Perceived Effects of Lead Recycling to Selected Communities in Bulacan, Philippines

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ABSTRACT

The province of Bulacan, Philippines is considered as the biggest producer of used lead acid battery (ULAB) in the country and in Southeast Asia. But with the boom of the ULAB industry, a continued concern on the industry's effect to human health and the environment intensifies. The study was conducted in two municipalities of Bulacan, Philippines to determine the perception of the respondents on the effects of lead recycling to their health and their community. These two areas are where ULAB industry is concentrated.

Data were gathered from primary and secondary sources. Interview schedule using a structured interview guide and key informant interview were used. The respondents believed that there are toxic and hazardous substances used in lead recycling that contributed to their health problems and environmental pollution. Identified pathways of pollution include air, soil and water. But while they are aware of the health and environmental risks this industry brings, they also recognized its economic contribution to their families and their respective communities. The complexity of the problem continues to pose a challenge that needs to be addressed soon to balance economic prosperity and the communities' welfare.

Key words: *Perceived effects; used lead acid battery recycling; and human and environmental health*

INTRODUCTION

The early 1990's saw the boom of the vehicle industry in the Philippines. From 1990-1996 alone, vehicle registration increased by 80 % (*Institute of Trade and Commercial Diplomacy 2004*). With the surge of demand for vehicle ownership, higher demand for lead acid batteries followed. Hence, the used lead acid battery (ULAB) industry, both from the regulated and unregulated or informal sectors multiplied. This is expected since these vehicles depend on lead acid batteries to run. Local and internally-sourced batteries were recycled to meet the demand. While the country is a signatory to the Basel Convention (The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal) that bans the trading of hazardous wastes from developed countries to developing countries, this did not hamper the production and demand for the used lead acid batteries (ULAB). The continued recycling, especially if it is not compliant with the government's requirement, poses serious environmental and human health pollution especially to communities where the operation of this industry is concentrated.

In the Philippines, over a hundred thousand people are estimated to be directly affected by the ULAB industry in one province alone. Studies showed that health impact of lead to adults include irritability, poor muscle coordination, nerve damage, higher blood pressure, and problems with hearing and seeing. Reproductive difficulties (low sperm counts) and disturbed pregnancies might also develop. In children, lead poisoning can cause brain damage and retardation, anemia, liver and kidney damage, hearing loss, hyperactivity, and even death (*Fuller 2010*). While the income generated from this industry is needed for the survival of many people, especially those from the informal sector, they give adverse effects to the environment that worsen the problem of pollution.

For over two decades now, Bulacan, Philippines is the hub of ULAB industry. This is where the biggest recycling of ULAB in Asia is located. Many other recyclers sprouted thereafter especially in the municipalities of Meycauayan City and Marilao. While the government-recognized recyclers may be compliant to the government's requirements on lead recycling, many informal recyclers are not. A study showed that there are more people involved in lead recycling from the informal sector (around 20,000) compared to around 1,500 from the formal sector (*Wilson 2001*). Lead-acid battery recycling ranked number 8 in the top ten toxic industries and an estimated 18-22 million people are at risk due to lead pollution worldwide (*Blacksmith Institute 2011*). A study conducted by *Suplido and Choon* (*2000*) in Metro Manila, Philippines showed that battery recycling/repair activities were found to contribute to the significant increase of blood lead levels to all workers and their children. Alarmed with the potential effect of lead poisoning to the communities in Bulacan, various interventions from the government and non-government organizations were implemented. The participation of the community people is crucial since they are the ones who are directly affected by

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this concern. To ensure continued community participation on the interventions being implemented and to be introduced in the future, determining the perception towards the industry is very important.

Thus, this study aimed to determine the perception of the respondents on the effect of lead recycling in the two municipalities of Bulacan, Philippines. Specifically, it aimed to: characterize the respondents; identify the perceived effects of lead recycling in their communities; determine their perception towards lead and lead recycling done in their respective communities; discuss the interventions implemented to address the lead pollution; and analyze the gaps needed to be addressed in the future.

When the Meycauayan – Marilao – Obando Rivers System (MMORS) was listed in 2007 as one of the most polluted rivers in developing countries due to industrial waste haphazardly dumped in the river, the various sectors of the society in the province were surprised at the inclusion. The national and local government offices mandated to ensure environmental integrity and security of the province. This resulted to the collaboration of the government, non-government organizations and civil society to work on the cleaning up of the MMO River.

In this study, it was assumed that the pressures and concerns on the effect of lead pollution to communities and the socio-demographic characteristics shape the perception of the respondents on the effect of lead recycling to their health and the environment. This also affects their behavior towards interventions that were implemented to address the effects of pollution. These findings anchored on selective perception and retention theory. It posits reality as a social construct. It recognized that individuals interpret facts to suit their existing biases. With this, they would hear what they want to hear and expect to hear. To reinforce this, they would only listen to issues that support their opinions and beliefs. Thus, this study attempted to recognize the meanings of the respondents to understand their perception towards the effect of lead recycling to their health and the environment (**Figure 1**).

METHODS

The study was conducted in Meycauayan City and Marilao, Bulacan. Meycauayan City is a first class urban city in the Philippines with a population of 196,569 (*National Statistics Office 2007*). It is located about 19 km north of Manila and about 22 km south of Malolos City, provincial capital of Bulacan. It is bounded by the town of Marilao to the North, Valenzuela City to the South, Caloocan City to the east and Obando to the West.(*Meycauayan Development Plan 2004*).

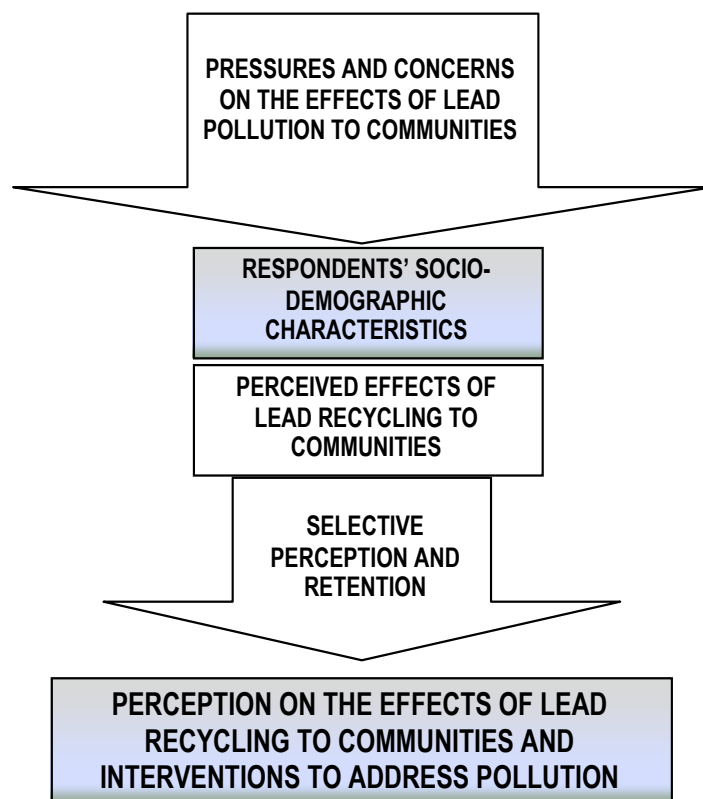Marilao, on the other hand is about 20 km northwest

Figure 1. Conceptual framework of the study.

of Manila. It is bounded on the North by Bocaue and Sta. Maria, on the South by Meycauayan City, on the East by San Jose del Monte, on the West, by the municipality of Valenzuela (*Marilao Development Plan 2004*). The population is 160,452 (*NSO 2007*).

Sampling

Five barangays were selected as the study site: three in Marilao and two in Meycauayan City. These barangays were chosen since these are where the lead recycling industry was concentrated. In these areas, both active and legacy sites were identified. Purposive sampling was used to select the respondents per barangay. The household head was selected as the respondent of the survey (**Table 1**). In case the household head is not present during the visit, the enumerator interviewed another member of the household who is in a position to answer the questionnaire items or scheduled a second visit.

Primary and secondary data were gathered. Interview schedule using a structured interview guide and key informant interview were used. The interview schedule consists of the following parts: I- Respondents' socio-demographic characteristics; II- Socio-demographic characteristics of the respondents' households; III- Awareness and knowledge on lead and other toxic and hazardous substances from lead recycling; IV- Perceived effects of lead recycling to their families and community members; and V- Problems in the community as perceived by the respondents. Data was

encoded using the Statistical Package for the Social Sciences (SPSS) and MS Excel program. Simple statistical analysis tools such as measures of central tendency, percentages, frequency distribution tables, graphs, and charts were used in the data analysis and presentation.

Table 1. Number of households and sample size per barangay.

Barangay	Total no. of Households (HH)	Sampling Size
Marilao		
Patubig	1,070	101
Tabing Ilog	2,231	107
Sta. Rosa 2	1,024	13
Meycauayan		
Iba	210	42
Tugatog	22	18
TOTAL	4,557	281

RESULTS AND DISCUSSION

Socio-demographic characteristics of the respondents and their household members

The respondents' socio-demographic characteristics include sex, age, educational attainment, occupation, and monthly income (**Table 2**). Majority (56 %) of the respondents are female and are in the early and middle adulthood (56 %) with their age ranges from 26-45. Others (31 %) belong to 46 and above age range while few (11 %) are 25 years old and below. Many (61 %) of them reached high school but few pursued college degrees. Only 9 % reached college and 6 % finished it. The rest either reached elementary or graduated elementary school.

With this educational attainment, it is expected that many of them are not gainfully employed. Some (25 %) are housewife, few are into buying and selling of food items and other household needs (20 %) and are engaged in other seasonal jobs like factory or construction work (14 %). Others are unemployed (14 %). Since there are few who have stable employment, their monthly income are very low. The majority (64 %) have a monthly income of PhP 5,000 and some (23 %) receive between PhP 5,001-P10,000. This income bracket is way below the poverty line for the province which is PhP 17, 000 for a family of five in 2008 (*National Statistics Office 2010*).

Similar to the socio-demographic characteristics of the respondents, their respective household members reached high school (45 %). However, almost the same percentage (40 %) only reached elementary or not in school yet. This is so because some (29 %) are only 12 years old and below and still 16 % falls under the 13-19 age group. These two groups belonged to the children who are still dependent to their parents. Majority (51 %) of the parents are either

Table 2. Socio-demographic characteristics of the respondents.

Characteristics	Frequency (n=281)	Percentage
Sex		
Male	124	44
Female	157	56
Age		
25 and below	30	11
26 – 35	92	33
36 – 45	66	23
46 – 55	46	16
56 and above	47	17
Educational Attainment		
Elementary Level	19	7
Elementary Graduate	50	18
High School Level	55	20
High School Graduate	115	41
College Level	24	9
College Graduate	16	6
Vocational	2	1
Occupation		
Housewife	71	25
Factory /Construction worker	38	14
Business/Entrepreneur	40	14
Private/public Employee	28	10
Laundrywoman	4	1
Driver (Pedicab/Tricycle/Jeepney)	2	1
Others (small scale buy and sell of food and other house needs, seasonal odd jobs, etc)	60	21
None	38	14
Monthly income (in PhP)		
5000 and below	181	64
5,001 to 10,000	64	23
10,001 to 15, 000	8	3
15, 001 to 20,000	2	1
20, 001 to 25,000	3	1
25, 000 and above	2	1
No Income	21	7

in early adulthood with 20-35 years old (26 %) or middle adulthood (35-55 years old) representing 25 % of the household. Majority (54 %) of the household members are either children or no work at all (**Table 3**).

Common Problems Encountered in the Study Sites

The most common problems identified by the respondents include issues concerning the environment (72 %). This was followed by economic problems (58 %);

Table 3. Socio-demographic characteristics of the respondents' household.

Characteristics	Frequency (n=1,117)	Percentage
Sex		
Male	582	52
Female	535	48
Age		
12 years old and below	323	29
13-19	164	16
20-35	283	25
36-55	295	26
56 and above	42	4
Educational Attainment		
No education	109	10
Elementary Level	221	19
Elementary Graduate	124	11
High School Level	171	15
High School Graduate	330	30
College Level	95	9
College Graduate	52	5
Vocational	15	1
Occupation		
Housewife	101	9
Factory /Construction worker	105	9
Business/Entrepreneur	53	5
Private/public Employee	73	7
Driver (Pedicab/Tricycle/Jeepney)	8	1
Others (small scale buy and sell of food and other house needs, seasonal odd jobs, etc)	169	15
Children under 17 years and no work	608	54

Table 4. Problems in the study areas as perceived by the respondents.

Problems*	Frequency (n=281)	Percentage
Environmental	203	72
Economic	163	58
Health	159	57
Peace and order	79	28
Education	10	4
Government	7	2
Others	2	1

Table 5. Commonly-occurring illnesses prevalent in the study areas.

Illnesses*	Frequency (n=281)	Percentage
Cough/colds/fever	200	71
Skin problems/disorder	23	8
Lung problems	70	25
Heart and blood problems	33	8
Dengue	5	2
Diabetes	3	1
Cancer	1	0.3
Asthma	35	12
Dengue	15	5
TB	36	13
Typhoid	2	1
Pneumonia	2	1
Chest pains	32	11
Infertility	10	4
Constipation and vomiting	2	1
Don't know	20	7

*multiple responses

health (57 %); peace and order (28 %); education (4 %); and 2 % for government (**Table 4**). Environmental problems include water and air pollution, flooding, garbage, and wastes dumped in the river. Campaigns on environmental rehabilitation and protection could maximize the increasing residents' recognition of the environmental problems in their community. Aside from the concern on environment, the study also focused on health effects to the community people (**Table 5**). Thus, they were also asked to identify the commonly-occurring illnesses prevalent in their respective communities. Among the illnesses identified, cough/colds and fever topped the list (71 %). This was followed by respiratory-related illnesses like lung problems (25 %), tuberculosis (13 %), asthma (12 %), and chest pains (11 %). Others include skin problems (8 %), heart and blood problems (8 %), and infertility (4 %).

With the prevalent illnesses identified, the respondents were asked more on their perception on the health effects of this industry per sector of the household. The sectors include babies and children, women and pregnant women, adult male in the family and the elderly. Almost all of these sectors mentioned chest pains, lung problems and asthma as the most common illnesses the respondents' and their family members have recently experienced (**Table 6**).

Respondents' perception on the effect of lead recycling to their community

The respondents were asked on their perceived effect of lead recycling to their health and the environment. According to them, several toxic and hazardous substances used in lead recycling contributed to the environmental pollution. These include lead (20 %); 17 % each for KNO_3, ammonium sulfate; caustic soda and color paint and 12 % sulfide. Some (4 %) are not sure and very few (1%) do not

care. They recognized that the both active and legacy sites of lead recycling contributed to the environmental pollution. Results of the Blacksmith Institute's Global Inventory Project in 2008-2010, where they conducted initial site assessment of the most polluted sites in the country, revealed that it is in Central Luzon where the lead recycling industry was concentrated. Of the 18 active and legacy ULAB sites studied, nine are in Central Luzon; four in Southern Tagalog; two in National Capital Region; and one each for Western and Central Visayas and Southern Mindanao. The site in Marilao, Bulacan, the location of the largest lead recycling plant in the country, was found to have its air, soil, and water of the local and downriver communities polluted with chromium, cadmium and lead. In many of the sites studies, the identified pathways for pollution are through the air, soil, and water (*Blacksmith Institute 2010*).

Similarly, the pathways of pollution to human is through the air they breathe, soil, either eating food grown from it or exposure to the polluted soil due to the presence of battery scraps/case and the toxic chemicals that goes with it. The respondents believed that humans can be affected through the food they eat, water they drink, and exposure to the polluted water. The identified substances perceived to affect human health include lead (23 %); 17 % each for KNO_3, ammonium sulfate, caustic soda, and color paint; and 12 % sulfide (**Table 7**).

Aside from their awareness to the presence of toxic and hazardous substance that caused pollution to the environment and negative effects to their health; they were also asked about their perception towards this industry. Several statements were asked to determine their perception towards the industry itself. Of the statements to measure its effects to the environment, most of them believed that lead recycling contributed to the pollution of their communities. They disagreed to the following statements: the lead recycling industry does not affect health (86 %); the lead recycling industry does not affect the quality of air in the community (83 %); the lead recycling industry does not affect the river, lake and creek in the community (76 %); and the lead recycling industry contributes significantly to my family's income (66 %).

The first three statements showed that the respondents are indeed aware of the negative effects of the industry to environment. This is consistent with the respondents' opinion and issues of the industry's negative effect to the environment and to their health. However, some (34 %) also recognized that this industry contributed to their income and it is a big industry in their community. While majority (66 %) believed that the industry did not significantly contribute to the families' income, they also recognized its contribution to the other members of the community. The respondents identified their neighbors, friends, relatives and family

Table 6. Respondents perceived health effects of lead recycling per sector.

Illnesses*	Frequency (n=281)	Percentage
Babies and children		
Cough/colds/fever	185	66
Skin problems/disorder	23	8
Dizziness, chest pains and lung problems,	43	15
Cancer	32	11
Decreased educational performance	7	2
Loss of appetite/ constipation/ vomiting	4	1
Slow development of body parts	2	1
Don't know	12	4
Pregnant women/women		
Asthma	35	12
Cough/colds/fever	31	11
Heart problem	30	11
TB	30	11
Miscarriage	10	4
Manas	1	0.3
Child abnormalities	1	0.3
Don't know	16	6
Industry Workers/Men		
Chest pains/lung problems	30	11
TB	38	14
Asthma	30	11
Cough/colds/fever	36	13
Infertility	11	4
Don't Know	12	4
Elderly people		
Cough/colds/fever	46	16
Diabetes/high blood	34	12
Heart problems	13	5
Chest pains/ lung problems	41	15
Arthritis	27	10
Don't know	12	4

members as those involved in lead recycling.

Recognizing the adverse effects of this industry to the environment and their health, almost half (45 %) of the respondents are willing to join effort to clean up the environment and participate in the projects that aims to improve human health of the community people. This concern may be due to their awareness on the effects of lead recycling. The Blacksmith Institute, in cooperation with the University of the Philippines Los Baños and the local government of these municipalities have conducted a series of information, education and communication (IEC)

Table 7. Identified toxic and hazardous substances from lead recycling perceived to affect human health and contribute to environmental pollution.

Toxic and Hazardous Substances*	Frequency (n=281)	Percentage
Environment		
Lead	57	20
salitre	48	17
ammonium sulfate;	48	17
caustic soda	48	17
color paint	48	17
Sulfide	33	12
Not sure	10	4
Don't care	3	1
Human health		
Lead	65	23
Salitre	48	17
ammonium sulfate;	48	17
caustic soda	48	17
color paint	48	17
Sulfide	33	12

campaign on the effects of lead and lead recycling in the past years.

This IEC campaign include mother and children classes to directly affected communities, distribution of IEC materials like brochure, pamphlets, posters, komiks, exhibits and others Despite these campaigns, result of the study showed that majority (68 %) of the respondents both have positive and negative perceptions on the industry. They still cannot make a definite stand either to turn away from the industry or continue to embrace it. This reinforces the theory of selective perception and retention. While the respondents are very much aware of the possible harm this industry do to their communities, they cannot give a straight answer if they have negative or positive perception because they also recognized the economic contribution the industry brings to their communities and families. Thus, any information against the industry was put in stride since they are very much aware that they need to address more immediate concern than the environment or their health. Few however, have made a stand. Some (23 %) have negative and positive (9 %) perception towards the industry.

This finding is similar to the study conducted on the perception of the community people towards mining in Romania. While they are very much aware of the pollution in their river system caused by mining activities in their communities, they also consider mining as constant and source of income (*Dogaru, et al.* 2009). Furthermore, a study conducted by *Mendoza et al.* (*2012*) on the knowledge, attitudes and practices of community people in Bulacan

towards toxic and hazardous substances revealed that while they are aware of the industries that are perceived to pollute the MMOR system, they have an ambivalent attitude towards gold smelting, leather tanning and lead recycling. It was revealed further that the respondents' have this attitude toward the industries mentioned because they recognized the economic contribution of these industries to their families and their respective communities.

Interventions/Projects Implemented to the Study Areas

Under the Clean the Marilao-Meycauayan-Obando River System Project of Blacksmith Institute, several baseline studies have been conducted to determine the extent of the pollution and systematically guide the stakeholder groups and program management in prioritizing interventions and investments.

These baseline studies include two researches to determine the respondents' knowledge, attitudes, and practices of the community people towards toxic and hazardous pollution in MMOR System and those affected by lead pollution. The results of the study served as an input to the information, education and communication materials and campaigns in the area. An information, education and communication (IEC) workshop was also held together with the College of Development Communication, UPLB, Blacksmith Institute and MMO Water Quality Management Area (MMO WQMA) Board. Several IEC materials such as posters and primers were developed from the workshop. In 2011, IEC materials targeted specifically towards lead pollution and how to prevent health risks from lead pollution were developed together with CDC-UPLB, National Poison Management and Control Center-UP-PGH, DOH Region 3 and the local government of Meycauayan. These materials include posters, calendars, flipcharts, and booklets. The said materials focused on the health impacts of lead particularly to vulnerable sectors such as children and pregnant women. Lead learning sessions for directly affected children and mothers in an area in Meycauayan were conducted. The topics included health impacts of lead contamination and ways to reduce these negative impacts through hygiene, proper nutrition and non-handling of contaminated materials.

CONCLUSIONS AND RECOMMENDATION

Respondents are aware of the effect of lead recycling to their health and their environment, majority (52 %) of them being female and some (25 %) housewives. They even identified toxic and hazardous substances as a result of lead recycling. Their knowledge may have come from various information sources like the local officials, government and non-government organizations concerned with environmental pollution. In some of the study areas, intensive information, education and communication campaign was conducted to

inform the residents of the effect of lead recycling. Some are even participants of the programs implemented like the information, education and communication campaign of the effects of lead recycling and others industries in the area.

Despite their awareness and knowledge on the effects of lead recycling to their respective communities, many of the respondents have ambivalent perception towards it. This is because they recognized the economic contribution the industry brings or may bring to their family and to other members of the community. Environmental, economic and health are the top three problems identified earlier by the respondents. Considering the complexity on the relationship of these problems to the respondents' respective families and to their communities, their ambivalent perception towards this industry is expected. This phenomenon is not only prevalent in this industry but to other industries that pose danger to the health of communities as well. Thus, the challenge for the local government units concerned and the national agencies mandated to look after the environmental and health concerns of community people to balance the economic prosperity and communities' welfare continues.

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