

Processes and challenges associated with informal electronic waste recycling at Agbogbloshie, a suburb of Accra, Ghana

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Abstract: Electronic waste (e-waste) is a worldwide problem in terms of increasing production rate in the global waste stream. Its recycling is known to be associated with adverse health outcomes. The recycling site at Agbogbloshie is a major e-waste recycling hub which presents enormous health threats to the residents in this community as a result of exposure to complex mixtures of chemicals associated with the poor work methods employed. This paper describes the processes involved in e-waste recycling at Agbogbloshie and discusses some of the associated health and psychosocial challenges. Direct field observations and in-depth interviews of eight e-waste workers were conducted from November, 2017 to December, 2017. Results from a thematic analysis of the data gathered; suggest that inappropriate recycling methods, financial constraints, and the high physical demands of e-waste recycling work were associated with adverse musculoskeletal health conditions among the workers. A more systematic ergonomic study is currently being undertaken to quantify the associations between physical work exposures and worker musculoskeletal health among e-waste workers in Agbogbloshie. Further studies that focus on locally adapted ergonomic interventions for effective recycling of e-waste and reducing the health risk to workers are needed.

INTRODUCTION

Technological advancement and high demand for new electronic and electrical equipment have resulted in high turnover and shorter lifespan for these equipment. This phenomenon has presented the world with a huge burden of managing end-of-life electrical products. Tons of e-waste are dumped in developing countries and eventually become a problem to manage (Bakhiyi et al., 2018). A greater part of the challenge in managing e-waste in developing countries is lack of appropriate recycling methods and technology required for efficient extraction of the required constituents from old or discarded electronics, while minimising occupational health risk to e-waste recycling workers (Zhang & Xu, 2016).

In most developing countries, those engaged in recycling activities often belong to vulnerable groups in society (Zhang & Xu, 2016), and their livelihood is fully dependent on earnings from e-waste recycling activities (Amankwaa, 2013). Agbogbloshie is one of the world's largest e-waste recycling sites creating a potential for numerous health challenges. Agbogbloshie has served as a major e-waste hub for over a decade (Davis et al., 2018) with an estimate of over 171,000 tons of e-waste processed annually (Prakash et al., 2010). The fact that rudimentary methods are used for e-waste processing presents occupational health and environmental problems.

This paper aims to describe the processes involved in manual e-waste recycling at Agbogbloshie, and highlights the health and psychosocial challenges associated with this type of work.

METHODS

This study was conducted at the Agbogbloshie e-waste processing site located in the heart of Accra, adjacent to the Agbogbloshie food market, and close to the central business district. The study employed a qualitative approach relying on direct visual observations and interviews. The study was approved by the institutional review board of the University of Ghana, College of Health Sciences.

Eight (8) e-waste workers were engaged in in-depth interviews. Initially, an interview guide was developed through rigorous literature search in addition to field observations at the e-waste site. The interview guide required workers to describe; in detail, the processes and tools used during e-waste recycling. Workers were also asked about the reasons for their choice of the specific e-waste job category they worked in, the health challenges they experience from their work the level of stress or difficulty associated with their work and their ability to cope with these stressors. A series of walk through observations were done to supplement information obtained from the interviews. The interviews lasted between 10 to 15 minutes and were recorded using a Sony™ voice recorder. The audio recordings were transferred onto a computer for transcription and subsequent analysis.

An interpretive analysis approach was used to analyse the data. A reflective cognitive approach was used in explaining the observations made as recommended by Gambo (2017).

RESULTS

Demographics

The study sample comprised eight male e-waste workers with ages ranging from 19 to 34 years and with an average $\pm$ SD age of 25.88 ± 5.22 years. Five of the participants had primary education, one had completed junior high school and two had been educated up to senior high school. The number of years they had worked as e-waste workers at Agbogbloshie ranged from 3 years to 10 years with an average of 6.88 ± 3.00 years. Participants worked 3 to 6 days a week depending on the availability of e-waste to recycle.

Description of e-waste recycling processes at Agbogbloshie

Figure 1 is a flowchart summarizing the observed e-waste recycling processes at Agbogbloshie. There are 3 main job categories among e-waste workers at Agbogbloshie, namely, representing the essential activities of collection, dismantling and burning of e-waste and interspersed with other supporting tasks (Acquah et al., 2018, unpublished).

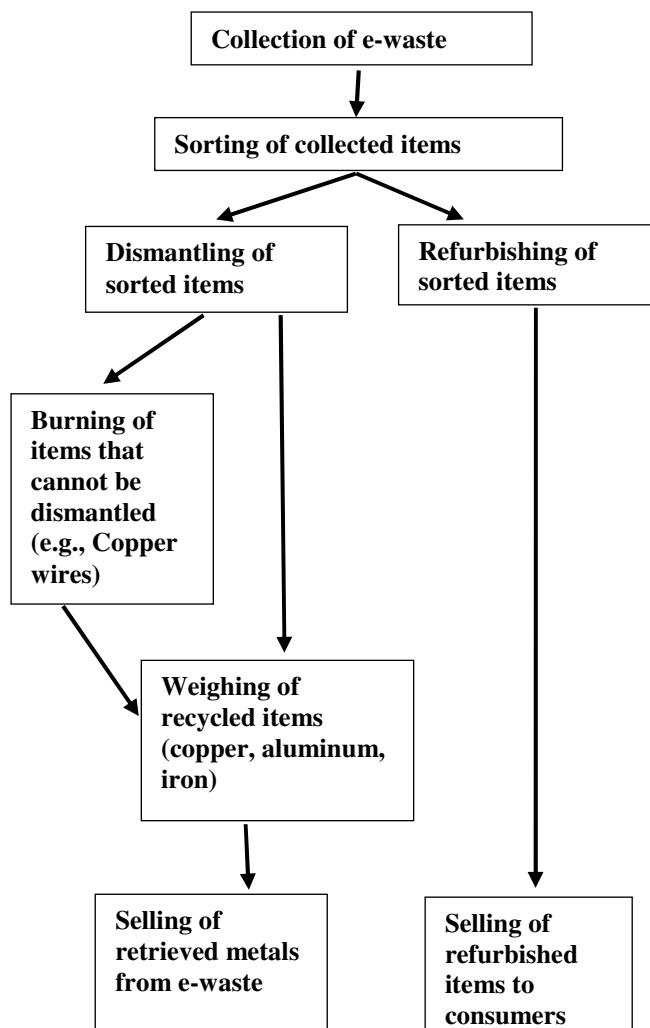


Figure 1: Flowchart showing e-waste recycling processes at Agbogbloshie.

Collection of e-waste could span the entire working shift which is usually from 6am to 5pm. It involves workers travelling to different neighbourhoods in the city and surrounding towns in search of end-of-life electronics.

Workers usually walk to these places pulling a collection cart along as shown in Figure 2A. E-waste is sometimes collected for free from small local dumps, or are purchased from owners for a small fee. The collected e-waste is loaded onto a cart and pulled to the dismantling site where it is sold to dismantlers or dismantled by the same collectors. Some collectors who may be fortunate to have motor bikes or bicycles may use these as a means of transportation during the collection process.

Occasionally, when collectors gather very large quantities of e-waste that may not fit on their bikes or collection carts, they hire the services of transporters who use tricycles to aid in conveying the items to the e-waste site. These tricycles are commonly known among the workers as “motor king”. The transporters (motor king riders) are usually stationed adjacent the main dismantling area close to the main Agbogbloshie street awaiting customers who require their transport services. In addition to e-waste purchased from the neighbouring towns, cargo trucks full of imported e-waste were occasionally seen making their way into the e-waste site. Illegal import of e-waste is a major source of e-waste in Ghana (Balde et al., 2015). The e-waste from these trucks are subsequently sold to e-waste workers for recycling.

E-waste items brought to the dismantling site are sorted initially into two groups as shown in Figure 1. The first involves an attempt to salvage e-waste that could be reused. Electronic items that may not be completely damaged and could be repaired for reuse are sold to a group of workers called repairers whose main interest is to refurbish e-waste and resell them to consumers. The second process of sorting involves collating of items that can be dismantled which are then sold to dismantlers.

Dismantling involves the use of predominantly locally made simple tools such as hammer and chisel and occasionally screw drivers and spanners to break apart e-waste in order to separate the different metals (Figure 2B). The metal constituents are usually copper, iron and aluminium. Items usually dismantled includes, computers, fans, refrigerators, air conditioners, photocopy machines, car engines as well as starters and any other item gathered that is likely to contain some metal constituent. A typical dismantling session lasts between 3 to 4 hours.

Dismantling is usually done employing one of three postures. Smaller electrical gadgets are usually dismantled while sitting and supporting the object being dismantled with the feet as illustrated in Figure 2B. Occasionally, dismantlers may need to stand and bend over to dismantle larger items such as car engine blocks or static condenser components from refrigerators. The third major posture adopted, consists of prolonged upright standing to dismantle very large objects. During the walkthrough observations, some dismantlers were observed dismantling a minibus using this posture. After e-waste items are dismantled, they are then sorted into their respective metallic constituents and items that could not be dismantled are sent for burning to recover the metal constituents (e.g., electric cables) as shown in Figure 2C.



A: Collectors pulling a cart with e-waste



B: Dismantling of e-waste



C: Carrying cables for burning

Figure 2: Picture showing the three main e-waste activities performed at Agbogbloshie.

Burning involves setting up fire to items using foam materials retrieved from spoilt refrigerators. A single burning session of e-waste lasts between 30 to 45 minutes. A long metal rod is used to rotate/flip the burning items to ensure a uniform distribution of the fire and expose the metal. The final metallic end products retrieved from burning and dismantling are then sent for weighing.

Weighing of e-waste involves placing the sorted retrieved metals (e.g., copper, aluminium, iron) onto a weighing scale to determine its resale value. Copper is sold at a higher price than aluminium which is also sold at a higher price than iron. The retrieved metals are often sold to middlemen. These middle men buy processed e-waste from workers in small quantities and gather them into larger piles to be sold at higher rates to industrial companies in Tema, an industrial city in Accra, where these are processed into iron rods, roofing sheets, cooking utensils and gas cookers (Amankwaa, 2013).

Health risks of e-waste recycling in Agbogbloshie

This study investigated health and psychosocial challenges among the 3 main e-waste job categories (Collectors, dismantlers and burners). Participants were interviewed about the health challenges experienced during their work. Symptoms reported included burns and lacerations, musculoskeletal pains, headaches, elevated body temperature and respiratory issues (e.g., coughs). A few sample quotes from participants are provided below.

“You see my hand? It is fire that burned it to make it appear this way” – 23 years old, e-waste burner

“When the smoke is inhaled by you, you will experience coughing at night. And the phlegm produced are blackish in colour just like the colour of the smoke from the burning. When you cough, it will make you feel pain.” – 23 years old, e-waste burner.

“When we go back home and sleep, we realize that your body aches..... your body becomes hot. Then you go and buy ‘Kwik Action’ and you take it as medication then you sleep.....When it becomes hot, I take Kwik Action to make it cool.” – 28 years old e-waste burner.

“I get joint pains and headaches from the hot sun” 29 years e-waste collector.

Six out of the 8 workers interviewed reported body pains as a frequently experienced health challenge. These workers rely extensively on pain medications in order to cope with the symptoms. This is indicated in some quotes from workers reported below.

“You see when it comes and maybe you get some pain killer, maybe it will take a day or two and it will just go” – 24-year-old, e-waste dismantler,

“You need to take pain killers before you can sleep” – 19-year-old, e-waste dismantler.

Psychosocial challenges

Interviewed workers overwhelmingly considered the work of e-waste recycling to be stressful and difficult to perform. Below are some reports from the workers interviewed:

“The job is very difficult to do..... I want to quit it. The last time, I was injured by it and I want to quit” 23 years old, e-waste burner.

“Every aspect of the work is difficult.....It’s not good for a human being to do this work.” 30 years old, e-waste burner.

Interviewed workers complained about the high physical demands of e-waste recycling which makes it a difficult job to cope with. The desire to quit e-waste recycling was obvious among participants. Participants also expressed concerns that,

although their work presented injury risk, a leave of absence from work presented the risk of losing prior customers to other workers. Thus, workers felt the need to push themselves to the limit and work every day despite their injuries.

Workers also complained about the low revenue they earn from e-waste recycling as indicated in the quote below:

“I work for long hours and I only earn a little money....when I make enough money, I will quit this job and find a less risky job” **23 years old, e-waste burner.**

One of the participants reported earning between GH¢20 to GH¢50 Ghana cedis (about \$4 to \$10) a week. According to the worker this income is inadequate and does not allow saving to generate some capital to change job.

Burning of e-waste usually requires very little or no revenue to operate. Thus, workers who lack the financial resources needed to buy e-waste resort to engaging in e-waste burning. One burner admitted that although high risks are associated with burning of e-waste, he does not have enough money to buy e-waste from collectors to dismantle and as such continues in his current job until he can raise enough money to find another job.

“I don’t have a job and I don’t have money to buy from the others to dismantle. That’s why I am doing this work little by little.” **23 years old, e-waste burner.**

For this worker, since, burning of e-waste does not really require purchasing of items, it was much easier to cope with. Thus, he waits for his other colleagues to dismantle their purchased good and then help them recover metals via burning at a fee from items such as copper wires that cannot be dismantled.

The e-waste job category an e-waste worker was enrolled into was largely influenced by the person who initially introduced them to e-waste recycling and provided the initial financial support to work with. Thus, workers were compelled to continue work in the same e-waste job category as their financiers.

DISCUSSION

The present study qualitatively described the processes involved in e-waste recycling at Agbogbloshie, Accra, Ghana, as well as explored the health and psychosocial challenges encountered by workers. Basic collecting, dismantling and open-air burning are used to retrieve essential metals from e-waste during the recycling process. The e-waste recycling process relies on the use of simple manual tools such as hand-pulled collection carts; hammers, chisels, spanners and screw drivers for dismantling as well as the use of long metal rods or pipes for rotating, flipping and moving items burnt during recycling. While it seems cost effective, these tools are inefficient and subject workers to high risks of musculoskeletal injury.

Laceration injuries were common among e-waste workers. Earlier studies conducted at Agbogbloshie, have reported a 96.2% prevalence of lacerations among e-waste workers (Adusei et al., 2015, unpublished) which is

exceptionally high. Similarly, burn injuries were a common challenge reported among burners. The lack of appropriate personal protective equipment (PPE) usage during burning may be a significant contributing factor to the occurrence of these injuries. Burners at Agbogbloshie usually wear boots to protect their feet and long clothes to cover their limbs and torso. That notwithstanding, the clothes worn were regular clothes and not fire retardant. Workers hands and faces are usually left exposed and were the common sites of burn injuries. A burner narrated an account of how his younger brother sustained serious injuries to the face during e-waste burning. Other workers had various scars on their hands to show for the numerous instances of burns they had experienced. Injuries sustained during e-waste recycling may be devastating, disabling, and life threatening.

The use of gloves, nose masks and other PPE was not a common practice. According to the participants, PPE was occasionally provided by donor groups in limited supply. However, when the PPEs were worn out, workers were unable to replace these on their own and so their use was discontinued.

In addition to burns and injuries, participants reported episodes of coughs and chest pain from coughing. The exposure of e-waste workers to high volumes of smoke from the burning process poses a great risk to the respiratory system and health of these workers. Amankwaa (2013), reported high acute respiratory infections among e-waste workers in Agbogbloshie. Other global studies have shown significant relationships between e-waste recycling and adverse respiratory health outcomes (Zheng et al., 2013). The use of face masks could have been a first line attempt to reducing respiratory exposures by e-waste workers. This was, however, not the practice at Agbogbloshie.

Participants in this present study reported body pain after the workday. E-waste recycling at Agbogbloshie entails multiple instances of lifting, bending and twisting as well as assuming non-neutral postures for prolonged periods. These activities are suspected to cause musculoskeletal pain (Wai et al., 2010) and disorders (Chaffin et al., 2006). Unpublished results from a study by the Global Environmental and Occupational Health (GEOHealth) research group of the University of Ghana (GEOHealth, 2019) showed a 90% prevalence of work-related musculoskeletal disorders among e-waste workers.

In an attempt to manage the pain experienced by workers during e-waste recycling, e-waste workers at Agbogbloshie resort to self-medication and excessive reliance on pain medication. The over-dependence and inevitable abuse of these medications is a worrying health concern. Recent media reports in Ghana indicated a surge in tramadol abuse (GhanaWeb, 2018) and this was particularly evident during our field observations. Workers were seen mixing tramadol with energy drinks and consumed the mixture during work. Workers interviewed in this study indicated that, it helps them to work for longer periods without experiencing body pain or fatigue. The self-medication habits as well as the possible abuse of tramadol may result in long term health consequences. Immediate measures to address this problem could save workers from expected adverse effects.

High level of stress as well as excessive physical demand were a concern to participants. Participants complained about the difficult nature of their job and consistently expressed great dissatisfaction with their jobs. Although e-waste recycling provides some form of livelihood, little income is earned by workers despite the excessive physical demands of the job. Psychosocial risk factors such as high job demands and low job satisfaction have been shown to increase the level of stress of workers and subsequently increasing their chances of experiencing musculoskeletal disorders (Bongers et al., 1993; Netherlands Organisation for Applied Scientific Research, 2017). Hence, it is suspected that, some of the psychosocial challenges experienced by e-waste workers at Agbogbloshie may have a bearing on the musculoskeletal symptoms experienced by these workers and could require further investigation.

Despite these obvious challenges associated with e-waste recycling at Agbogbloshie, the lack of the needed financial, social and governmental support required to address the increasing problem of e-waste recycling, compels these workers to continue in this hazardous trade.

CONCLUSIONS AND RECOMMENDATIONS

The methods used in recycling of e-waste at Agbogbloshie in Accra, Ghana are rudimentary and manual. These occupational exposures have undesirable health implications for workers. Although workers are unsatisfied with their working conditions and income earned, finding alternate jobs is challenging.

An ergonomic study is underway to quantify the associations between physical work exposures and worker musculoskeletal health among e-waste workers in Agbogbloshie (Acquah et al., 2018, unpublished). The purpose of this study is to identify and reduce the adverse effects of e-waste recycling by improving procedures used in recycling as well as educating workers on observing health and safety protocols. Further research is needed to identify locally adapted ergonomic interventions for effective recycling of e-waste and reducing the health risks to workers.

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