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Opportunities and Threats to Adjacent Community in a Sanitary Landfill, Philippines

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Abstract

This study assessed the adjacent community in Cebu City Sanitary Landfill (CCSL), Philippines. Data were gathered on April, 2011 using interview-questionnaire covering sixty three households. Areas assessed include the general household profile, perceived opportunities, water resources and utilization, health status and services, waste management practices, and perception to CCSL management and institutions. Result showed that households perceived opportunities in CCSL as a result of employment, resources, and security through informal workforce like scavenging. However, the adjacent community was found to be at high risk owing to use of contaminated groundwater and unsafe waste management practices. These threats were manifested through prevalence of gastrointestinal, respiratory, and dermal diseases. Households also acknowledged the negative impacts to health and environment however their major concern was accessed to employment upon closure and relocation of CCSL. The study provided basis for policy makers and concern institutions on identifying basic services to be made available to the adjacent community considering the closure of CCSL.

Keywords: sanitary landfill; scavenger; household

1. Introduction

As of the third quarter of 2011 the Philippines have a total of 7,327 material recovery facilities (MRF), 384 controlled disposal sites, 640 open dumpsites, and 38 landfills both in rural and urban areas (National Solid Waste Commission, 2011). The large number of disposal sites in the country suggests environmental quality monitoring to both ecology and human health as these will draw settlers adjacent to disposal sites to secure informal employment like scavenging (Asim *et al*., 2012).

In 2010 Cebu City, Philippines has a total population of 866,171 and a population growth rate of 3% (National Statistics Office, 2010). The population rises over a million in daytime due to the influx of the work force towards the city. Given the population density in Cebu City which is 2,204 m^2 and waste generation in the country which is 0.40 kg capita day^{-1} (Ancog *et al*., 2012) suggests the need for more waste disposal facilities. Locally, the waste disposal site available in Cebu City is the Cebu City Sanitary Landfill (CCSL) receiving 450 tons of wastes daily largely organic (51.57%) (WCS, 2006), plastics, bottles, clothes, glasses, and scrap metals which were utilized as resources by scavengers and local settlers.

However, the adjacent community to a landfill is similarly exposed to health risks. In most cases the utilization of landfills showed incomplete information for leachate and gas handling (Johannessen and Boyer, 1999) which can threaten the environment and public health. Similarly, potential contamination of the groundwater by chemical, physical, and biological constituents adjacent to a landfill site were studied to likely occur (Galarpe and Parilla, 2012; Mor *et al*., 2006). Disposal of hazardous materials such as medical wastes were prevalent along with ordinary municipal wastes (Alloway and Ayres, 1997) which exposes the public if not contained. Despite the risks associated to landfill, scavenging waste picking among communities with close proximity to the disposal site remains to continue as the landfill brings economic dependency (Sia Su, 2007a) and livelihood (Paul *et al*., 2012; Afon, 2012).

Considering these factors this study was initiated to assess the adjacent community in CCSL with the aim of determining the opportunities and threats. The sub parameters used to assess the community included, household profile, perceived opportunities, water resources and utilization, health status and services, waste management practices, and perception to CCSL management and institutions.

2. Materials and Methods

2.1. Framework

This study identified threats and opportunities of CCSL towards the adjacent community basing from the environmental quality and the socio-economic components, respectively. This study integrated the results of the previous studies evaluating the environmental quality in CCSL which covered analyses of groundwater (Galarpe and Parilla, 2012) and plants metal uptake (Nazareno *et al*., 2011). The other socio-economic component was inputs from the community upon survey. Under the socio-economic component were the following variables i) general household profile; ii) perceived opportunities in CCSL; iii) water resources and utilization; iv) health status and services; v) waste management practices; and vi) perception to CCSL management and institution. The results served as basis to recommend approaches of providing services among adjacent community to CCSL. Fig. 1 presents the framework of the study.

2.2. Study site

Cebu City is located on the central eastern part of Cebu Province, an island at the center of the Visayas in Southern Philippines (latitude: $10^0 17'$N and longitude: $123^0 54'$E). Cebu City's flat land occupies about 23 km^2, representing 8% of its total land area but it contains over 40 barangays (smallest community unit) and about two thirds of its population. Waste generation in the city is diverse with 0.50 kg average waste capita per person. Waste management in the city is under the supervision

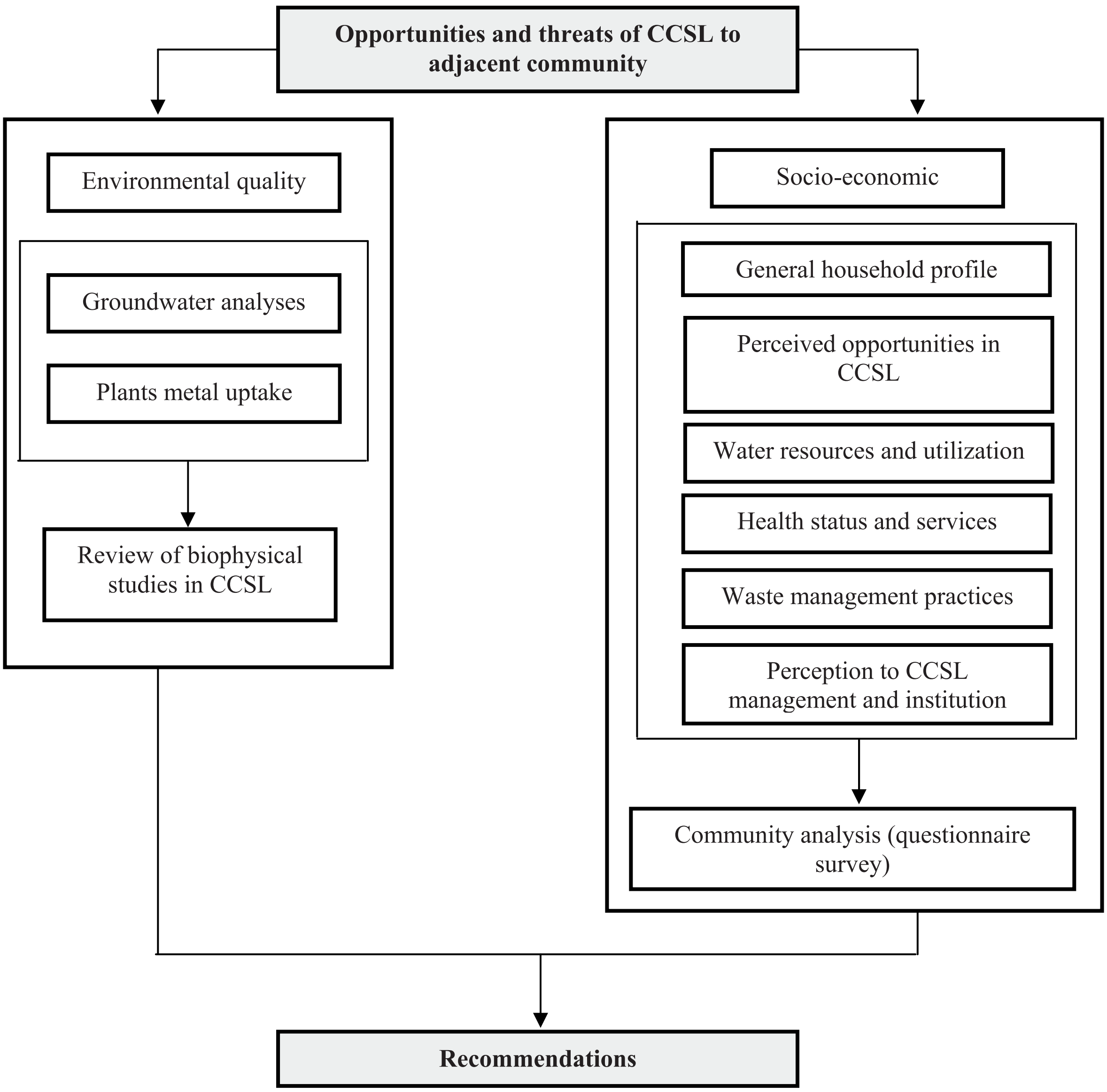

Figure 1. The theoretical framework employed in the study

of the Department of Public Services (DPS). The task of the department includes regulation and management of the city waste which include management of CCSL. The site studied was CCSL located in the South District of the city in Barangay Inayawan (Fig. 2). The landfill is located adjacent to the neighboring city of Talisay. It has a total lot area of 15.41 ha of which 11.73 ha is allotted for dumping with a designed capacity of 920,000 ton. Landfill operation began on September 11, 1998 with projected use for seven years.

Daily average weight of garbage dumped is approximately 450 tons (WCS, 2006). Table 1 shows the waste monitoring report for solid waste which include domestic and commercial wastes (organic, paper, plastic, mixed residue, metal, special waste, glass, construction material, hazardous, and electronics) in CCSL on September 19-25, 2010. Waste analysis and characterization in 2010 revealed that dumped wastes in CCSL were 81.05 % biodegradable and 18.95% non-biodegradable respectively. The biodegradable wastes were consisted of food waste (66.65%), paper waste (4.11%), wood waste (1.08%), textile waste (1.60%), rubber, leather, bones and straw (0.83%), and other organics (6.78%). The non-biodegradable wastes included metallic waste (1.49%), plastic waste (15.61%), construction and demolition waste (0.82%), and glass-ceramic waste (1.03%).

Waste management gaps in CCSL were observed implicating ill effects to both environmental and health. The following gaps were reported by the Department of Environment and Natural Resources-Environmental Management Bureau Region 7 (DENR-EMB 7);

1. identified operational deficiencies;
2. no daily soil cover;
3. landfill was half full, leachate has no treatment but sprayed back to active dumping area;
4. no segregation and recycling;
5. conveyor not functioning;
6. and medical waste were disposed directly

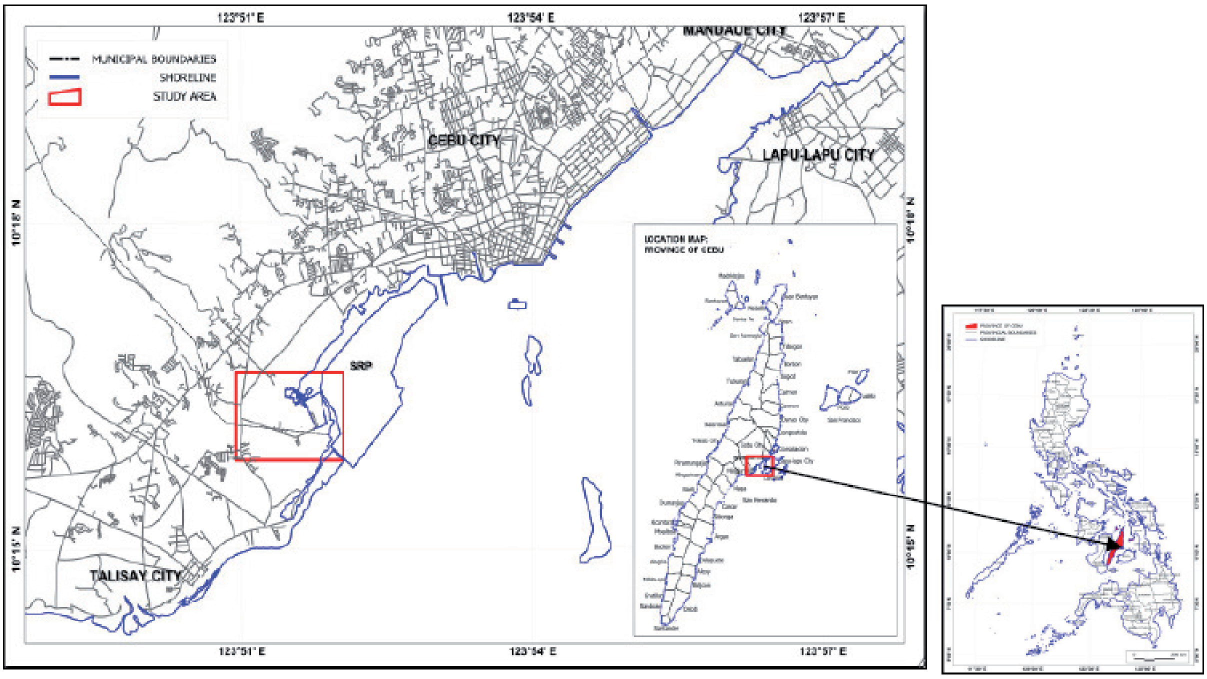

Figure 2. Location of Cebu City Sanitary Landfill, Philippines (Nazareno *et al*., 2011)

Table 1. Waste monitoring in CCSL from September 19 - September 25, 2010

Year 2010	Total number of trips of dumping trucks per day	Total estimated wastes disposed daily (kg)
September 19	135	367, 640
September 20	185	476, 040
September 21	226	567, 510
September 22	195	502, 450
September 23	203	515, 160
September 24	175	443, 290
September 25	131	352, 410
Mean	178.57	460, 643

2.3. Survey

A total of sixty three (63) households directly living (10-30 m) to CCSL were surveyed using interview questionnaire instrument on April, 2011. This was carried particularly assessing the following: i) general household profile; ii) perceived opportunities in CCSL; iii) water resources and utilization; iv) health status and services; v) waste management practices; and vi) perception to CCSL management and local institution. There were no secondary data to assess the socio-demographic profile of the adjacent community in CCSL.

2.4. Statistical analyses

The obtained data were statically expressed in percentage and frequency. Descriptive statistic using arithmetic mean and standard deviations were collectively used to evaluate the data including the maximum and minimum quantitative values.

3. Results and discussion

3.1. Environmental quality of CCSL

3.1.1. Groundwater quality

The groundwater quality data were obtained from the study of Galarpe and Parilla (2012) citing particularly the parameters total Pb and Cd, coliform (total and fecal), and TDS (Table 2). All parameters from the examined three groundwater stations regardless of seasonal variations exceeded water quality guidelines (PNSDW, 2007; WHO, 2008). It can be extrapolated that groundwater in CCSL is unfit for human consumption and may bring health risks.

Determined Pb maybe associated to waste containing Pb based paints, pipes, batteries, and chemicals for photograph processing are dumped in the area (Mor *et al*., 2006). The Cd on the other hand can similarly be attributed to waste materials like paints, pigments, plastics (Bagchi, 2004), effluents of batteries (Alloway and Ayres, 1997), scrap metal, old slum tenements,

Table 2. Selected physicochemical properties of groundwater in CCSL (Galarpe and Parilla, 2012)

Parameters	Groundwater stations						Total mean (SD)	PNSDW [a]	WHO [b]
	G1		G2		G3				
	Dry	Wet	Dry	Wet	Dry	Wet			
TDS (mg L^{-1})	3,713	4,382	586	6,225	4,032	1,024	3,327 (2,143)	500	500
Total coliform (MPN/100 mL)	8.10	4.60	8.00	4.50	43.05	7.20	12.58 (15)	0	0
Fecal coliform (MPN/100 mL)	8.40	1.75	1.10	1.80	43.05	8.10	10.7 (16)	0	0
Total Pb (mg L^{-1})	0.0199	0.0521	0.0521	0.0468	0.0178	0.0420	0.0385 (0.015)	0.010	0.010
Total Cd (mg L^{-1})	0.0033	0.0033	0.0024	0.0042	0.0078	0.0038	0.0041 (0.001)	0.003	0.003

[a] Philippines National Standard for Drinking Water (2007)
[b] World Health Organization (2008)

Table 3. Mean total Pb and Cd in CCSL groundwater compared to dormant landfills elsewhere

Total heavy metal (mg L^{-1})	CCSL (n =3) [a]	Lagos, Nigeria [b]	Payatas Dumpsite, Philippines [c]	Yemen [d]	Ampar Tenang, Malaysia [e]	On-nuch, Thailand [f]
Pb	0.0385	0.05	<0.015	0.142-0.283	1.179-1.18 [g]	NA
Cd	0.0041	0.04	<0.007	0.0095-0.1890	0.058-0.095 [g]	0.005-0.006

[a] mean of the three groundwater stations (Galarpe and Parilla, 2012); [b] (Akoteyon *et al*., 2011); [c] (Sia Su, 2008); [d] (Sabahi *et al*., 2009); [e] (Taha *et al*., 2011); [f] (Watananugulkit *et al*., 2003); [g] downstream

dirty scrap, and waste disposal yard (Cumar and Nagaraja, 2011). The Cebu City characterization study in 2006 reported that wastes in CCSL were composed of plastics (16.67%), electronics (0.25%), and metals (7.07%) (WCS, 2006). Cited form of wastes once dumped in CCSL can potentially exhibit the high levels of Pb and Cd in the groundwater.

Groundwater studies in landfill and disposal sites elsewhere (Akoteyon *et al*., 2011; Sia Su, 2008; Sabahi *et al*., 2009; Taha *et al*., 20111; Watananugulkit *et al*., 2003) observed contamination through leachate percolation. Although anthropogenic factors may likely affect the water quality, still percolation brought by leachates remains the main factor. Table 3 highlights a relative comparison between the Pb and Cd in CCSL groundwater compared to other dormant landfill studies. As presented, both Pb and Cd levels in CCSL groundwater were higher than the study in Payatas dumpsite, Manila (Sia Su, 2008) and relatively lower than the studies in Nigeria (Akoteyon *et al*., 2011), Yemen (Sabahi *et al*., 2009), and Ampar Tenang Landfill, Malaysia (Taha *et al*., 2011). Factors to consider with the variability of obtained results were the type of wastes dumped in the studied disposal sites, volume of wastes dumped, precipitation, and geochemical factors.

The study of Nazareno *et al*. (2011) evaluated thirty two (32) plant species in CCSL for Pb and mercury (Hg) uptake in roots, stems, leaves, and soils where plants grown. Their study revealed Pb uptake in *Commelina benghalensis, Cynodon dactylon*, and *Cyperus odoratus* however with minimal BCF (bioconcentration factor) and TF (translocation factor). Further, they found out that *Tridax procumbens* was an accumulator of Hg and *Muntingia calabura* with internal transfer of Hg to leaves. This provides further basis to carry phytoremediation in CCSL owing to health associated risk brought my metals.

3.2. General household profile

The 29% of the surveyed households were locals living near CCSL whereas the other 71% relocated adjacent to CCSL owing to seen opportunities. Access of identifying the CCSL as waste disposal site were sought generally from direct personal observation (89%) while the others were informed through the CCSL management prior to construction (5%), invitation from existing settlers prior to landfill construction (2%), media (1%), while the other 3% decided not to disclose further reasons (Fig. 3).

Majority of the households owned a house (82%) while 16% were extended families. The other 2% were renting an apartments or rooms this was found in agreement with the study of waste dumpsites cities in Nigeria (Ogunrinola and Adepegba, 2012). Although some houses were built with concrete, mostly however were built on light and make shift materials typically consisting of wood, poly vinyl roofs, and recycled materials (cardboards, tarpaulins, and plastics). A total of 54% of the households owned a septic or sewerage facility (open type) whereas 46% shares a common septic with either extended family members or neighbors. Each household have five average members with few having fourteen members as a result of extended families. Respectively, the monthly income per household reaches to an average of Php 4,044.26 (101 US $) although the maximum can reached to Php 16,000.00 (395 US $) depending on the size of the family and the nature of employment (Table 4). Both

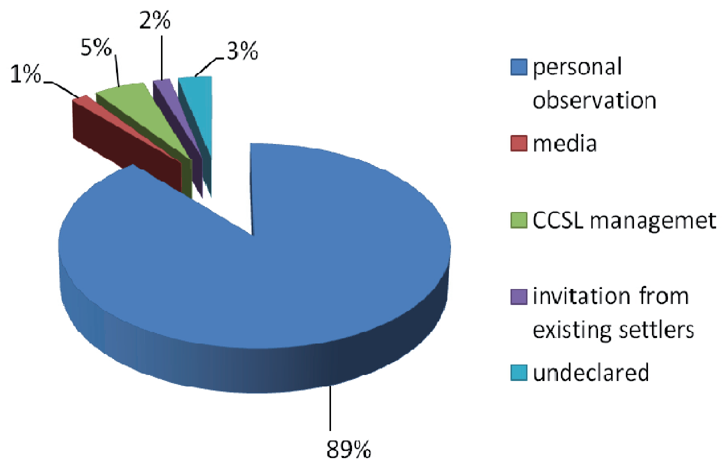

Figure 3. Information access of surveyed households to the use of CCSL as waste disposal site

Table 4. Average number of household members with their corresponding monthly income

Parameters	Total	Mean	Maximum	Minimum	SD
No of household members	335	5	14	1	2.69
Monthly income PHP (US $) [a]	246,700.00 (6,167.50)	4,044.26 (101)	16,000.00 (395)	1,000.00 (25)	2889.84 (72.25)

[a] current exchange rate 1 US $ = PHP 40.50

poverty related factors, namely, poor housing and family income were found to be correlated with water pollution and sanitation among urban poor communities (Kumar Karn and Harada, 2002). This was found to be a concerned affecting potentially the health of the adjacent community.

3.3. Perceived opportunities in CCSL

The CCSL brings economic opportunities to the adjacent community since 53% of the surveyed households were scavengers. This is usually the case in landfills since scavenging provides sustainable livelihood among those who cannot secure employment in the formal urban market (Rankokwane and Gwebu, 2006). The other 25% were unemployed. The 5% were store owners which secure financial stability by providing goods and services to scavengers. Some of those who belong to this sector were junkshop dealers or operators which do the reselling acting as middlemen to recycling industries (Asim *et al*., 2012; Sia Su, 2007a; Nzeadibe, 2009). Often the junkshop dealers or operators can be tapped by individuals and family members of scavengers as informal lending sources (Sia Su, 2007a). Both scavengers and store owners accounts for a total of 58% employment obtained from CCSL which is common among residents adjacent to disposal sites. On the other hand the 14% of the surveyed households were employed by private sectors and the other 3% decided not to disclose their employment status (Fig. 4).

The obtained employment options in Fig. 4 were in agreement when the households were asked about their perception to CCSL as to providing the advantage towards them. Positively, 94% of the 63 households responded to have perceived CCSL giving them employment benefit. This was in agreement with large number of respondents involved in the operation as scavengers or waste pickers despite the inability to secure health benefits. Similarly, 46% of the surveyed households perceived CCSL to provide resources. By observation it was common that most of the houses adjacent to CCSL were built of light materials obtained from the landfill. Second, some practiced the concept of cash from trash and trash to products strategy which also co-exist outside CCSL as barangay level initiative to address waste reduction in Cebu City (Ancog *et al*., 2012). In both practices households were producing goods from secondary raw materials for direct use by consumers and conversion of recovered materials into intermediate products (Nzeadibe, 2009). This included making bags and accessories from scavenged materials which were then sold in a nearby market. Another 24% perceived the landfill to provide them with business options (local grocery stores and junkshop operators). The others felt secured (6%) attributed to employed security guards dispatched in CCSL (Fig. 5).

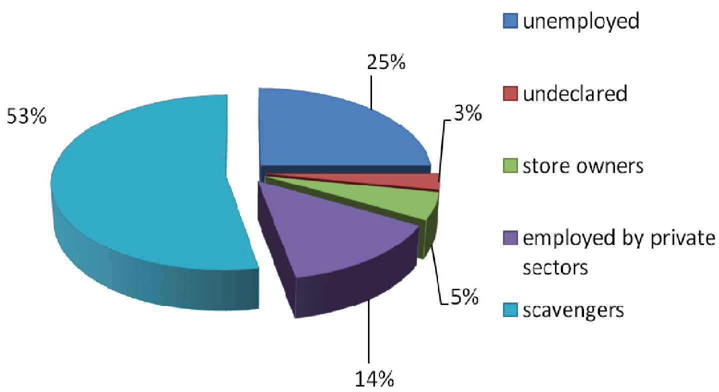

Figure 4. Employment of surveyed households in CCSL

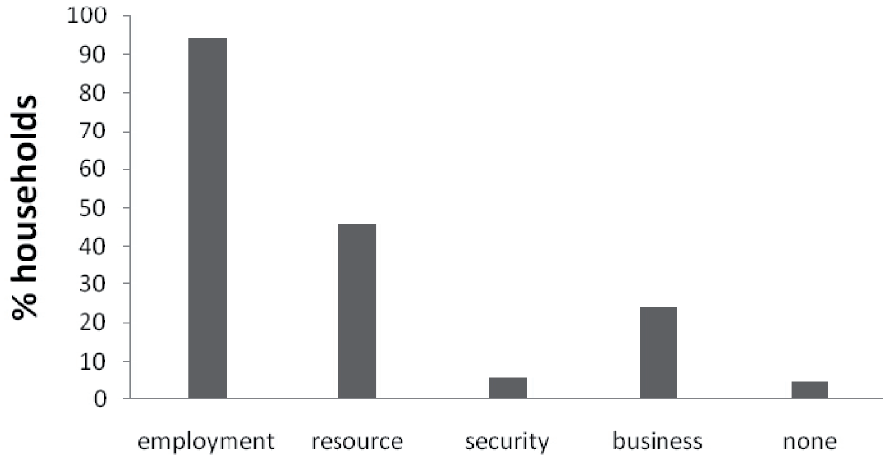

Figure 5. Perceived opportunities in CCSL

3.4. Water resources and utilization

Most of the surveyed households relied on Metro Cebu Water District (MCWD) for water domestic consumption, specifically for bathing (79%), drinking (90%), washing and cleaning (68%), and cooking (95%). While most of the surveyed household utilized MCWD water for drinking the other 10% purchased commercially available bottled water (Table 5). However, some of the respondents utilized deep wells adjacent to CCSL for cooking (5%), bathing (21%), and washing and cleaning (32%). This in return provided concerns considering that the groundwater in CCSL contains Pb, Cd, dissolved solids, and coliform (total and fecal) exceeding water quality guidelines regardless of seasonal variation (Galarpe and Parilla, 2012).

The Cd in particular has been known to be associated with the development of atherosclerosis and hypertensions in animals with prolong exposure despite low concentrations. In combination, the existence of Pb further potentiates the hypertensive effects of Cd (Klaassen, 2008). A study using dose-response functional model developed through a multiple linear regression analysis indicated that total Cd correlated significantly with the prevalence of diarrhea cases in Payatas dumpsite, Manila (Sia Su, 2007b). On the other hand, water containing Pb has been linked to hypertension during childhood exposure. The direct vasoconstrictor effect of Pb maybe related to the putative hypertensive response in effect activating rening-angiotensin-aldosterone (Klaassen, 2008). Both metals (Pb and Cd) can bring toxicological responses.

On the other hand coliform (total and fecal) may not be directly associated to cause health problems however it is an indicator for the presence of other pathogens which may be present in the groundwater resulting to health problems once it entered into the body either oral or dermal.

Table 5. Sources and utilization of water among surveyed household's in CCSL

Percentage of Water Usage	MCWD [a]	Purchased [b]	Deep well
Drinking	90	10	NA
Cooking	95	NA	5
Bathing	79	NA	21
Cleaning and Washing	68	NA	32

[a] MCWD = Metro Cebu Water District; [b] Commercially available bottled water; *n= 63*; NA= not applicable

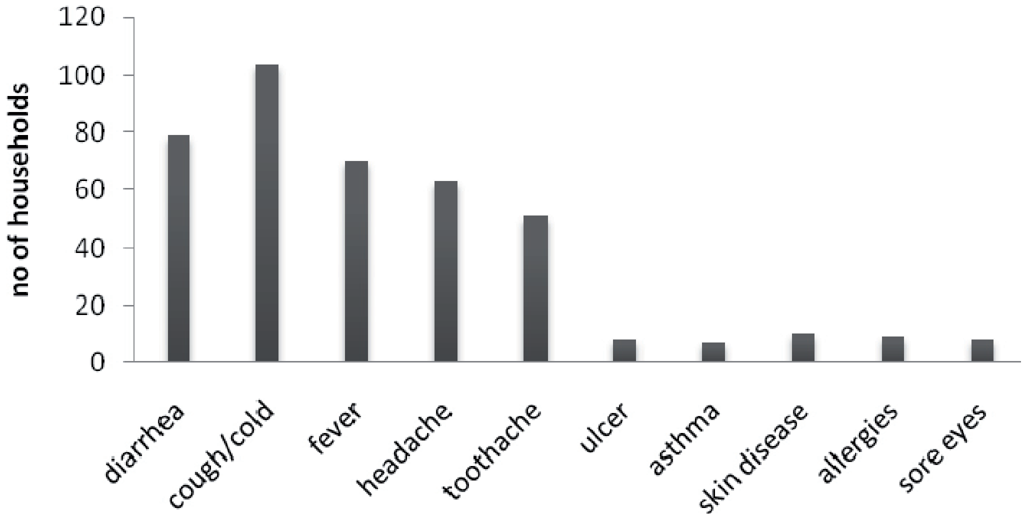

Figure 6. Frequency of household members experiencing common diseases

3.5. Health status and services

Although the households were not all working in CCSL as scavengers or securing formal employment in CCSL management they were still exposed potentially to health hazards considering the proximity of the settlements to the landfill. Common diseases experienced by the surveyed households in the rank were cough and cold > diarrhea > fever > headache > toothache > skin diseases and associated allergies > sore eyes > ulcer > asthma (Fig. 6). Respiratory diseases which covered common cough and cold accompanied by headache were predominant among surveyed households. While present review suggested inadequate correlation between respiratory diseases and symptoms to landfill operation (Porta *et al*., 2009), however the occurrence of respiratory diseases among neighboring population to waste disposal site was relevant (Heller and Catapreta, 2003).

Studies also found out prevalence of respiratory symptoms and a greater decrease in lung function among municipal solid waste workers (Athanasiou *et al*., 2010) and high cases of wheezing among waste-picking children (Romero *et al*., 2010). The occurrence of respiratory diseases can be linked to potential exposure from chemical toxins in the disposal site. In particular, xenobiotic organic compounds (XOC's) were found to co-exist with metals in landfill leachates (Slack *et al*., 2005; Kjeldsen *et al*., 2002) which can potentially all be volatilized during methanogenic decomposition of dumped wastes. Similarly, volatile organic compounds (VOCs) were detected among landfill studies elsewhere (Eklund *et al*., 1998; Majumdar and Srivastava, 2012; Al Ahmad *et al*., 2012). The small scale domestic waste composting facilities were also found out to emit VOCs (Domingo and Nadal, 2009). Exposure to VOC's, including emissions from chemical manufacturing plants, was found to be associated with increased rates of chronic respiratory symptoms characterized by reactive airways (Ware *et al*., 1993). Exposure to solvents like chloroform and its associated halogenated compounds produced in landfills (Sullivan *et al*., 2005) was established to likely affect central nervous system (CNS) manifested through respiratory symptoms.

On the other hand, few responded (less than 20) to have household members experiencing asthma although roughly cannot be directly associated to CCSL operation. However, the presence of VOCs can similarly trigger the risk for asthma (Rumchev *et al*., 2004). It was known that several environmental factors may increase asthma like exposure to pesticides, reactive dyes, auto-body spray paint, and cosmetics (Walker *et al*., 2003) which can be found in dumped wastes.

Incidence of diarrhea among surveyed households in CCSL was also observed affecting to nearly 80 household members. Settlements located less than 200 m from a dumpsite were found to be affected by diarrhea (Abul, 2010). Similarly, gastrointestinal symptoms (diarrhea) were also found to likely occur in MRF associated to exposure to endotoxin and (1→3) - β-D-glucan (Gladding *et al*., 2003). A study in Poland reported gram negative rods (primarily intestinal) in all municipal waste collection systems (Krajewski *et al*., 2002) this in return can pose health risk specifically manifested through gastrointestinal diseases. Bioaerosol study also suggested a cross linked to gastrointestinal complaints by workers involved in paper waste sorting (Wurtz and Breum, 1997) which was found as a common practice among scavengers in CCSL. The presence of coliform in CCSL groundwater (Table 2) can be an indicator of other pathogens which can be a potential cause leading to gastrointestinal problems. The same observation was recorded with high coliform count in CCSL leachate (Galarpe and Parilla, 2012) exposed to scavengers and settlements at landfill refuse sites. The study of El-Sayrafi *et al*. (2011) confirmed that there were coliform associated pathogens (*Citrobacter* spp., *Acinetobacter* spp., *Pseudomonas aeruginosa*, and *Salmonella* spp.) in landfill leachates which can similarly bring about gastrointestinal diseases once ingested. The study however in Payatas dumpsite, Manila found out significant correlation between Cd in water and the prevalence of diarrhea (Sia Su, 2007b). The determined Cd levels in all groundwater stations in CCSL were higher compared to PNSDW and WHO water regulations (Galarpe and Parilla, 2012). As a consequence, it can be deduced that Cd in groundwater can be associated similarly to occurrence of diarrhea.

Waterborne illnesses like diarrhea can occur as a result of ingesting contaminated food. It was a common observation in CCSL a high density of common flies (*Musca domestica*). This species is known as vectors for microorganisms like *Salmonella* spp. to contaminate food and utensils. Observation in the past revealed that poor sanitation and high population density to likely cause diarrhea (Gasana *et al*., 2002). Sia Su (2005) also determined that household with more than five members had higher probabilities of getting waterborne illnesses. On the other hand, the prevalence of headache (Vrijheid, 2000) and toothache (Rankokwane and Gwebu, 2006) were found common. Although there are no conclusive literature to establish a direct effect of landfill to human health, there are still several studies of landfills elsewhere (Gladding *et al*., 2003; Heller and Catapreta, 2003; Rushton, 2003; Perez *et al*., 2006) that supported the observation in CCSL showing prevalence of respiratory, gastrointestinal, and dermal diseases.

During the field analysis it was observed that medical wastes were also dumped in CCSL along with other recyclables (Fig. 7). Disposal of medical wastes in CCSL along with municipal solid wastes was found to be a common problem with the study in Turkey (Uysal and Tinmaz, 2004). Mainly, this posed health threat exposing scavengers and the adjacent community. This problem however is uncommon owing to lack of knowledge by health workers despite pertinent legislation (Moreira and Gunther, 2012).

Further, majority (71%) of the households in CCSL preferred to avail medical services to barangay health centers owing to accessibility, free medical consultations, and medicines. But for serious medical need they seek assistance to government hospitals. The other 24% preferred to avail the free missionary medical services (Fig. 8) provided as extension services by church entities and non government organizations (NGOs).

3.6. Waste management practices

A total of 83% of the surveyed households can distinguish biodegradable wastes from non-biodegradable whereas the other 6% lacks the knowledge. The remaining 11% can classify the wastes slightly (Fig. 9). Majority of the surveyed households (60%) does not recycle their own domestic wastes while the other 40% practiced recycling. Their recycling practices

a

b

Figure 7. Medical waste typically dumped in CCSL along with domestic and industrial wastes a) waste syringes and blood vials; b) waste dextrose and oxygen tubes

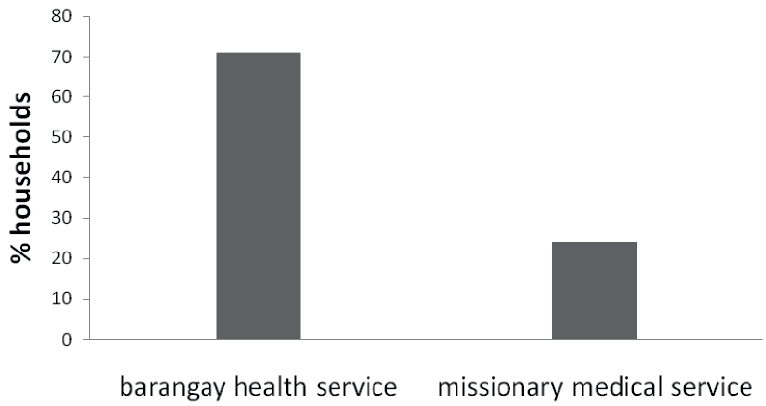

Figure 8. Medical services availed by CCSL households

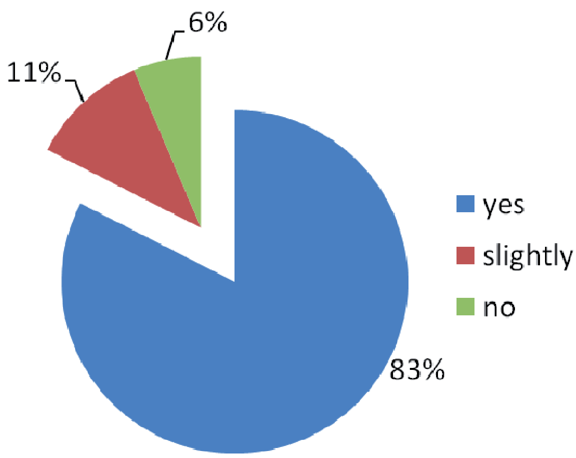

Figure 9. Household's capacity to distinguish biodegradable wastes

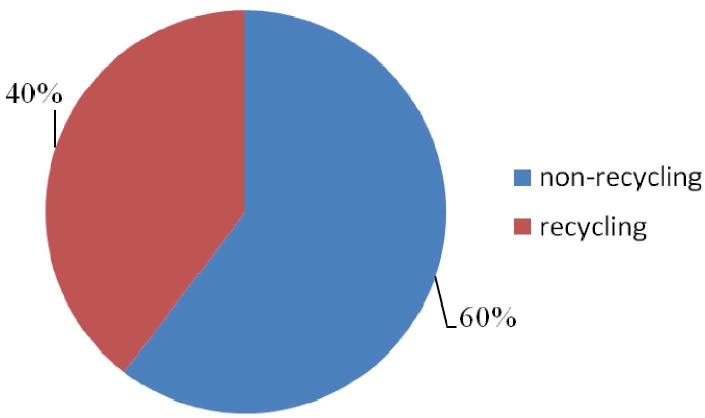

Figure 10. Domestic waste management of surveyed households

were found to be diverse in coupled with reusing which include selling plastics, PET bottles, cans, and metal scraps to junkshops nearby (Asim *et al*., 2012; Rankokwane and Gwebu, 2006). The other existing practices involved producing valuable products (e.g. bags, clothes, shoes, and rags) utilizing scavenged wastes as raw materials (Fig. 10). Well-planned recycling programs in coupled with composting were found to be an imperative formula to save waste management costs to 18.6% and 57.7% in landfill avoidance costs (Agunwamba, 2003).

Although recycling was found to be practiced, still 54% of the surveyed households practiced burning domestic wastes while mostly dumped their wastes elsewhere (86%). Burning was found alarming considering that most of the houses in CCSL were built on light materials and have lesser distances. Further, the physical structure of the area was unsuitable for the burning practice since scavenged wastes from CCSL were fled between houses and along small pathways, making the chance of fire to likely occur. Similarly, inability to contain the waste can eventually result to environmental mechanical risk like collapsing of dumped wastes brought about by heavy rain fall (Towhata, 2007). Nonetheless, the other 32% of the surveyed households depends on scheduled waste collection system initiated by the local government and the 8% practiced composting (Table 6).

3.7. Perception to CCSL management and institutions

While CCSL provided the adjacent community with economic opportunities 88% however recognizes the ecological ill effects brought by CCSL operation. The negative impacts they perceived can be ranked in the order: human health (48%) > release of pungent odor (46 %) > contamination of the groundwater (13%) > nuisance due to landfill operation (10 %) > road congestion (2 %). (Fig. 11). It is likely common that adjacent community and scavengers perceived disposal sites to pose health hazard (Rockson *et al*., 2013).

The perceived threat to health was manifested by the health assessment survey showing prevalence of respiratory and gastrointestinal diseases (Fig. 5). Although there was no direct association between the released of pungent odors to health, it was clear that quality of life was affected (Abul, 2010) and health can be compromised (Sakawi *et al*., 2011). Further, it can be pointed out that the factor of odor exposure can likely reduce earnings of residents in a landfill (Ogunrinola and Adepegba, 2012). A small number of households (< 10%) observed road congestion near CCSL. In general, direct settlers to landfills perceived the negative impacts, however less than 50% of the public are well informed and the rest were generally unable to acknowledge landfills ill effects to health and environment (Al-Yaquot *et al*., 2001).

Table 6. Waste disposal practices of surveyed households in CCSL

Respondents	Burning	Composed pit	Collected	Dumping elsewhere
No.of households	34	5	2	54
% households	54	8	32	86

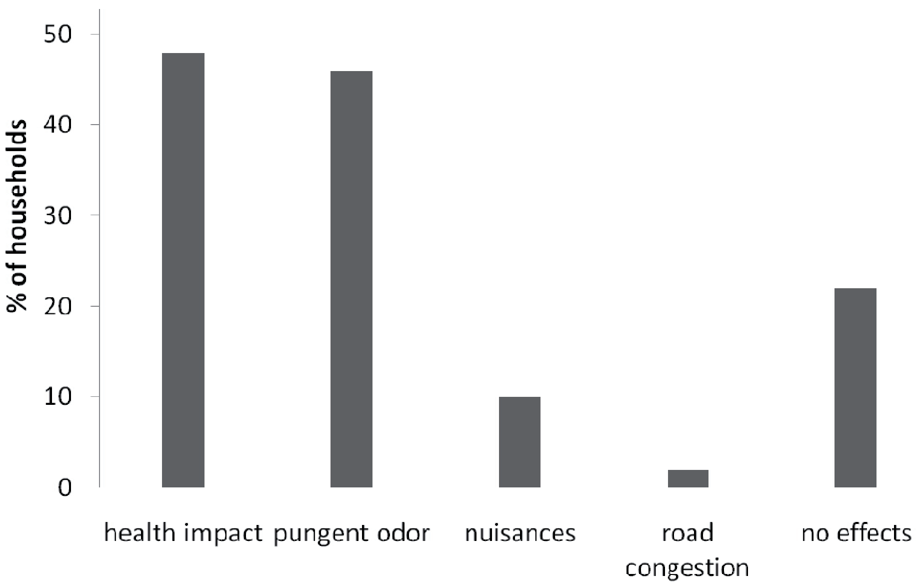

Figure 11. Perceived impacts of CCSL by surveyed households

Table 7. Perception of the surveyed households to CCSL management

Perception to CCSL Management	Total [a]	Mean [b, c]	Maximum	Minimum	SD
concern to the management	462	8	10	4	1.65
opposition to the management	404	7	10	1	2.35

[a] 630= maximum total points (calculated by multiplying the maximum score (10) and the total number of surveyed households (63)); [b] 10 points = highest in rank; [c] 1 point = lowest in rank

The surveyed households also expressed concern (8 points) and opposition (7 points) to CCSL management as summarized in Table 7. Given reasons were due to potential relocation of the landfill to Consolacion, Cebu (Ancog *et al*., 2012) and waste management implementation introducing MRF and continuous excavation. All these were seen to threaten their employment. This was justified when 25% of the surveyed households raised concerns to the management and to the local government about relocation and closure of CCSL. Sia Su (2007a) found out that adjacent residents to Payatas dumpsite, Manila perceived to be given less attention by the government limited to housing but without livelihood programs to sustain. In CCSL access to employment remains a concern.

4. Conclusion

Groundwater quality report and analyses metals in plant species in CCSL revealed potential threats to the environment and the health of the adjacent community. Hygiene among surveyed household was seen as an area of concern particularly on groundwater utilization (cooking, bathing, cleaning, and washing), septic and sewerage, facilities, and waste management practices which primarily include dumping elsewhere and burning. Similarly, prevalence of gastrointestinal, respiratory, and dermal diseases exists. Despite the seen health threats scavenging and enterprising through store facilities (e.g. junk shops) continues as the CCSL provided the community in general opportunities, namely, employment, resources, and security. It is recommended to consider the result of this study for policy implementations for CCSL closure and providing sustainable services to the adjacent community like livelihood and health services.

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