Journal of Advances and Scholarly Researches in Allied Education
Vol. 15, Issue No. 7, September-2018, ISSN 2230-7540

Occupational Health Risks in Solid Waste Management: A Literature Review

Firdaus Fatima Rizvi[1]* Sharad Kumar Sharidendu[2]

[1] PhD (Economics) Assistant Professor, Department of Development Studies, Central University of South Bihar, Panchanpur, Gaya

[2] Research Scholar, Department of Development Studies, Central University of South Bihar, Gaya

Abstract – This is a literature review paper based on articles on occupational health risks of workers involved in municipal solid waste management. It looks into the environmental health problems associated with solid waste management, health effects on workers near hazardous waste landfill sites, musculoskeletal disorders arising out of handling municipal solid wastes etc. It also looks into the cost (loss) and magnitude of occupational health in solid waste management. Lastly the paper provides some recommendations for safety and suitability of municipal solid waste management practices, improving work organization and availability of personal protection equipment.

Key words: Occupational Health Risks, Workers, Municipal Solid Waste Management, Occupational Diseases

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1. INTRODUCTION

The term "**Occupational Risk Factor**" is defined as a chemical, physical, biological or other agent that may cause harm to an exposed person in the workplace and is potentially modifiable.

An "O**ccupational Disease"** can be defined as a disease which rises from work or is intensified by work. The International Labour Organization (ILO, 1964) defines occupational disease as a disease contracted as a result of an exposure to risk factors arising from work activity. The World Health Organization (WHO, 1999) states that an occupational disease is not characterized purely by the disease itself but by a combination of a disease and an exposure as well as an association between the two.

Occupational diseases and illness have enormous social and economic effects for working individuals, their families and society as a whole. Occupational diseases have its very disastrous economic impacts on the life of workers and in the form of direct and indirect costs for society as a whole. The total costs of occupational diseases and illness have been estimated at between one and three percent of GDP in various countries. The direct cost consists of cost of medication, interruptions in production, cost linked with damage in the workplace and compensation costs incurred for treatment. There are several indirect costs related with occupational diseases such as cost of livelihood lost, cost connected with care giving by families and the community.

In the broader framework of sustainable development, healthy and safe working conditions are among the first pre-conditions for sustainability. In world of work the first expectations of workers are that risks of occupational diseases will not deprive workers of their livelihood or of their quality of life. Occupational diseases and health hazard can also distress public health and safety and environment. Negative impact on health and safety of workers and public, cost to the economy and disastrous impact on the environment must be linked with reducing occupational health risks efforts.

A solid waste management sector has very poor health record on occupational diseases and illness. Waste management processes are very risky and dangerous as well as challenging because they can degrade reasonably, rapidly and they change as progress of waste management. Ergonomic hazards are widespread in solid waste management because solid waste workers usually handle heavy loads and equipment and do intense heavy works. In some cases, ergonomic hazards, which are connected with poor engineering design, contributed to increased safety risks.

All over the world, most adults and numerous children spend much of their times at work. Work offers a number of economic and additional profits and benefits. At the same period, individuals at work

face a range of hazards in arrears to biological agents, chemicals, bodily factors, hostile ergonomic conditions, allergens, intricate net of security risks, and numerous and wide-ranging psychosocial factors.

Exposure subjection towards occupational hazards can harmfully affect the human body. Unfavourable effect ranges from biological, functional and bio-chemical alterations to signs of sickness, to detected diseases and lastly to death. For certain risk issues there are a very strong linking sandwiched between the exposure and the disease. For instance, the principal path of contact to aerial particulates, smokes and vapours is breathing, whereby these mediators gain entrance towards the respiratory system and remain there either deposited (in the situation of particulates) or arrive the circulatory system (smokes and vapours). Several risk factors cause more than single kind of result of interest. For instance, exposure to asbestos can affect in infectious conditions of the lung.

2. ENVIRONMENTAL RISK AND PUBLIC HEALTH

Inefficient and unscientific Municipal Solid Waste Management (MSWM) creates health hazard to human being and damage created to environment. It also leads to severe diseases, epidemic, environmental degradation, odour and fires (Dung-Gwom and Magaji, 2007).

The major self-reported health symptoms by population residing near dumping and landfill sites are restlessness, sleepiness, fatigue and headache in areas situated near dumping and they found to be increasing (Vrijheid, 2000). The landfill sites are the point of direct toxicological chemical pollution. Ground water of the nearby area of landfill sites are found to be contaminated by leachate caused by dumping sites. The drinking water by residents was found to be polluted with higher concentration of carbon tetrachloride. There is urgent need of controlling potentially harmful and hazardous substances in landfill sites close to residential areas.

The harmful effect of the two so called “Smart Waste Management” technique namely landfill and incineration are the resultant releases of number of toxic chemicals, gaseous substances and preparation have the ability to pollute the wide range of atmospheric system (Porta et al 2009).

3. OCCUPATIONAL HEALTH RISK IN MSWM

The climate change affects the workplace, workers and occupational morbidity, mortality and injury. There are seven categories of climate related hazards such as increased ambient temperature, air pollution, ultraviolet exposure, extreme weather, vector borne diseases and industrial transition changes in built environment (Schulte and Chun 2009). There are variety of biological, chemical, mechanical, physical and psychosocial hazards involved in lifting, carrying, pulling and pushing the solid wastes (Mehrad et al 2008).

MSW contains a number of chemical and biological agents that harms workers health and compost derived from the organic fraction of MSW can contain a number of metals and persistent organic pollutants as well as microbial and fungi toxins and they can create a health risk (Domingo and Nadal 2009). Certain occupational and health risks are associated with the composting process and compost application such as odours, bio-aerosols generation emission of volatile organic compounds and potential pathway from use on land for contaminants to enter into food chain.

Moderate evidence is available for an increased risk of respiratory complaints and musculoskeletal injuries with significant odd ratios reported varying between 1.9 to 4.1 and 1.5 to 3.3 respectively (Kuijer et al 2010). Limited evidence exists for gastrointestinal hearing loss. Worker’s health surveillance (WHS) in waste collection is warranted for early detection of respiratory, gastrointestinal and musculoskeletal disorders and hearing loss.

There is a wide range of possible illness on employees of waste facilities and on the residents’ population and there is substantial proof of a high risk of gastrointestinal problems associated with pathogens originating at sewage treatment plants (Guisti, 2009). Malaria parasite was high among the solid waste disposal workers (Confidence and Eleanya, 2007). Adequate personal protective equipment (PPE) should be provided to avoid occupational diseases among the solid waste workers.

The occupational health problems are very frequent among the solid waste workers. The risk factor involved in solid waste management is interrelated with technical factors (such as poor accessibility to the waste, design of solid waste equipment) and may act in concert with high working rate, visual fatigue due to poor illumination and perhaps muscle fatigue due to high work load. There are high incidence rates of gastrointestinal problems, irritation of the eye and skin, cough muscle pain, fever, fatigue, headache among workers collecting the solid waste (Poulsen et al, 1995).

Higher health risks are involved in children who are waste pickers when they are exposed to solid waste dumping site. The major diseases reported are worm infestation, scabies, abnormal pain, respiratory tract infection, lymph node enlargement and fever (Hunt, 1996). The major negative health impacts are respiratory, dermatological and gastrointestinal diseases (Parez et al, 2006). Various other disorders and diseases of

musculoskeletal origin associated with solid waste management related to work exposure and diseases. They are major musculoskeletal diseases namely sprain, strain, pain, carpel tunnel syndrome, connective tissue disorders, hernia, cases of spinal malfunctioning (Morse and Dillon et al 2008).

There is a link of reproductive and developmental disorders due to hazardous exposure in work place commonly found in men and women who are working in vicinity of hazardous exposure. Increased rates of pregnancy loss have been reported in the wives of men who are occupationally exposed to lead, inorganic mercury, organic solvent, pesticides. The major reproductive and developmental disorders reported in their study are congenial malformation, low birth weight, neuro- developmental disorders and childhood cancer (Frazier and Fromer 2011).

Work related hearing loss is one of the most prevalent occupational health concerns in solid waste management. Noise induced hearing loss and disorders are estimated to be the most common cause of acquired hearing loss (Morata et al, 2009).

Occupational skin disorders are categorised into three groups. The first category is a physical insult, which includes friction, pressure, trauma, vibration, and heat, and cold, variation, in humidity, radiation, and electric current. Second category is biological causes: it encompasses plants, bacteria, rickettsia, viruses, fungi, protozoa, parasites, and arthropods. Third category is chemical Insults: Water, inorganic acids, and salts of heavy metals, compounds, resin and proteins. He also classifies the various types of occupational dermatology and its different variety. It includes irritant contact dermatitis, allergic contact dermatitis, contact urticarial, skin infection, skin cancer and a large group of miscellaneous skin diseases (Lushniak, 2004).

The major associated symptoms of health hazard caused due to waste collection and recycling are traffic accidents, broken bones, cuts from glass and sharp metals found in waste dump sites, tiredness and fatigue, breathing problem, burns, aches and pains, circulatory problems and infections, ulcers, influenza, bronchitis and high blood pressure (Perizeau, 2011, Nguyen et al, 2003 and Gutberlet & Beader 2008).

Majority of recyclers and waste pickers having lacerations had cuts wound in such a poor condition that medical official was often unable to stitch them. The main health risks reported by them are blunt trauma, infections needle sticks and lacerations. Pathological waste causes infection to the waste handlers. Improper and unscientific disposal of medical and health care waste, human waste and decomposed organic waste material generate pathogens. Hepatitis B and possible case of HIV that has been contracted by unintentional and accidental needle stick (Rendleman & Feldstein, 1997). Pathogens induced biological hazards are common consequences of direct contact of pathogens due to improper waste collection, sorting, segregation and mishandling of medical waste such as dead organs, used needle, syringes and other bio medical waste (Martin et al 2007).

Informal waste workers and waste pickers are prone to awkward postures, repetitive movement and vibration due to job requirement as well as nature of work. Frequent bending, leaning and kneeling are very common in sorting, collecting, lifting and dumping of solid waste and is thus linked with lower and upper extremity disorders (Silva et al, 2006, Kennedy et al 2004, Robazzi et al (1997).

4. COST AND MAGNITUDE OF OCCUPATIONAL DISEASE

Solid waste is capable to create a serious risk to both environment and human health. The study provides example of Denmark, in which it is investigated that solid waste workers were 5.6 times more prone to incur by occupational injury and 1.5 times more inclined to an exposure to the waste related occupational diseases in comparison to the national average (Cointreau, 2006). The study in India reveals that children involved in this sector had 2.5 times higher potential of morbidity than national average. The major occupational disorders and associated symptoms are worm infestation, respiratory tract infection and lymph node enlargement suspected tuberculosis (Hunt, 1996, Porto et al 2004). The informal recyclers at 3 dumpsites in Mexico City were reported to have life expectancy of only 39 years (Medina, 2000).

The magnitude and cost of work-related musculoskeletal disorders (WMSD) in various industries and solid waste management sectors is quite high. Musculoskeletal disorders are related with excessive work i.e. physical and psychosocial demands. An annual incidence rate (IR) of Musculoskeletal disorder is 35 per 10,000 workers. Musculoskeletal diseases accounted for 29 percentage of all injuries and illness and the estimated average mandays lost due to WRMD is nine days (Silverstein and Evanoff, 2011). The compensation due to musculoskeletal injury in work sector varies between $13 and $20 billion in direct cost. The estimated annual costs of repetitive motion injuries are 2.1 billion (Silverstein and Evanoff, 2008).

The cost and magnitude of occupational dermatitis as reported “the safety and health assessment and research for prevention (SHARP) program” for the duration of 5 years was nearly 5000 claims and 42471 mandays lost, costing more than $ 1.6 million and $1.5 million in medical bills (Belsito, 2005).

Occupational diseases are diseases contracted as a result of an exposure to risk factors arising from

work. An estimated 2.34 million people die each year from work- related accidents and disease. The ILO estimates that 160 million cases of non- fatal work-related disease occur annually. Occupational disease imposes enormous costs. They deprive workers and their families, reduce work capacity and dramatically raise health care expenditure. The ILO estimates that occupational accidents and diseases results in an annual percent loss in global gross domestic product (GDP), equivalent to US$2.8 trillion, indirect and indirect costs of occupational injuries and diseases.

5. RECOMMENDATIONS

There is inextricable link between waste disposal and pollution. The safety and suitability of municipal solid waste management practice are of serious concern from the public health point of view. It is important to manage solid waste with bio treatment controlling application such as thermophilic bio processing (Harmer, 2003). Better to adopt policy of do not mix pathogen free waste stream with sanitary and other pathogen contaminated waste stream. There is a persuasive need of informing administrator, designers and managers of recycling processing plants about the inherent occupational health and safety risks involved in this profession. The main emphasis should be to document the biological, chemical, physical and ergonomic risks in waste recycling plants. The action must be focused on improving work organization and availability of personal protection equipment (Lavoie and Guertin, 2001).

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Corresponding Author

Firdaus Fatima Rizvi*

PhD (Economics) Assistant Professor, Department of Development Studies, Central University of South Bihar, Panchanpur, Gaya