead poisoning	R E	Role of government in the prevention of childhood lead poisoning
Fri 30th	Revision Post test	Plans for follow up	A K	Closing ceremony

Appendix 8- Follow up activities and action plan

SN	Activity	Person responsible	Target population	Resources needed	Time frame					
					Wk1	Wk2	Wk3	Wk4	Wk5	Wk6
1.	Debriefing Head teachers about outcome of the training and submission of report to Head teachers	Trained teachers	Head teachers							
2.	Assessment of the training needs of other teachers	Trained teachers	Other teachers							
3.	Analysis off the training needs of other teachers	Trained teachers supported by trainers	Other teachers							
4.	Training design and development for other teachers	Trained teachers supported by trainers								
5.	Training implementation	Trained teachers supported by trainers								
6.	Training evaluation	Trained teachers supported by trainers								
7.	Dissemination of the outcome of the training for other teachers to	Trained teachers supported by trainers								
	a. Parents									
	b. Health authorities									
	c. Educational authorities									
	d. Other stakeholders									

Appendix 9- The training curriculum

SN	Objective	Content elements	Methods	Materials	Assessment
1.	At the end of the training programme, teachers should be able to discuss the history, natural occurrence and uses of lead	• History of lead and lead poisoning • Natural occurrence • Uses of lead	Lectures, brainstorming, questions and answers	Lecture notes, pamphlets, slides, pictures, writing materials	Pre/post-test
2.	At the end of the training programme, teachers should be able to outline sources of lead	• Common sources of lead in homes, schools and the environment → Lead based paints, petrol, foods and vegetables, air, dust, water including potable water, soil, local concoctions and cosmetic, school and laboratory materials	Lectures brainstorming, group discussion, questions and answers	Lecture notes, pictures, slides, pamphlets, writing materials	Pre/post-test
3.	At the end of the training programme, teachers should be able to list and discuss the portal of entry of lead into the body, associated risk factor.	• **Portal of entry of lead** → Oral, inhalation, trans-placental and dermal • **Common risk factors for lead exposure:** → Age (hand to mouth behaviour in children, their growing bodies absorb more lead and are particularly sensitive to its effects) , poverty, socioeconomic status, nature of housing, nutritional deficiency, pregnancy	Lectures, group discussion, questions and answers	Lectures, pictures, slides. pamphlets, writing materials	Pre/post-test
4.	At the end of the training programme, teachers should be able to list and discuss the health problems associated with lead poisoning.	• **Health problems:** → Learning disabilities, attention deficit disorder, decreased intelligence, speech and language problems, behavioural problems, slow physical growth, hearing impairment, damage to kidney, delayed puberty	Lectures, group discussion, questions and answers	Lecture notes, pamphlets, writing materials	Pre/post-test

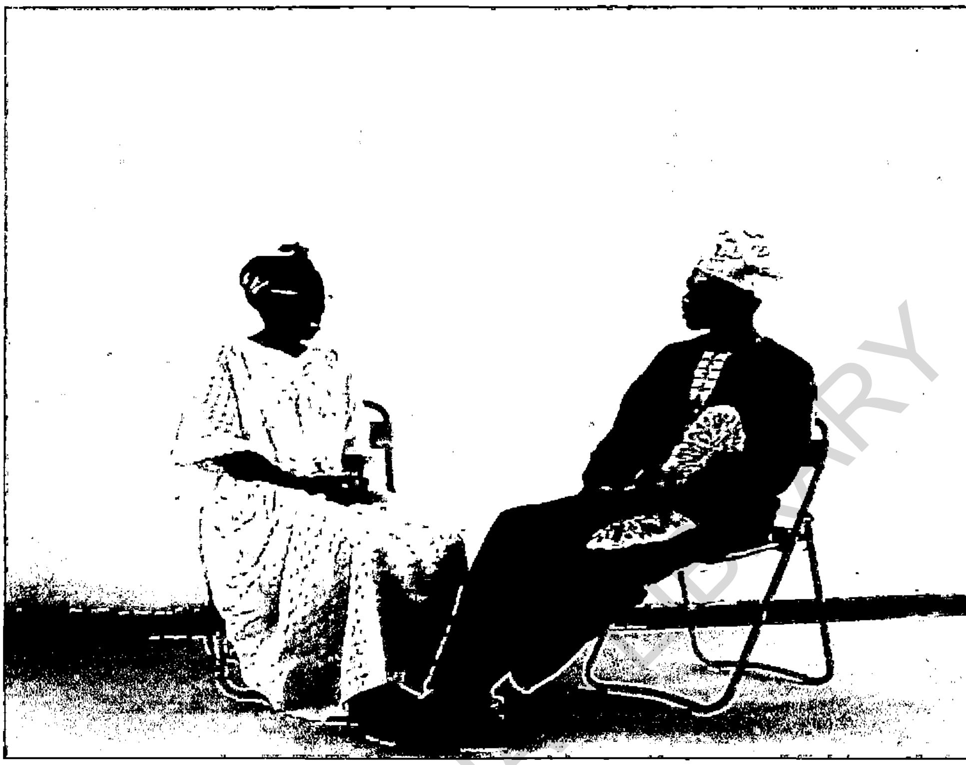
SN	Objective	Content elements	Methods	Materials	Assessment
5.	At the end of the training programme, teachers should be able to state how lead poisoning could be recognized.	• Signs and symptoms of lead poisoning: → Tiredness, hyperactivity, restlessness, loss of appetite, weight loss, reduced attention span, sleeplessness, constipation	Lectures, questions and answer, group discussion	Lecture notes, pamphlets, writing materials pictures and slides	Pre/post-test
6.	At the end of the training programme, teachers should be able to discuss the scientific ways of detecting lead in the human body and the treatment of lead poisoning.	• Methods of detecting lead in human body: → WHO tolerable blood lead level • Treatment of childhood lead poisoning: → Medical management with the use of chelating agents. → Nutritional intervention	Lectures, questions and answer, group discussion	Lecture notes, pamphlets, writing materials pictures and slides	Pre/post-test
7.	At the end, of the training programme, teachers should be able to list and discuss the preventive and control measures for childhood lead poisoning	• Prevention and control of lead poisoning: → Environmental management → Health education → Nutritional intervention → Specific school based preventive measures	Lectures, questions and answer, group discussion	Lecture notes, pamphlets, writing materials pictures and slides,	Pre/post-test

Appendix 9- Contd.

SN	Objective	Content elements	Methods	Materials	Assessment
8.	At the end of the training programme, teachers should be able to list and discuss the roles of government in the prevention and control of childhood lead poisoning.	• **Roles of government:** → Minimize further entry of lead into the environment; → Expand services that promote primary lead poisoning prevention; → Develop and implement strategies to encourage safe elimination of lead hazards; → Identify all children with excess lead exposure → Establish and enforce jurisdictional policies that mandate ensuring lead safety in housing → Develop and apply systematic approaches to prevent exposure to even small amounts of lead in consumer products → Promote implementation of state and local primary prevention plans → Expand the availability of and promote the use of early enrichment programmes Promote and fund additional research	Lectures, brainstorming.	Lecture notes, Writing materials, slides	Pre/post-test

SN	Objective	Content elements	Methods	Materials	Assessment
8.	At the end of the training programme, teachers should be able list and discuss the roles of parents in the prevention and control of childhood lead poisoning.	• **Roles of parents:** → Building good habits and safe surroundings → Teaching children about the dangers of lead and their role in keeping themselves safe → Taking children for lead test; → Taking personal basic steps to decrease exposure to lead if work involve lead → Advocating for lead prevention and control programme	Lectures, brainstorming, group discussion	Lecture notes, Writing materials, slides	Pre/post-test
9.	At the end of the training programme, teachers should be able list and discuss the roles of teachers in the prevention and control of childhood lead poisoning.	• **Roles of teachers:** → Teachers should educate children → Teachers should send messages on lead and lead poisoning home to parents → Teachers should also identify children that are displaying symptoms of lead poisoning → Teachers should also educate school authorities about lead and lead poisoning; → Teachers should advocate for lead poisoning prevention and control	Lectures, brainstorming.	Lecture notes Slides Writing materials	Pre/post-test
10.	At the end of the training programme, teachers should be able to counsel and educate children and their parents on prevention and control of childhood lead poisoning	• **Educational strategies** → Health education, training, sensitization workshop, campaigns, mass media, use of IEC materials. • **Social skills** → Communication and counselling skills	Lectures Role play	Observation checklist	Observation

Appendix 10- A role play session by trainees during the training intervention



Appendix 11- A cross-section of trainees been addressed by the project supervisor during the training intervention