

THE HEALTH PROBLEMS OF THE RESIDENTS IN THE MINING – AFFECTED AREAS IN SANTA CRUZ, ZAMBALES, PHILIPPINES

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ABSTRACT

The study was conducted to assess the health problems of the people in the mining-affected areas of Santa Cruz, Zambales, Philippines. The study utilized descriptive method and descriptive documentary analysis. Primary data were collected using a questionnaire to 146 respondents in seven barangays affected by mining activities. Secondary data on the incidence of diseases were gathered in the Rural Health Unit of Santa Cruz, Zambales. The most prevalent illnesses are acute upper respiratory infection (AURI) for the respiratory system, diarrhea for the digestive system, skin rashes for the integumentary system, hypertension for the cardiovascular system, urinary tract infection for the genito-urinary system and headache neurological system.

KEYWORDS: *Health Problems, Mining, Mining -Affected Areas, Philippines*

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INTRODUCTION

Mining is a major economic activity in many developing countries (Tauli-Corpuz, 1997; UNEP, 1997). As provided in Republic Act Number 7942 which is known also as Philippine Mining Act of 1995, the Philippine Government has the responsibility to promote the rational exploration, development, utilization and conservation all mineral resources in order to enhance national growth but safeguard the environment and protect the rights of the affected communities. However, operations, whether small or large-scale, are inherently disruptive to the environment (Makweba & Ndonde, 1996), producing enormous quantities of waste that can have deleterious impacts (UNEP, 1997). The environmental deterioration caused by mining occurs mainly as a result of inappropriate and wasteful working practices and rehabilitation measures. Mining has a number of common stages or activities, each of which has the potential-adverse impacts on the natural environment, society and cultural heritage, the health and safety of mine workers, and communities based in close proximity to operations (Panos, 1997, Akabzaa, 2001). As indicated by Noronha (2001), the social and environmental impacts are more pervasive in regions where operations are newly established or are closing down. Several authors (Tauli-Corpuz, 1997; Filer, 1998) have commented on the potential-adverse impacts of mining, which include displacement of local people from ancestral lands, marginalisation, and oppression of people belonging to lower economic classes.

Mining activities have contributed both positively and negatively to the economic and social aspects of the people in the mining areas. The impacts include land degradation, damage to water quality, pollution, and harm to livestock and

wildlife biodiversity which eventually affect health and livelihood. The impacts that occurred due to mining largely include air pollution due to suspended particles, vehicular exhaust and coating of roadside vegetation with dust, loss of wildlife habitat 'water pollution' in streams, rivers, wells and wetlands affecting fish population and fishermen, dairy and 'silting of the agricultural area and plantations, noise pollution affecting houses and institutions like schools on road sides as well as wildlife around mines.

The environmental issues led to the filing of the Writ of Kalikasan case against five operating mining firms and officials of the provincial government of Zambales in an attempt to end destructive mining operation in Zambales on May 25, 2016. The five mining firms include Benguet Nickel Mines, Inc. (BNMI), Eramen Minerals, Inc (EMI), Lnl Archipelago Minerals, Inc. (LAMI), Zambales Diversified Metals Corp. (ZDMC) and Shangfil Mining and Trading Corp. The five mining firms violate Republic Act 7942, otherwise known as the Mining Act of 1995, and its implementing rules and regulations. In 2016, Mines and Geoscience Bureau ordered Benguet Corp Nickel Mines Inc. and Zambales Diversified Metals Corp to stop operations after the Supreme Court issued a Writ of Kalikasan and the Local Government of Zambales suspended all mining operations in the province (**Macapagal, 2016**). Some of the complaints of local residents and concerned citizens on the impact of mining on health include mental problems including stress, depression and suicide, occupational diseases and accidents and infectious diseases. In order to validate the claims of the local residents and concerned citizens, it is important to assess the health status of the community. The scientific information that can be derived from the study could serve as the basis for remedial measures to mitigate the impact of mining on the health conditions of the people of Santa Cruz, Zambales.

RESEARCH METHODOLOGY

Research Design

This study made use of the descriptive survey and analysis of the data on the occurrence of illnesses in the locality. The descriptive survey was done to collect and describe primary data on the frequency of the occurrence of diseases among the respondents, while the descriptive documentary analysis was done to describe secondary data collected from the Rural Health Unit on the recorded cases of illnesses in the communities.

Locale of the Study

Santa Cruz, Zambales is the 14th municipality of Zambales, It has 25 barangays Respondents were taken from the six barangays in Santa Cruz, Zambales affected by mining. The different barangays include Guinabon, Lomboy, Guisguis, Canaynayan, Sabang and Tubo-tubo South. These barangays were most affected by siltation from rivers contaminated with heavy metals such as nickel and chromium due to their proximity to the mining site. Guisguis is the nearest barangay to the mining site since it is 27 km and the rest are slightly farther from the mining site.

Population and Samples

The respondents of the study were the 146 respondents from the six barangays in Santa Cruz, Zambales

Instrument

The main instrument for gathering data in this study was the questionnaire. It was composed of 4 main parts. Part 1 covered the profile of the respondents as to their age, sex, and course, parents' educational attainment of father and mother, size of the family, monthly family income and distance of the student's home to school. Part 2 included data to be

collected from respondents on the incidence of diseases among the residents in the communities. Part 3 included the data on various illnesses recorded by Rural Health Unit of the Municipality of Santa Cruz, Zambales. Part 4 contained the laboratory analysis of the heavy metal and microbial contamination of the drinking water from the six barangays included in the study.

Data Gathering Procedure

Primary data on the frequency of occurrence of diseases were collected from the respondents of the different barangays after a permit was obtained from the barangay captains.

Secondary data on the incidence of diseases were obtained from the Office of the Rural Health Unit through the Municipal Health Officer.

RESULTS AND DISCUSSIONS

Common Health Problems

Diseases of the Respiratory System

The occurrence of diseases provided by the Rural Health Unit and assessment of the respondents’ diseases of the respiratory system is shown in Figure 1 and Table 1. Rural Health Unit of Santa Cruz, Zambales recorded that since 2002 up to 2015, acute respiratory illness (AURI) was the most common respiratory disease complained by the residents. In fact, this is the most prevalent of all the illnesses of the different body systems such as integumentary, digestive, genito-urinary system. AURI is followed by asthma and acute bronchitis. Before mining in 2005, the number of individuals infested with acute respiratory disease, bronchial asthma, acute bronchitis, pneumonia and

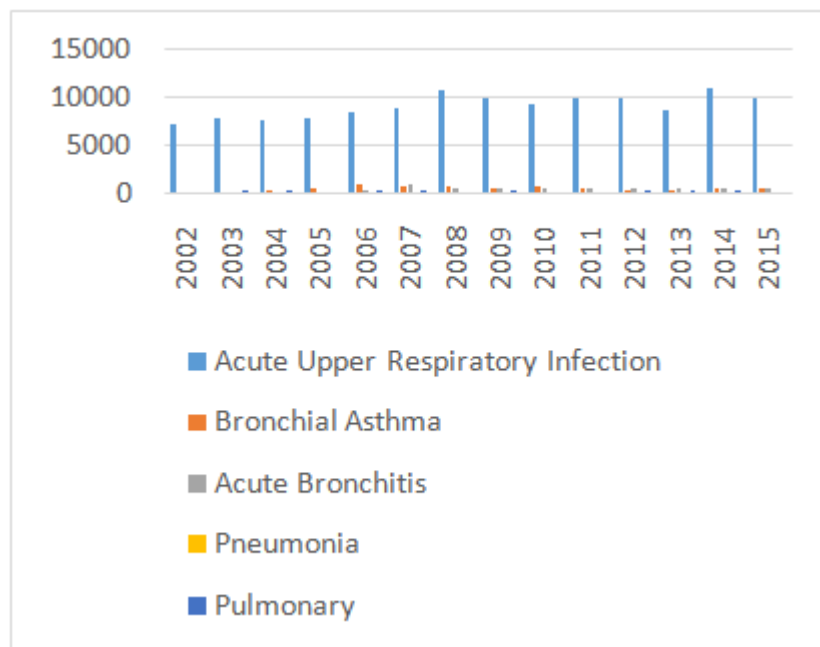


Figure 1: Incidence of Diseases of the Respiratory System Recorded by the Rural Health Unit from Year 2002 to 2015

Tuberculosis was relatively low. In 2002, there were 7,369 for AURI, 3119 for asthma, 1,681 for bronchitis, 0 for pneumonia and 168 for tuberculosis. There was a very slight increase or reduction up to 2004. But in 2005, when mining

started, the number of people experiencing AURI increased by 269, asthma 227 and bronchitis 249. The peak of individuals affected by AURI was in 2008, 2011 and 2014 where more than 10,000 persons were recorded to suffer from this infection. According to the respondents, the most common and obvious impact of mining operations in terms of air quality was the increase in dust or particulate matter (PM) in the air during the peak of mining operation in 2008. High dust emission was due to the transport of the materials to and from the port and stock pile area. Visualizing the dust and smoke generation of 200 hauling trucks/day and each truck with 5 loads/day for just one mining company is quite alarming. There are specific barangays that serve as the route of these trucks. Air analysis that was conducted by the (DENR-EMB, 2008) on the last quarter of 2012 revealed that the TSP (total suspended particulates) of the ambient air was two to three times above the standard limit set in the Clean Air Act (Molino, 2015). The number of people affected by asthma increased from 596 in 2005 to 1,133 or an increase of 537 equivalent to 90.07 % in 2006 but went down from 897 to as low as 440 in 2013. One mitigating measure done by the companies was sprinkling of water along the roads but this resulted to a muddy road that even more pose rage to the commuters.

Table 1: Assessment of the Respondents' Diseases of the Respiratory System

Diseases of the Respiratory System	Mean	Description
Difficulty Of Breathing	2.80	Seldom
Coughing	4.07	Often
Frequent Sneezing	1.93	Sometimes
Tight Chest	2.50	Seldom
Tuberculosis	1.13	Never
Asthma	2.87	Seldom
Emphysema	1.2	Never
Total	2.36	Seldom

The number of people infected with tuberculosis in 2002 to 2004 ranged from 168 to 250 in 2003 and 2004 but increased to 291.7 in 2006 or a tremendous increase of 109.09%. The highest number of people with bronchitis was recorded by RHU in 2007 with a total of 958 or an increase of 102.32%. On the other hand, the peak of tuberculosis cases was in 2007 with 377 cases or an increase of 170 % from 2005 data or an increase of 29% from 2006 data. The increase in the number of people infected by bronchitis from 0 in 2004 to 224 in 2005 was very evident that mining increased the number of people infected with bronchitis by 111.32%. However, like any other diseases the number of infected people went down from 2006 to 2015. **Yeboah (2008)** asserted that the combined effects of environmental problems have culminated into health problems with high prevalence of diseases such as malaria, respiratory tract infections and skin diseases. Major air pollutant in mining areas is dust, generated in course of a number of activities associated with mining which would result to respiratory infections (**Shukla, 2006**). Dust is one of the major threats to human health. The Alaska Department of Environmental Conservation analysed the air outside the mill at the Red Dog mine and found lead concentrations 30% higher than considered safe for human health. The dust emissions along the access road to the Red Dog mine have significantly contaminated the environment with toxic metals including lead and cadmium. Even moss 1,000 to 1,600 meters from the road was contaminated at levels above those found in many of the most polluted countries in Europe. Dust from mining operations can potentially contaminate the surrounding environment with any of the toxic substances found at the site. Mining activities may expose local residents to hazards as well. Dust from mining operations may be transported to local communities. **Campo et al. (2015)** further observed that the source of dust particles may not only come from the quarry area in the mining site, but the national roads where vehicles transport minerals from the quarry site to destinations.

The respondents indicated the problems of the respiratory system such as difficulty breathing, coughing, frequent sneezing, tight chest, asthma and other respiratory illnesses. Most of the respondents often experienced coughing with a mean of 4.07 while the difficulty of breathing and asthma were seldom experienced by means of 2.80 and 2.87 respectively. This is expected since the people in Santa Cruz during the dry season are exposed to dust pollution because of the mining activities.

Numerous health problems such as malaria, tuberculosis, conjunctivitis and other skin diseases posed by mining activities were recorded (**World Rainforest Movement, 2004**). It has been found that due to the negative environmental impacts of mining activities in Obuasi by the AshGold Mining company, the health of most of the people in that community is very poor with a high prevalence of upper respiratory tract infection (URTI) in the area which medical experts attributed to the mining activities and its associated pollution, arsenic poisoning (**Awudi, 2002**). In addition, mining impact related diseases such as malaria, diarrhea, upper respiratory tract infections, skin disease, acute conjunctivitis and accidents are noted to be high in Tarkwa, another mining community in Ghana (**Awudi, 2002**). In fact, apart from these diseases that may emanate directly from the mining activities itself, it is observed that the miners themselves can also bring diseases to local indigenous populations such as HIV/ AIDS and other transmittable diseases (**Rhett, 2006**). Communicable diseases, nutritional deficiencies and maternal and perinatal conditions are commonly related to the environment, poverty and poor access to health services, and are most prevalent in Africa and, to a lesser extent, Asia and Latin America. Communicable diseases include malaria, dengue, HIV/Aids, tuberculosis, acute respiratory infections and gastrointestinal diseases such as cholera; nutritional deficiencies comprise stunting, wasting and micronutrient deficiencies; key maternal and perinatal conditions include hemorrhaging, infection, eclampsia, anemia and low birth weight.

Diseases of the Digestive System

The occurrence of diseases provided by the Rural Health Unit and the assessment of the respondents' diseases in the digestive system is shown in the Figure 2 and Table 2. Of the diseases in the digestive system recorded by the Rural Health Unit diarrhea was the most prevalent. The peak of diarrhea infection was in 2008 followed by the year 2005. According to the respondents the incidence of diarrhea was during rainy season when there was flooding. There was bacteria contamination in their drinking water as indicated in the Table 15. It can also be noted that the start of operation of mining was in 2004 by the Acoje mining. In 2007, additional four mining companies were given permits to operate. So the problem with diarrhea worsens. However, after it was detected that the digestive problem was due to bacterial contamination, the residents who take their drinking water from the underground or through pumps, learned to boil their drinking water. So the incidence was reduced of diarrhea from 2009 and onwards up to 2015. In the case of diarrhea, its occurrence was due to contaminated drinking water which was found positive in the barangays where sampling of drinking water was done.

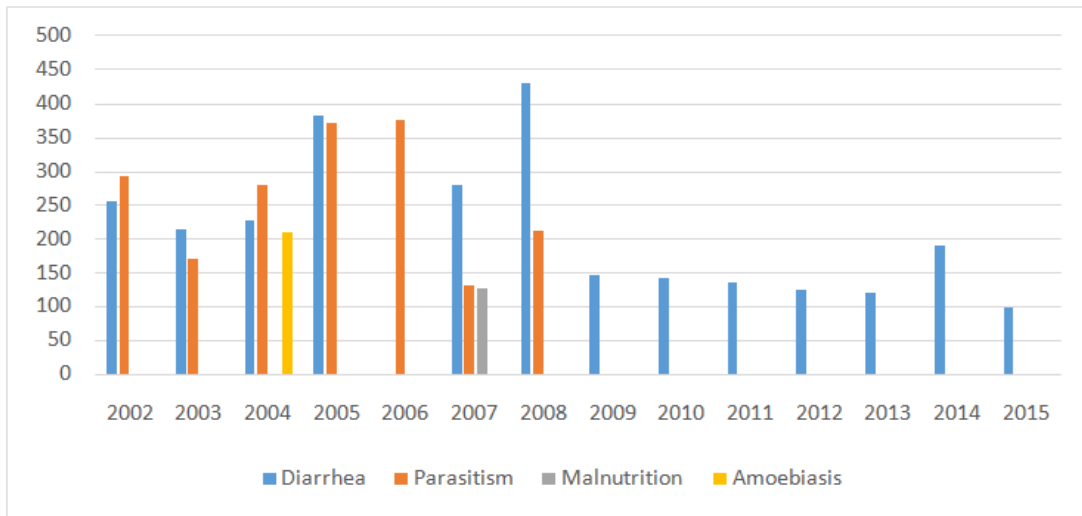


Figure 2: Incidence of Diseases of the Digestive System Recorded by the Rural Health Unit from Year 2002 to 2015

The study conducted by Akabzaa (2000) on the health impact of mining indicated chemical pollution of ground water and streams, siltation through increased sediment load, increased faecal matter and dewatering effects. The increased faecal matter may have contributed to increased concentration of microbial contaminants such as total coliform, faecal coliform and heterotrophic plate count which were brought about by flooding of the different barangays was contributory to diarrhea and to some extent amoebiasis. Physical examination of children in Marinduque towns affected by mining showed that the affected communities had more undernourished children than the unaffected ones. Exposed children had blood disorders such as anemia, leucocytosis, and reticulocytosis (Valderrama and Hudtohan, 2015).

Table 2: Assessment of the Respondents' Diseases of the Digestive system

Diseases of the Digestive System	Mean	Description
Constipation	1.47	Never
Diarrhea	3.33	Sometimes
blood in the stool	1.07	Never
nausea and vomiting	2.53	Seldom
stomach ache	2.73	Sometimes
Mean	2.23	Seldom

Among the respondents, diarrhea and stomach ache are two of the most common digestive system problems in the mining affected areas. However, the respondents indicated that they sometimes suffer these diseases with means of 3.33 and 2.73, respectively. A mean of 2.23 was obtained indicating that all the digestive illnesses were seldom experienced. Although this may not be associated to mining, drinking from the underground water or through the use of lift pump is one of the causes of diarrhea especially during the rainy season.

The respondents answered that nausea and vomiting were seldom suffered having a mean of 2.53. Due to the low incidence of illnesses in the digestive system like diarrhea, the infection which may be caused by bacteria may not be associated to mining activities but can be traced to the drinking water which was contaminated during flooded conditions.

Diseases of the Integumentary System

The occurrence of diseases provided by Rural Health Unit and the assessment of the respondents' diseases in the integumentary system is shown in the Figure 3 and Table 3. Skin disease like rashes allergies and wounds in the

integumentary system are the common diseases brought to rural health unit by the residents of Santa Cruz, Zambales.

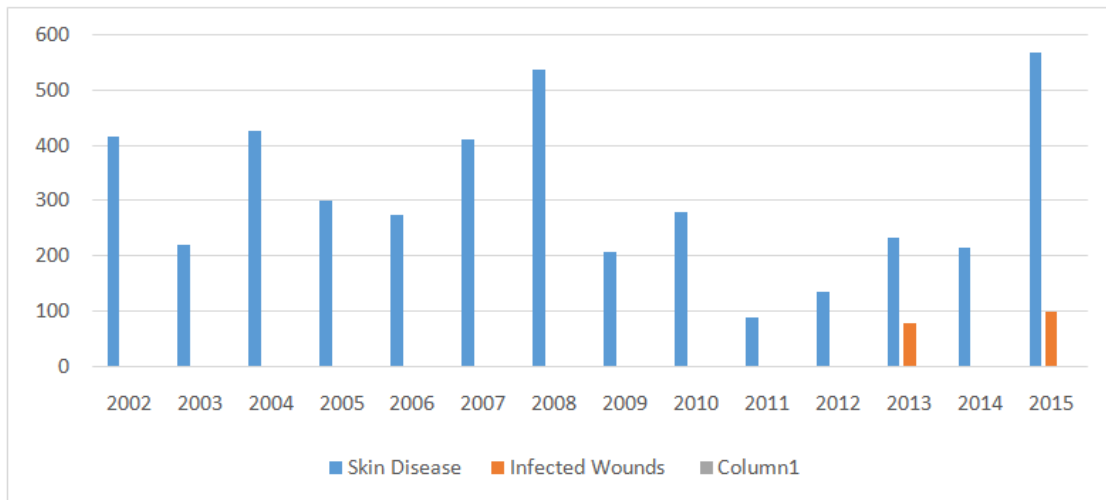


Figure 3: Incidence of Diseases of the Integumentary System Recorded by the Rural Health Unit from Year 2002 to 2015

Data indicate that an irregular trend was observed, although the peak of cases was in 2015 with 568 cases. It can also be recalled that during this year that there was flooding caused by typhoon Lando, which had caused the movement of nickel to the different barangays especially the barangays near the area of mining. This high number of cases in 2015 were followed by the year 2008. This could be attributed to the increased number of mining companies operated in the mountains. More mining companies, more nickel and chromium are produced in the air, the higher chromium is released in the atmosphere together with the dust. Chromium VI is the most dangerous form of chromium and may cause health problems, including: allergic reactions, skin rash, nose irritations and nosebleed, ulcers, weakened immune system, genetic material alteration, kidney and liver damage, and may even go as far as the death of the individual (Sneddon, 2012). According to Yeboah (2008), the combined effects of environmental problems have culminated into health problems with high prevalence of diseases such as malaria, respiratory tract infections and skin diseases.

Table 3: Assessment of the Respondents’ Diseases of the Integumentary System

Diseases in the Integumentary System	Mean	Description
Non-Healing Wound	1.27	Never
Skin Rashes	3.87	Often
Severe Itchiness Of The Skin	2.6	Sometimes
Redness, Swelling Skin	1.2	Never
Discoloration Of The Skin	1.27	Never
Mean	2.04	Seldom

Skin rashes are the most common skin problem experienced by the people of Santa Cruz, Zambales with a mean of 3.87 indicating that the respondents often experienced skin rashes. In 2015, as published by Zambales Mining Investigation, residents of Sta. Cruz, Zambales complained against nickel mining in their area as cases of leukemia and skin irritation rise.

Severe itching is the next common illness of the integumentary system which still feels as allergy, was the next skin problem, although the respondents indicated that they sometimes suffer from this kind of skin problem. It was found by Yoshihisa and Shimizu (2012) that metal allergy may result in allergic contact dermatitis (SCD). It was found that

dermatitis can be due to nickel or cobalt ingestion in mining affected area. The water and soil of the mining affected areas were found positive and high in nickel and chromium (Bacani & Farin, 2012). Skin rashes are widespread, particularly among communities living along rivers and streams which regularly receive leaked cyanide waste waters and other mining wastes within concessions (Akabzaa&Darimani, 2001). There is evidence of long-term impacts of mining on the health of the workers and communities (Stephens & Ahern, 2001).

Diseases of the Cardiovascular System

The occurrence of diseases provided by the Rural Health Unit and the assessment of the respondents' diseases of the cardiovascular system is shown in the Figure 4 and Table 4. Hypertension was the only illness of the cardiovascular system, recorded by RHU with a relatively higher incidence. Although hypertension is a common illness among aging, obese or any individual with some problems like high cholesterol uric acid and sugar, there was also a noticeable increase in the number of people affected by hypertension.

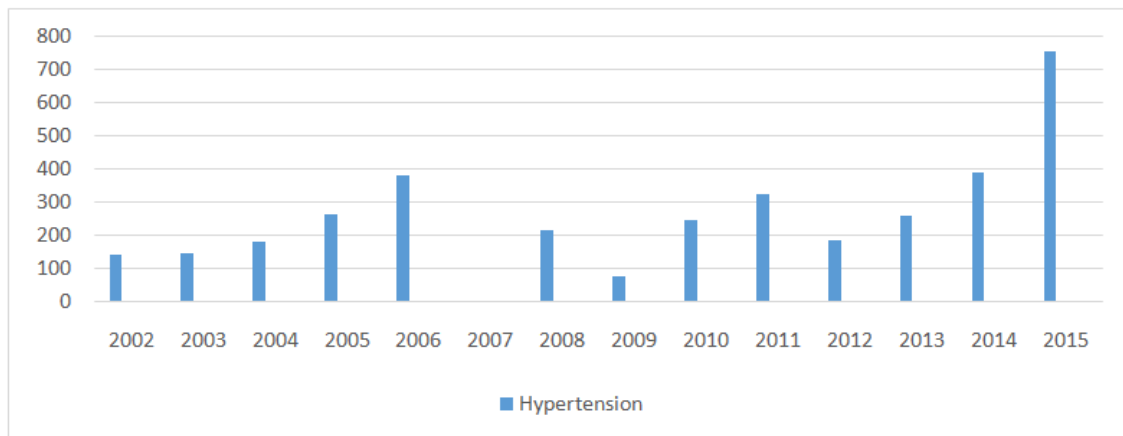


Figure 4: Incidence of Diseases of the Cardiovascular System Recorded by the Rural Health Unit from Year 2002 to 2015

Hypertension was observed to show an increasing trend from 2002 up to 2015. The peak of cases was in 2015 where the increase was noted at 93.60 % from 2014. Some of the respondents indicated that their hypertension was more of psychosocial in nature such as reduction of their income from their farms due to siltation caused by mining. Although there are several risk factors such as smoking, drinking, high body mass index and aging, this study did not look into those aspects. In Potosi, Bolivia, a study of Faraget al.in 2015 in the mining region, he found out that the people near the mining site had significantly higher frequencies of hypertension, hematuria, and ketonuria. Hematuria was significantly elevated among those watering livestock downstream from mines and eating grains from their own farm. Significantly higher blood concentrations of Pb were observed in a subsample of participants with hematuria (Frag et al., 2015).

However, zero case noted in 2007. This may have error in the record filed by the Rural Health Unit of Santa Cruz, Zambales. Cardiopulmonary disease, chronic obstructive pulmonary disease, hypertension, lung disease, and kidney disease have been found in higher-than-normal rates among residents who live near coal mines, according to a 2001 US study.

According to the respondents from six barangays, increased blood pressure is the most common illness of the people's cardio vascular system having indicated as always suffered with a mean of 4.53. Maepe and Outhoff (2011) confirmed that hypertension is an important health challenge for the mining industry in South Africa and detection,

treatment and adequate control of hypertension should receive high priority from the mining authorities.

Table 4: Assessment of the Respondents’ Diseases of the Cardiovascular System

Diseases of the Cardiovascular System	Mean	Description
Hypertension (Increased Blood Pressure)	4.53	Always
Decreased Blood Pressure	2.53	Seldom
Low Hemoglobin Count	1.13	Never
Increased Heartbeat/Palpitations	2.00	Seldom
Tight Chest	2.07	Seldom
Slow Heart Rate (Bradycardia)	1.2	Never
Mean	2.24	Seldom

Although this is common, among the aging individuals, the respondents indicated that increased blood pressure may not only due to mining, but can be due to the heat during the dry season. During the dry season, the area where the mining vehicles pass is dusty and hot. Decreased blood pressure, palpitations and tight chest were seldom experienced by the respondents. The average mean of the diseases indicated by respondents was 2.24 which implies that the cardiovascular system illnesses were seldom suffered by the respondents.

Diseases of the Genito-Urinary System

The occurrence of diseases provided by the Rural Health Unit and the assessment of the respondents’ diseases of the genito-urinary system is shown in the Figure 5 and Table 5. The Rural Health Unit of Santa Cruz recorded that the cases of urinary tract infection (UTI) were common and high especially during the mining operation. The highest level of urinary tract infection was highest during the year 2006. However, a decreasing trend was observed in the succeeding years from 2007 to 2015. According to the respondents, they started boiling their drinking water when they experienced stomach aches after drinking their water. Mining operations of four mining companies started to operate after they were given permit in 2005. This implies that the level of contamination in water, which might have caused UTIs was elevated especially during flooding. The study of **Farag et al. in 2015** found that hematuria, a kidney disorder was significantly elevated among those people near mines and eating grains from their own farm. Significantly higher blood concentrations of Pb were observed in a subsample of participants with hematuria (**Farag et al., 2015**).

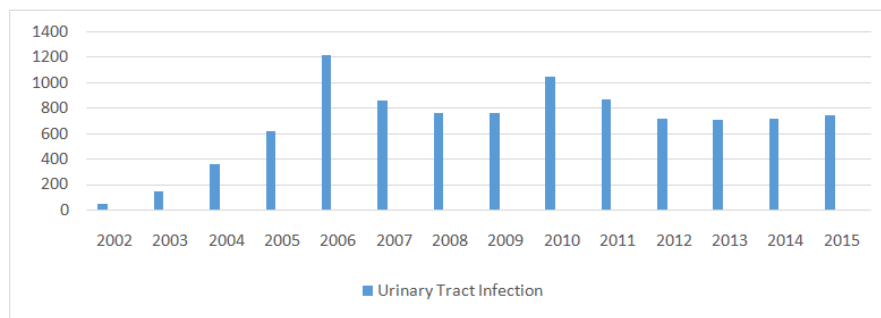


Figure 5: Incidence of Diseases of the Genito-Urinary System Recorded by the Rural Health Unit from Year 2002 to 2015

The bacteria-borne urinary tract infections (UTIs) are a common medical problem among young girls in Pakistan mainly due to lack of safe and hygienic drinking water facilities, deficiency of water, and other fluids in the daily diets of the grown-up girls (**Zadi, 2010**). Medical experts have observed an increase in cases of renal disease (kidney disease), in at least three towns in Marinduque towns affected by mining (**Valderrama & Hudtohan, 2015**).

The record of RHU validates the complain of the respondents that urinary tract infection is the most common problem encountered by the people in Santa Cruz, Zambales. Although the occurrence was low or a rating of 2.6 which is described as sometimes, the rest of the diseases mentioned were seldom experienced like urinary frequency and rheumatism. The rest of the illnesses were never experienced by the respondents.

Table 5: Assessment of the Respondents' Diseases of the Genito-urinary System

Diseases of the Genito-urinary System	Mean	Description
Pain During Urination (UTI)	2.6	Sometimes
Urinary Incontinence	1.20	Never
Urinary Frequency	1.87	Seldom
Flank Pain	1.60	Never
Blood In The Urine	1.33	Never
Urinary Retention	2.20	Seldom
Mean	1.80	Seldom

Diseases of the Neurological System

The assessment of the respondent's diseases in the Neurological System is shown in Table 6. There was no case of illnesses provided by the rural health unit. However, according to respondents headache is the most common problem of the people in Santa Cruz which was rated by the respondents as 5 or described as always. Other illness which was oftentimes experienced was dizzy with a rating of 3.93.

Table 6: Assessment of the Respondents' Diseases of the Neurological System

Diseases of the Neurological System	Mean	Description
Headache	5.00	Always
Dizziness	3.93	Often
Behavioural Confusion	1.13	Never
Depression	1.73	Never
Convulsions	1.13	Never
Mean	2.58	Seldom

Zander (2012) indicates in her report that one of the signs of heavy metal toxicity is headache and sleepiness. In a study conducted by Ekosse et al. (2006) in Botswana, South Africa, they found that mining activities of nickel and copper, especially the release of sulphur gases and fumes into the atmosphere, and other climatic factors could possibly be contributory to the rampant occurrence of headaches at SelebiPhikwe. Behavioural confusion, depression and convulsions were never suffered by the respondents. The finding of this study contradicts the finding of DOH and UP Phil General Hospital in Santa Cruz and Boac, Marinduque in 2002 that children in the exposed areas of the site. Cruz and Boac had histories of convulsions while those from unexposed Torrijos and Buenavista towns had none (Valderrama & Hudtohan, 2015).

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The ten leading causes of morbidity in Santa Cruz, Zambales as recorded by the Rural Health Unit are acute upper respiratory infection, fever, asthma, tuberculosis, diarrhea, hypertension, pneumonia, bronchitis, tonsillitis, parasitism and colds. The most prevalent illnesses as indicated by the respondents in the mining areas are acute upper respiratory

infection(AURI) for the respiratory system, diarrhea for the digestive system, skin rashes for the integumentary system,hypertension for the cardiovascular system, urinary tract infection for the genito-urinary system and headache inneurological system.

RECOMMENDATIONS

With the findings arrived at, the following recommendations are posited:

- The Local Government Unit in collaboration with non-government organizations should work together to conduct some orientation/awareness on the respondents on how to minimize the occurrence of illnesses in the mining affected areas.
- In order to confirm the findings that hypertension and other diseases were caused by toxic metals from mining, there is a need to analyse the residents' blood sample.
- There is a need for the Rural Health Unit to strengthen its health monitoring activities in the mining affected areas in Zambales.
- In order to address the health problems, the mining companies should initiate the putting up of health clinics to be provided with facilities in the barangay level.
- The Municipal Health Units should institute periodic free medical check-ups for mining related diseases among the populations so that serious cases can be detected and cured early enough before they escalate into mortality situations.
- More importantly, since most of the water resources in the municipality (particularly the villages) have been contaminated with bacteria, there should be rigorous efforts by the Mining Companies to provide alternative sources of well treated drinking water in the form of bore holes and others.
- If the health status of the communities is and can no longer be addressed, and the mining companies could not mitigate the health problems of the people, the closure of the mining companies is recommended.
- There is a need to repeat the study to compare the data of Santa Cruz, Zambales with other municipalities where there is no mining activity to validate the findings that the illnesses are due to mining activities.
- Further research needs to be done along economic valuation of the impact of mining on health status of the people and the ecosystem.

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REFERENCES

1. Akabzaa, T. & Darimani A. (2001) - *Impact of Mining Sector Investment in Ghana: A Study of the Tarkwa Mining Region, Draft Report Prepared for SAPRI.*
2. Akabzaa, TM. (2000). *Boom and dislocation, environmental and social impacts of mining in the Wassa West District of the Western Region of Ghana, Africa, Third World Network Africa Publication, Accra*
3. Makweba MM, Ndonde PB. *The mineral sector and the national environmental policy.* In: Mwandosya MJ, et al, editors. *Proceedings of the workshop on the national environmental policy for Tanzania (Dar es Salaam, Tanzania), 1994; 1996. p. 164e73.*
4. Bacani, M. & Farin, E. N. (2012) *Phytoremediation of Heavy Metal Contaminated Soils in Mining Affected Areas of Santa Cruz, Zambales. Unpublished undergraduate thesis. Ramon Magsaysay Technological University. Iba, Zambales pp65*
5. Ekosse, G., De Jager, L. and Van Den Heever, D. (2006). *Headaches among residents within the SelebiPhikwe Ni-Cu mining environment, Botswana. Afr. J. Health Sci., 13: 43-52.*
6. Farag S., Das R., Strosnider W.H., and Wilson R.T. (2015) *Possible health effects of living in proximity to mining sites near Potosí, Bolivia. J Occup Environ Med.; 57(5):543-51*
7. Maepe, L. M. and Outhoff K. (2011) *Hypertension in goldminers. The South African Medical Journal. Vol 102, No 1, 30-33*
8. Awudi, B.K. (2002). *The role of Foreign Direct Investment (FDI) in the mining sector of Ghana and the environment". A paper presented at the conference on foreign direct investment and the environment. Retrieved from <http://www.oecd.org/dataoecd/44/12/1819492.pdf>*
9. Campo A., F. Bianchini, G. Pascual, S. Orecchio, Bonsignore, P. Blandino and P. Pietrini. (2015). *Elemental contamination of an open-pit mining area in the Peruvian Andes. International Journal of Environmental Science and Technology. March 2015, Volume 12, Issue 3, pp 1065–1074*
10. DENR-EMB. (2008). *Manual on Ambient Water Quality Monitoring: Water quality monitoring manual. Quezon City: EMB-DENR.*
11. Filer C. (1998). *Mining in the South Pacific. Retrieved from <http://www.antenna.nl/ecsiiep/bulletin.html>*
12. Macapagal J. (2016) *Gov't stops nickel mining in Zambales. Malaya Business Insights. Retrieved from <http://malaya.com.ph/business-news/business/gov%E2%80%99t-stops-nickel-mining-zambales-0>*
13. Molino, B. (2015, February 5). *When the government turned her back from her people, where will people turn to? {Facebook status update} Retrieved from <https://www.Facebook.com/notes/benito-e-molino/the-mining-saga-of-sta-cruzzambales/10153060576998516/>*
14. Panos, M.R., (1997). *SP. Environmental assessment of mining projects. Retrieved from <http://www.worldbank.org/mining.xls>; 1997.*

15. Rhett, B. A. (2006). "Environmental impact of mining in the rainforest". *Mongabay.com / A Place Out of Time: Tropical Rainforests and the Perils They Face*. Retrieved from <http://rainforests.mongabay.com/0808.htm>.
16. Shukla, P.R. (2006). *India's GHG emission scenarios: Aligning development and stabilization paths*. *Curr. Sci.* 90: 384–395
17. Sneddon, C. (2012) *Chromium and its negative effects on the environment from Geology and Human Health Topical Resources. Health case study*. Retrieved from <http://www.lennotech.com/periodic/water/chromium/chromium-and-water.html>.
18. Stephens, C. & Ahern M. (2001). *Workers and Community Health Impacts Related to Mining Operations Internationally* Retrieved from <http://pubs.iied.org/pdfs/G01051.pdf>
19. Tauli-Corpuz V, (1997): *The Globalisation of Mining and its Impact and Challenges for Women*. Retrieved from <http://www.twinside.org.sg/bookstore.htm>.
20. UNEP (1997): *Industry and Environment, Mining and Sustainable Development*. Retrieved from <http://www.uneptie.org/vol20 no4.htm>.
21. Valderrama, J.T and Hudtotan E. T. (2015). *Impact of Mining on Health and Wellbeing*. Retrieved from <http://emilianohudtohan.com/impact-of-mining-on-health-and-wellbeing/>
22. World Rainforest Movement. (2004). *Mining: Social and Environmental Impacts*. Retrieved from <http://www.wrm.org.uy/deforestation/mining/text.pdf>.
23. Yeboah, J.Y. (2008). *Environmental and Health Impact of Mining on Surrounding Communities: A Case Study of Anglogold Ashanti in Obuasi*. Retrieved from <http://ir.knust.edu.gh/bitstream/123456789/631/1/Joseph%20Yaw%20Yeboah.pdf>
24. Zadi, E. (2010). *Contaminated water causing UTIs among girls*. Retrieved from <http://nation.com.pk/national/01-Nov-2010/Contaminated-water-causing-UTIs-among-girls>
25. Zander, A. (2012, June 30). *Part I: Heavy Metal Poisoning Signs & Symptoms* Retrieved from <http://www.livestrong.com/article/184759toxicmetalshairloss/#ixzz2CaDi4FRX>

