

1 **OPEN LANDFILL BIOMEDICAL WASTES DISPOSAL SYSTEM AND IMPACT**  
2 **ON HEALTH AS PERCEIVED BY HEALTH WORKERS**  
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5

6 **Abstract**

7 *This paper examined the influence of open land fill as a biomedical wastes disposal*  
8 *system and perceived impact on health among health workers in Calabar Education*  
9 *Zone of Cross River State, Nigeria. One hypothesis was formulated to guide the study.*  
10 *Literature review was carried out based on the variable under study. Ex-post facto*  
11 *research design was considered most suitable for the study. Purposive and simple*  
12 *random sampling techniques were adopted in selecting the 401 respondents sampled for*  
13 *the study. A validated 30 item four point modified likert scale questionnaire was the*  
14 *instrument utilized for data collection. The reliability estimate of the instrument was 0.91*  
15 *using Cronbach Alpha method. To test the hypotheses formulated for the study simple*  
16 *linear regression statistical too was used at 0.05 level of significance. The findings*  
17 *revealed that there was a significant positive influence of open land fill of biomedical*  
18 *wastes on health as perceived by health workers in Calabar Education Zone of Cross*  
19 *River State. It was recommended among others that dumpsites should be properly*  
20 *located and managed to minimize its effects on residents and government and*  
21 *municipalities should revise laws regarding the locations of the dumpsites.*

22 **Key words: Open landfill, biomedical wastes, perceived impact, health workers**  
23

24 **Introduction**

25 Every day, relatively large amount of potentially infectious and hazardous wastes  
26 are generated in the health care hospitals and facilities around the world. An important  
27 issue of human health protection process is the waste disposal systems that include  
28 responsible planning of collecting, transporting, processing and disposing of hazardous  
29 and non-hazardous waste materials. A special concern focuses on effective disposal of  
30 biomedical waste incorporating an appropriate waste reduction and neutralization  
31 component. Along with this idea, a systemic approach of biomedical waste is  
32 compulsory, since without proper guidance, the hazardous medical waste management  
33 may compromise the quality of patient caretaking.

34 Medical care is vital for our life and health, but the waste generated from medical  
35 activities represents a real problem to nature and human health. World Health  
36 Organization (2011) stated that high-developed countries produce an average of 0.5 KG  
37 of hazardous waste per hospital bed per day while the figure for developing countries  
38 was only 0.2 KG per hospital bed per day. Eighty-five percent of generated waste from  
39 hospitals and other health care facilities were in fact non-hazardous while the remaining  
40 15% is considered to be hazardous materials that may be radioactive, toxic or infectious.

41 An increase and expansion in the number of hospitals and health care facilities  
42 cause an increase in the utilization of disposable medical materials, which further  
43 contributed in production of a large amount of biomedical wastes in these health care  
44 facilities. The introduction of more complicated equipment and overall medical  
45 advancement also results in increase in waste production per patient in health care  
46 facilities globally (Radha, Kalaivan, & Lavanya, 2009). The increased production rate of  
47 biomedical waste was combined by mishandling and poor disposal methods. The risk of  
48 disease transmission was raised among the health care workers and other environmental  
49 issues such as pollution. On the basis of these facts, incorporation of an integrated  
50 biomedical waste management system for hospitals and health care facilities was  
51 becoming a cross cutting issue.

52 Main purposes of waste management and disposal are to clean up the surrounding  
53 environment and to identify the appropriate systems for waste neutralization, recycling  
54 and disposal. Within waste disposal, the health care waste management (HCWM) is a  
55 process that helps to ensure proper hospital hygiene and safety of health care workers  
56 and communities. Health care workers and patients are concerned about planning and  
57 procurement, staff training and behaviour, proper use of tools, machines and  
58 pharmaceuticals, proper methods applied for segregation, reduction in volume, treatment

59 and disposal of biomedical waste. Studies have demonstrated that there is not a single  
60 method of biomedical waste treatment or disposal that completely eliminates all risks to  
61 humans or to environment. The first step of this approach focuses on the risks caused by  
62 an inappropriate biomedical waste management and disposal

63 Biomedical waste is produced in all conventional medical units where treatment  
64 of (human or animal) patients is provided, such as hospitals, clinics, dental offices,  
65 dialysis facilities, as well as analytical laboratories, blood banks, university laboratories.  
66 This form of wastes refer to all materials, biological or non-biological, that are discarded  
67 in any health care facility and are not intended for any other use Within a health care  
68 facility or hospital, the main groups submitted to risks are: - Doctors, medical nurses,  
69 healthcare unit workers and maintenance staff; -Patients; -Visitors; - Workers in ancillary  
70 services: laundry, medical supplies store, those charged with collecting and transporting  
71 waste; - Service workers dealing with waste treatment and disposal of health unit.

72 Regarding the health care workers, three infections are most commonly  
73 transmitted: hepatitis B virus (HBV), hepatitis C virus (HCV), and human  
74 immunodeficiency (HIV) virus. Among the 35 million health care workers worldwide,  
75 the estimations show that each year about 3 million receive hard exposures to blood  
76 borne pathogens, 2 million of those to HBV, 0.9 million to HCV, and 170,000 to HIV  
77 (Cole, 2015; Kralj & Stamenkovic, 2006). Also, the workers involved in the collection  
78 and disposal of the biomedical waste are exposed to a certain risk and these risks have  
79 health implications such as cancers (especially lung and larynx cancer, leukemia,  
80 lymphoma, soft tissue sarcoma), respiratory symptoms and congenital malformations,  
81 low birth weight, birth defects, cholera, plague, tuberculosis, hepatitis B, diphtheria etc.,  
82 in either epidemic or even in endemic form and thus is a major problem for healthcare  
83 facilities, their employees, and the community at a large.

84 Waste disposal systems usually relate to all kinds of planned activities concerned  
85 with the proper handling and disposal of wastes from the point of generation to the point  
86 of final disposal. Wastes disposal systems are comprehensive, integrated, rational and  
87 systematic approach towards the achievement and maintenance of acceptable human  
88 health. Modern systems of wastes disposal have emerged in response to the recognition  
89 of health impact. Basically, there are various systems of wastes disposal among workers  
90 and patients in the health sector, these include but not limited to the following:  
91 incineration, open dumping, open landfill, disposal of wastes into water bodies and  
92 recycling etc.

93 Open land filling of biomedical waste is a common waste disposal system and  
94 one of the cheapest systems for organized waste management in many parts of the world.  
95 Landfill practice is the disposal of biomedical wastes by infilling depressions on land.  
96 The depressions into which wastes are often dumped include valleys (abandoned) sites of  
97 quarries, excavations, or sometimes a selected portion within the residential and  
98 commercial areas in many urban settlements where the capacity to collect, process,  
99 dispose of, or re-use solid waste in a cost-efficient, safe manner is often limited. The  
100 practice of landfill system as a system of waste disposal in many developing countries is  
101 usually far from standard recommendations (Mull, 2005; Adewole, 2009; Eludoyin &  
102 Oyeku, 2010).

103 The urban population of Calabar is growing at alarming rates. While generally  
104 Nigerian population is increasing by about 2.8% per annum, the rate of urban growth is  
105 as high as 5.5% per annum, and this has increased the number of patients in hospitals and  
106 the number of hospitals in the zone (Thomas, Peng, Lezhong, Yaoliang, Emmanuel,  
107 Wang & UN-Habitat, 2006). As Nigeria aspires to improve her economic status by 2019,  
108 a healthier and wealthier population will generate more of all types of waste (domestic,

109 commercial, industrial and hazardous). There is therefore need for urgent action based on  
110 a clear national strategy, plans and programmes to manage this trend. Several efforts  
111 have been made by governments across Nigeria, and intervention projects have been put  
112 in place over the years to ensure proper disposal of biomedical wastes. It is also very  
113 worrisome to note that most health care facilities do not even have waste management  
114 experts or departments and so on.

115 This raises several questions that need answers. What are the biomedical wastes  
116 generated by health centers? How are these wastes disposed? How does the disposal  
117 systems relate to human health? Hence this study investigated the influence of open  
118 landfill biomedical wastes disposal systems and perceived impact on health among  
119 health workers in Calabar Education Zone of Cross River State, Nigeria.

120

### 121 **Literature review**

122 Waste from hospitals and clinics are an additional source of Municipal Solid  
123 waste (MSW). Most of the countries do not have any specific technique of managing  
124 hospital and clinical wastes. So, they are mixed with MSW and pose a threat to human  
125 population and surrounding environment. Unsuitable disposal of biomedical wastes  
126 causes all types of pollution: air, soil, and water. Indiscriminate open dumping of wastes  
127 contaminates surface and ground water supplies. In urban areas, MSW clogs drains,  
128 creating stagnant water for insect breeding and floods during rainy seasons. Open land  
129 filling of biomedical waste is a common waste disposal system and one of the cheapest  
130 systems for organized waste management in many parts of the world. Landfill practice is  
131 the disposal of biomedical wastes by infilling depressions on land. The depressions into  
132 which wastes are often dumped include valleys (abandoned) sites of quarries,  
133 excavations, or sometimes a selected portion within the residential and commercial areas  
134 in many urban settlements where the capacity to collect, process, dispose of, or re-use

135 solid waste in a cost-efficient, safe manner is often limited. The practice of landfill  
136 system as a system of waste disposal in many developing countries is usually far from  
137 standard recommendations (Mull, 2005; Adewole, 2009; Eludoyin & Oyeku, 2010).

138 According to the World Health Organization, 18 years ago it was estimated that  
139 injections with contaminated syringes caused 21 million hepatitis B virus (HBV)  
140 infection (32% of all new infections), two million hepatitis C virus (HCV) infection  
141 (40% of all new infection) in the world. When compared to the 2017 estimate of about  
142 34 million hepatitis B caused by contaminated syringes, four million hepatitis C virus  
143 infections, and more than 1.1million HIV infections in the world, it is important to note  
144 that the impacts are increasing on daily and perhaps yearly basis.

145 Studies have demonstrated that there is not a single method of biomedical waste  
146 treatment or disposal that completely eliminates all risks to humans or to environment,  
147 and the situation is everywhere in our country. The state of human health in Cross River  
148 is so poor and this is evident in the inadequate and poor health facilities (health centers,  
149 personnel, and medical equipment) in the state, especially in rural areas. While various  
150 reforms have been put forward by the Nigerian government to address the wide ranging  
151 issues in the health care system, they are yet to be implemented at the state and local  
152 government area levels and Nigeria is still ranked by World Health Organization at 187th  
153 position in its health system among 191 member states.

154 Wastes of different types, mostly medical wastes are the major input of  
155 dumpsites/landfills. With respect to the hydrological analysis of groundwater, it flows  
156 from areas of higher topography towards areas of lower topography, thereby bringing  
157 about the examination of the degradable material which form leachate and  
158 contaminate the groundwater of the study area. Landfill practice is the disposal of  
159 solid wastes by infilling depressions on land. The depressions into which solid wastes

160 are often dumped include valleys (abandoned) sites of quarries, excavations, or  
161 sometimes a selected portion within the residential and commercial areas in many  
162 urban settlements where the capacity to collect, process, dispose of, or re-use solid  
163 waste in a cost-efficient, safe manner is often limited. The practice of landfill system  
164 as a method of waste disposal in many developing countries is usually far from  
165 standard recommendations (Mull, 2005; Adewole, 2009; Eludoyin & Oyeku, 2010).

166 A standardized landfill system involves carefully selected location, and is  
167 usually constructed and maintained by means of engineering techniques, ensuring  
168 minimized pollution of air, water and soil and risks to man and animals. It involves  
169 placing waste in lined pit or a mound (Sanitary landfills) with appropriate means of  
170 leachate and landfill gas control (Alloway & Ayres, 2007; Eludoyin & Oyeku 2010).  
171 Land filling of municipal solid waste is a common waste management practice and  
172 one of the cheapest methods for organized waste management in many parts of the  
173 world (El-Fadel, Findikakis & Leckie, 2007; Jhamanani & Singh, 2009; Longe &  
174 Balogun, 2010). Increasing urbanization results in an increased generation of waste  
175 materials and landfills become the most convenient way of disposal. Most of these  
176 landfills are mere 'holes in the ground' do not qualify as sanitary means of solid  
177 waste disposal. Most of the areas around the Solous dumpsites depend either on dug-  
178 up wells or boreholes, which may likely be affected by the generated leachate through  
179 waste decomposition from the dumpsites despite the provision of pipe-borne water by  
180 government.

181 According Papadopoulou, Karatzas and Bougiouko (2007), as the natural  
182 environment can no longer digest the produced wastes, the development of  
183 biomedical waste management has contributed to their automated collection,  
184 treatment and disposal. One of the most common waste disposal methods is

185 landfilling, a controlled method of disposing biomedical wastes on land with the dual  
186 purpose of eliminating public health and environmental hazards and minimizing  
187 nuisances without contaminating surface or subsurface water resource.

188 In the study of Ifeoma (2014) on effects of landfill sites on groundwater  
189 quality in Igando, Alimosho local government area, Lagos state. With increasing  
190 population comes the concern for waste disposal. The absence of sanitary disposal  
191 methods has left most city residents with open landfills as their only source of waste  
192 disposal. The resulting leachate formed from the decomposition of these waste  
193 materials is highly polluting and finds its way to the underground water supply. The  
194 study investigated the effects of open landfill sites on the underground water quality  
195 by examining the physical and chemical properties of underground water in hand-dug  
196 wells around the Solous landfill sites in Igando, Alimosho Local Government Area of  
197 Lagos State. Solous landfill is the second largest landfill by landmass and volume of  
198 waste in Lagos State.

199 Systematic random sampling was used for data gathering. Eighteen hand-dug  
200 wells were sampled at increasing distances from the landfill site. Physical, chemical  
201 and microbiological parameters were analysed at the Lagos State Environmental  
202 Protection Agency (LASEPA). Soil samples were also taken from both the A (0 –  
203 30cm) and B (30 – 60cm) horizons of the water sampling points to determine the soil  
204 texture (silt, clay and loamy composition) and to show the impact of soil texture on  
205 ground water quality within the sampled area. The level of contamination of  
206 groundwater was also determined using the Contamination Index method. The results  
207 showed high degree of conformance with WHO standard with respect to the  
208 microbiological properties of the sampled groundwater. However, coliform tests  
209 indicated the potential presence of pathogens. Of the seven (7) physical parameters



210 tested, conductivity was higher in one sample. The study of chemical properties from  
211 the eighteen wells showed five (5) parameters (dissolved oxygen, total alkalinity, iron,  
212 lead, nitrates and copper) above WHO limits in some samples. The water may  
213 therefore not be safe for human consumption and there is a serious need to monitor  
214 the groundwater quality in the area. The level of contamination of groundwater was  
215 also determined using the Contamination Index method. Areas of high and medium  
216 contamination were discovered.

217 There was no area with low contamination level in the area sampled.  
218 Contamination levels were mapped to show the exact levels of contamination in the  
219 study area. The results of the soil analysis showed that the study area had soil that was  
220 mostly sandy in nature which may suggest an increase in parameters over time with  
221 significant health implications for the people who depend on surrounding wells for  
222 domestic use. The study also showed no significant variation in water quality with  
223 increasing distance from the dumpsite. Findings also indicated that the water around  
224 Solous 1 was of better quality for domestic use than groundwater around Solous 2 and  
225 3 due to temporal reduction of contaminant concentration. There is therefore a need  
226 for adequate and proper planning, design and construction, and strategic management  
227 disposal of waste, as well as the implementation of a better sustainable environmental  
228 sanitation practice.

229 The disposal of wastes in landfill sites has increasingly caused concern about  
230 possible adverse health effects for populations living nearby, particularly in relation to  
231 those sites where hazardous waste is dumped. Studies on the health effects of landfill  
232 sites have been carried out mainly in North America and existing reviews focus  
233 entirely on this literature (Upton, 2008; National Research Council, 2009). Recent  
234 publications of large studies both in and outside North America warrant an update of

235 evidence presented in previous reviews. Up-to-date knowledge about epidemiologic  
236 evidence for potential human health effects of landfill sites is important for those  
237 deciding on regulation of sites, their siting and remediation, and for those whose task  
238 it is to respond to concerns from the public in a satisfactory way.

239 Martine (2010) examined health effects of residence near hazardous waste  
240 landfill sites: a review of epidemiologic literature. This review evaluates current  
241 epidemiologic literature on health effects in relation to residence near landfill sites.  
242 Increases in risk of adverse health effects (low birth weight, birth defects, certain  
243 types of cancers) have been reported near individual landfill sites and in some  
244 multisite studies, and although biases and confounding factors cannot be excluded as  
245 explanations for these findings, they may indicate real risks associated with residence  
246 near certain landfill sites. A general weakness in the reviewed studies is the lack of  
247 direct exposure measurement. An increased prevalence of self-reported health  
248 symptoms such as fatigue, sleepiness, and headaches among residents near waste sites  
249 has consistently been reported in more than 10 of the reviewed papers. It is difficult to  
250 conclude whether these symptoms are an effect of direct toxicological action of  
251 chemicals present in waste sites, an effect of stress and fears related to the waste site,  
252 or an effect of reporting bias.

253 Although a substantial number of studies have been conducted, risks to health  
254 from landfill sites are hard to quantify. There is insufficient exposure information and  
255 effects of low-level environmental exposure in the general population are by their  
256 nature difficult to establish. More interdisciplinary research can improve levels of  
257 knowledge on risks to human health of waste disposal in landfill sites. Research needs  
258 include epidemiologic and toxicological studies on individual chemicals and chemical  
259 mixtures, well-designed single- and multisite landfill studies, development of

260 biomarkers, and research on risk perception and sociologic determinants of ill health.

261 Key words: epidemiology, hazardous waste, health effects, landfill, residence, review.

262 Jeffrey (2013) investigated the management of biomedical pollutants in the  
263 Accra Metropolitan Area in Ghana, using a qualitative case study approach involving  
264 interviews, focus-group discussions, and observation techniques. A state of  
265 precariousness was found to characterize the management of biomedical pollutants in  
266 the study area, culminating in the magnification of risks to the environment and public  
267 health. There is neither a single sanitary landfill nor a properly functioning  
268 incineration system in the entire metropolis, and most of the healthcare facilities  
269 surveyed lack access to suitable treatment technologies. As a result, crude burning and  
270 indiscriminate dumping of infectious and toxic biomedical residues were found to be  
271 widespread. The crude burning of toxic biomedical pollutants was found to provide  
272 environmental pathways for carcinogenic substances. These include polynuclear  
273 aromatic hydrocarbons (PAHs), polychlorinated dibenzofurans (PCDFs),  
274 polychlorinated dibenzopara-dioxins (PCDDs), polychlorinated biphenyls(PCBs),  
275 hydrogen, lead, mercury, cadmium, chlorobenzenes, particulate matter, and  
276 chlorophenols. The improper disposal of biomedical pollutants in open dumps and  
277 unsanitary landfills also carries a risk of providing environmental entry points for  
278 volatile organic compounds (VOCs), inorganic macro components, heavy metals, and  
279 xenobiotic organic compounds.

280 Sharifah, Syed and Latifah (2013) examined the challenge of future landfill:  
281 A case study of Malaysia. Landfilling is the most frequent waste disposal method  
282 worldwide. It is recognised as being an important option both now and in the near  
283 future, especially in low- and middle-income countries, since it is the easiest and the  
284 cheapest technology available. Owing to financial constraints, landfills usually lack of

285 environmental abatement measures, such as leachate collection systems and lining  
286 materials. As a result, a lot of contamination is inflicted upon the environment.  
287 Importantly, even with proper abatement measures in landfills, there is no guarantee  
288 that contamination will be prevented. Another major concern is the appropriate  
289 location for landfills to ensure the impact towards the environment are minimised.  
290 There is a tendency of landfill to be built on unsuitable area such as near to residential  
291 area or on agricultural land where most of the land are grading as high prospect value  
292 to be developed as business or industrial area that are more profitable.

293 More so, the rate of deaths and exposures to several diseases caused by  
294 biomedical wastes disposal has become one of the critical concerns even when there  
295 are well defined rules for handling such wastes. Unfortunately, laxity and the quality  
296 and availability of disposal facilities are generally poor and inadequate. Considering  
297 the increasing rate of perceived impact of biomedical wastes disposal on health  
298 workers, researchers have conducted researches in other part of the world on Bacterial  
299 Treatment and Metal Characterization of Biomedical Waste Ash. Also, some  
300 researches were carried out on open dumping of municipal solid waste – impact on  
301 groundwater and soil, Assessment of Open Dumps and Landfill Management in the  
302 Federal Capital Territory, Nigeria, Effect of open medical waste dumping on its  
303 surrounding surface water bodies in Cross River State. This shows that the issues of  
304 open land fill biomedical wastes disposal system and perceived impact on human  
305 health among health workers may not have been adequately studied and addressed in  
306 the study area. It is based on this background, the researcher sought to answer the  
307 question: what is the perceived influence of open land filled disposal of biomedical  
308 wastes among health workers in Calabar Education Zone of Cross River State? This

309 study may serve as an empirical study for any other researcher who may have a  
310 similar curious mind.

311

## 312 **Methodology**

313 The ex-post facto research design is considered most suitable. Ex-post facto  
314 literally means 'after the fact'. It basically studies phenomenon after they have  
315 occurred. Ex-post facto design is so important for opinion and studies of attitude  
316 because it relies solely on questionnaire and interview as a means of data collection.  
317 The design was considered appropriate for this research because it allows the  
318 researcher to make use of a representative sample of the population from where  
319 generalization of the study result will be. The area of the study is Calabar Education  
320 Zone of Cross River State, Nigeria. There are seven Local Government Areas namely  
321 Akamkpa, Akpabuyo, Bakassi, Biase, Calabar Municipality, Calabar South and  
322 Odukpani that make up the zone. It lies within latitude  $4^{\circ}27^{\circ}$  N and  $5^{\circ}32^{\circ}$  N and  
323 longitude  $7^{\circ}50^{\circ}$  and  $9^{\circ}.30^{\circ}$  E of the equator and has a landmass of 9,980 square  
324 kilometers.

325 The population of the study comprised registered laboratory scientists,  
326 pharmacists, nurses/midwives and cleaners in major public health care facilities. This  
327 study adopted the stratified random sampling technique. This study adopted the multi  
328 stage sampling technique. First, using stratified random sampling, all the government  
329 health care facilities in Calabar Education Zone was stratified into seven Local  
330 Government Areas while proportionate sampling technique was used to select the  
331 30% of health workers from each health facility sampled for the study and simple  
332 random sampling technique was employed to select the respondents from the health  
333 care facilities sampled for the study. The sample for this study consists of 401  
334 respondents proportionately and randomly selected from eleven public health care

335 facilities in Calabar Education Zone of Cross River State. The instrument that was  
336 used for data collection was a questionnaire. Each item elicited information from  
337 respondents on a four point modified Likert scale, Strongly Agree (SA) 4 points,  
338 Agree (A) 3 points, Disagree (D) 2 points, and Strongly Disagree (SD) 1 point.  
339 Simple linear regression statistic was utilized for data analysis.

340 In order to analyse the data, the raw scores of all the items in each variable  
341 were summed together to show the result for each variable. Data was analyzed using  
342 Statistical Package for Social Sciences (SPSS) program version 20. Results were  
343 presented in frequencies, percentages and tables as well as inferential statistics as all  
344 hypotheses were tested using simple linear regression at 0.05 level of significance (i.e.  
345 95% confidence interval). The hypotheses were stated in null form and simple linear  
346 regression statistic was used for data analysis.

### 347 **Results and discussions**

348 The hypothesis states that open landfill disposal system has no significant  
349 influence on health as perceived by health workers. The independent variable in this  
350 hypothesis is open landfill while the dependent variable is influence on human health  
351 as perceived by health workers. Simple linear regression test statistic was employed in  
352 testing the data for this hypothesis. The results of the analysis are presented in table 1.

353 The result of analysis which is presented in Table 1 showed that the predictor  
354 or independent variable (Open landfill of biomedical wastes) significantly influence  
355 the predicted variable (influence on health as perceived by health workers) in Calabar  
356 Education Zone of Cross River State. The predictor variable accounted for 25.9% of  
357 the influence in health as perceived by health workers in the study area.

358 Again, the regression ANOVA revealed there was a significant influence of  
359 open land fill of biomedical wastes on health as perceived by health workers F (1,

360 399) = 139.209;  $p < .05$ . This result indicated that there is a moderate positive  
361 contribution of open landfill of biomedical wastes on health as perceived by health  
362 workers in the study area. From this result it can be assumed that if the approach  
363 adopted in open landfill disposal of biomedical waste is improved, there will be a  
364 significant reduction in the influence on health as perceived by health workers in the  
365 study area. Furthermore, if the approach adopted in open landfill disposal of  
366 biomedical waste does not improve, there will be higher influence on health as  
367 perceived by health workers.

368 The finding of analysis indicated that the null hypothesis was rejected. This  
369 showed that there was a significant positive influence of open landfill of biomedical  
370 wastes on health as perceived by health workers in Calabar Education Zone of Cross  
371 River State. This finding could be as a result of the fact that land filling of municipal  
372 solid waste is a common waste management practice and one of the cheapest methods  
373 for organized waste management in many parts of the world. The finding of the study  
374 agrees with the finding of Papadopoulou, Karatzas and Bougiouko (2007) which  
375 asserts that one of the most common waste disposal methods is landfilling, a  
376 controlled method of disposing biomedical wastes on land with the dual purpose of  
377 eliminating public health and environmental hazards and minimizing nuisances  
378 without contaminating surface or subsurface water resource. However, the result of  
379 the study contradicts the result of Martine (2010) which stated that increased risk of  
380 adverse health effects (low birth weight, birth defects, certain types of cancers) have  
381 been reported near individual landfill sites and in some multisite studies, and although

382

383

384

TABLE 1

385

Simple linear regression analysis of the influence of open landfill of biomedical wastes on

386

health as perceived by health workers (N = 401)

|                    | R= .509 | R <sup>2</sup> =.259 | Adj.R <sup>2</sup> =.257 | St= .8053 |      |
|--------------------|---------|----------------------|--------------------------|-----------|------|
| Source of variance | SS      | Df                   | MS                       | F         | Sig  |
| Regression         | 90.283  | 1                    | 90.289                   | 139.209   | .000 |
| Residual           | 258.769 | 399                  | .649                     |           |      |
| Total              | 349.051 | 400                  |                          |           |      |

387

388

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389 biases and confounding factors cannot be excluded as explanations for these findings,  
390 they may indicate real risks associated with residence near certain landfill sites. An  
391 increased prevalence of self-reported health symptoms such as fatigue, sleepiness, and  
392 headaches among residents near waste sites has consistently been reported in more  
393 than 10 of the reviewed papers. It is difficult to conclude whether these symptoms are  
394 an effect of direct toxicological action of chemicals present in waste sites, an effect of  
395 stress and fears related to the waste site, or an effect of reporting bias. Although a  
396 substantial number of studies have been conducted, risks to health from landfill sites  
397 are hard to quantify. There is insufficient exposure information and effects of low-  
398 level environmental exposure in the general population are by their nature difficult to  
399 establish. More interdisciplinary research can improve levels of knowledge on risks to  
400 human health of waste disposal in landfill sites.

401 The result of this study is in contradiction with the result of Ifeoma (2014) on  
402 effects of landfill sites on groundwater quality in Igando, Alimosho Local  
403 Government Area, Lagos State. The absence of sanitary disposal methods has left  
404 most city residents with open landfills as their only source of waste disposal. The  
405 resulting leachate formed from the decomposition of these waste materials is highly  
406 polluting and finds its way to the underground water supply. The disposal of wastes in  
407 landfill sites has increasingly caused concern about possible adverse health effects for  
408 populations living nearby, particularly in relation to those sites where hazardous waste  
409 is dumped.

410

## 411 **Conclusion**

412 The purpose of this study was to investigate and present results on open land fill  
413 as a biomedical waste disposal system and perceived impact on health as perceived by  
414 health workers in Calabar Education Zone of Cross River State. In line with the statistical

415 finding obtained from this study, it was therefore concluded that: there was a significant  
416 positive influence of open land fill of biomedical wastes on health as perceived by health  
417 workers in Calabar Education Zone of Cross River State.

418 Several health impacts have been found to be related to biomedical wastes  
419 disposal systems. The importance of health in the life of an individual cannot be over  
420 emphasized. A healthy person is able to carry out various functions that would  
421 contribute to the realization of organization objectives. In the health profession,  
422 healthy workforce is required to carry out the day-to-day functions required to  
423 maintain a healthy population. The exposure of health personal to hazardous  
424 substances that impair their health is a risk and requires urgent attention.

425

### 426 **Recommendations**

427 Based on the finding obtained in the study, the following recommendations  
428 were made;

- 429 1. Dumpsites should be properly located and managed to minimize its effects on  
430 residents and government and municipalities should revise laws regarding the  
431 locations of the dumpsites.
- 432 2. Biomedical wastes should be burnt; or disposed off in approved dumpsites or  
433 recycled.

434

### 435 **References**

436 Adewole, A. T. (2009). Waste management towards sustainable development in  
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