

**Full Length Research Paper**

Occupational Safety of Cleansing Worker in Working Place and Practical Problem for Collection and Managing of Solid Waste in Lideta, Addis Ababa, Ethiopia

Massreshaw A. Abebe

Addis Ababa city, Lideta Sub city Cleansing Management office, Lideta subcity, Addis Ababa, Ethiopia.

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Corresponding Author:

Massreshaw A. Abebe

Addis Ababa city, Lideta

Sub city Cleansing

Management office, Lideta

subcity, Addis Ababa,

Ethiopia.

Abstract

Work on safety in order to protect his workplace before we use to protect ourselves from a variety of physical and psychological health problems primarily in cleaning, loft / office /. That's the main problem with the sector on human resources and employment and labor and delivery complicated job to make adequate and quality supply of equipment and the lack of employment, the employee unsolved limitations in place of using a convenient location data of mechanical tasks rather than improved business tool technology over a variety of employee health and disability. Accessing hole cleaning, and for this reason its direct economic impact on the continued political and social activities. The objective of this study Employees engaged in cleaning equipment work properly with regard to security accreditation in accordance with the procedure set out in case typifies the aspect of physical health problems. People engaged in cleaning the city's health and sanitation sector plays an important role all day. This high-quality laser is child proof waste daily features. Occupational Safety and important tool dissatisfied defined as a failure to act in accordance to quickly create barriers at 90% and 10%, is the standard work on the problems created by the use of safety equipment on practical utilization 50% of understanding intended warns that while 50% of understanding on implementation work safety equipment and clothing improper utilization see a problem with noise damage ruination variety of infectious diseases, especially it was exposing disability. there are efforts to rule the perpetrators of disability due to extra risk involved and bring great harm to health needed to change clothes and toiletries actors who work after directly in the shower and dirty work clothes are particularly vulnerable to health problems due to lack of space for resting and changing cloths. Work on risk and safety equipment is properly working and non-communicable diseases almost various work-up to see whether there have been extensive. Persons engaged in the sector on the length of time a high risk in terms of his personality and broaden risk. Waste type separating a variety of factors can reduce the risk of mutilation at the hands, or on the level of ignorance is transported home.

Keywords:-heath problem, risk, equipment material, physical and psychological health problem

Introduction

Municipal solid waste workers (MSWWs) or refuse collectors, universally expose too many work related health hazards and safety risks, notably allergic and other diseases of the respiratory system. Health impacts could also entail musculoskeletal, gastro-intestinal and infectious diseases as well as injuries caused by work-related accidents.[1,4,10] However, control of these work conditions and enforcement of appropriate hygienic measures are difficult due to the lack of hygiene standards for biohazardous materials present in the air of the workplace.[7,8,9]

Workers can be protected by employing safety procedures in the workplace and ensuring the use of adequate personal protective equipment [13].Health impact and morbidity data about occupational exposure to solid waste among MSWWs is scarce. No studies have been conducted thus far in Addis Ababa regarding exposure and health effects among workers engaged in solid waste collection, processing and disposal. According to the information available, this work provides a description of the health impact of communal solid waste management among 422 of employees in the main municipality organization Addis Ababa cleansing management office in order to estimate the potential excess in risks to which MSWWs can be exposed and adverse health outcomes and to consequently call for corrective measures, occupational safety and health hazard evaluation and monitoring program using health risk reduction behaviors models.Standard Classification of Occupations [13] classifies waste collection occupations into: sanitation workers; collectors of recycled matter; and others.

Work on safety in order to protect himself or themselves before we used to protect ourselves from a variety of physical health problems, primarily in or cleaning, loft / office / business associations in overalls and a hat and gloves on as hands, shoes, tools and

important field of security in connection with the cleaning work many places disposal of chemical wastes and direct contact to the workers should be very careful touch on the behavior of waste behaviors for disposing the current situation on the labor sectors, but simply not comfortable using their working material and solid waste management in different area dropped for various reasons are particularly interested in being different disasters.

In the current state of the city administration in 2012, the city tidy Favorite city is working to forgo the necessary steps to make the vision of Addis Ababa, but the overall condition of the cleaning is not the desired level. That's the main problem with the sector on human resources and employment and labor and delivery complicated job to make adequate and quality supply of equipment and the lack of employment, the employee unsolved limitations in place of using a convenient location data or information mechanical tasks rather than improved business tool technology over a variety of employee health and disability Accessing hole cleaning, and for this reason its direct economic impact on the continued political and social activities. The objective of this study Employees engaged in cleaning equipment work properly with regard to security accreditation in accordance with the procedure set out in case typifies the aspect of physical health problems, and also shows the resolution proposal. They took-school and utilization of health problems due to the solid waste collection and transportation system in attentions to a lasting solution give right attention for work safety equipment input incorrectly promptly and physical health at the Trials sector on improved equipment purchased quality problem equipment as the result of work tools offered timely and quality problem minority not time bounded be mentioned was the use of safety equipment and business who came down from above, and to describe the performance of the various stakeholders interested in the problem, but the job and employee health and disability do not giving punishment and responsibility to use their working safety reaching a solution is indicative him to work right way.

Material and Methods

Study Area/

Lideta is one of the subcity among ten subcity of addis abeba.the boarder subcity were at the north addis ketema, at the south kirkose, at the east arada and at the west kolfe keranyo the area of subcity was 918.27 hectar and the expected number of household is households and population are 36000 and 283,795 respectively.located at (9⁰ 0' 59'' N) lattitude & (38⁰ 44' 1'' S) longtiud.1200m above sea level. The subcity weather condition mainly categorized into four seasons. Hard rain season (kiremt) from June to august (mekher), from September to November, dry season (bega) from December to February and few rain season (tsedey) from March to may (from 2007 census of CSA report).



Fig 1:-The subcity boundaries of the surrounding subcities

Design of the Study

This research Qualitative and quantitative following mostly descriptive and / Descriptive type and A cross-sectional study was conducted between January and April 2016. We interviewed and evaluated from 741 workers took 170 workers for serving in about 15 different solid waste management activities regarding personal hygiene, the practice of security and health care measures and the impact of solid waste management.



Fig 2. Working flow as cause of injuries

Sample size and selection method

The study of this research was primarily in a study sample size and significance of persons participating in the study should be considered as representing the directly working on solid waste management practice for all participation.

Table 1:- Sample select system

Participation research	Participant number	Sampling	Sampling method
MSE	419	50	System sampling for quota of woreda
Street sweeping	220	50	System sampling for quota of woreda
professional	67	40	Simple random selection
Driver helper	15	15	Take all
Drivers of solid waste	7	5	Take all
Manager of woreda	10	10	Take all
Total	741	170	

Results and Discussion

Communal waste collection

Household and different institution waste collection care in lideta was performed in a traditional way, with most domestic, waste products generated at homes being mixed together without being sorted (as followed in most of modern countries where three separate bins are used to separate paper, plastic and cardboard from broken glass or food waste). The mixed domestic waste was stored in plastic bags, to be stored in special plastic bins or metal containers in the street and collected every day by waste collectors. Waste collection vehicle was a compactor truck with a closed container or scoop for storage of the waste. Household and other waste was collected by other vehicles. Loading system comprised automatic fork that align carefully with sleeves of waste containers through a set of levers. The containers was lifted till it get to top, the contents are slipped upside down and is emptied into vehicle hopper. Bulky garbage was compacted hydraulically forward by moving walls that oscillate to push waste to the rear of the vehicle. The collection vehicle transport waste to be evacuated at the discharge site that receives wastes from all municipal districts, where it was reloaded into loaders, weighed and transported to plants for sorting and recycling. Medical waste was treated by incineration or autoclaving and segregation. Part of un-reusable waste was used for fertilizer production and the remaining was transported to the dumping site for final disposal in pre-designed landfill cells. A network of pipes and wells were present to collect methane gas to be then burnt.

Respiratory Problem

Higher prevalence of respiratory complains particularly cough (dry or productive) were found amongst collectors, sorting workers, street cleaners, truck drivers, landfill workers, welders, and vehicle technicians who are subjected to variable direct exposure to both chemical and biological sensitizers in the workplace. More specifically, collectors who ride on footplates on the backs of the trucks and truck drivers are exposed to exhaust fumes, cleaners are exposed to street dust, sorters are exposed to molds and bioaerosole, welders are exposed to reactive oxygen species, carbon mono-oxide and welding fumes containing heavy metals, mechanics are exposed to benzene and paints, and workers in dumping sites are exposed to bioaerosole, dust and harmful methane gas. Some workers experienced breathlessness probably due to air way obstruction and inflammation as stated earlier.

General health problem

Poor personal hygiene and self-care, inadequate protective and safety measures for potentially hazardous exposure were described. Impact of solid waste management on health of MSWWs entailed high prevalence of gastrointestinal, respiratory, skin and musculoskeletal morbidities. Occurrence of accidents and needle stick injuries amounted to 52% and 64% respectively.

Street cleaning staffs working conditions and equipment safety position Apparel

Table 2:-Street sweeper asking questions

S.no	Questions	Respondent number	Response	%
1	How you used the safety material during street sweeping?	50	29 said did not used because of late giving and bad quality	58
			21 they used properly	42
2	Did have problem due to unused safety material?	50	40 yes, they did get health problem	90
			10 no, problem	10
3	Did you use safety material during time of work?	50	31 did not used due to the material unconvertible	62
			19 yes, they can use	38
4	You finish the work how you safe your safety?	50	32 No, did not safe	64
			18,yes,did safe themselves	36
5	The working time was suitable for activities	50	35 exposure to car accident	76
			12 yes, it was nice	24
6	How did not the work short and practical perform?	50	32 under standard material and technology used	64
			18 health problem of worker	36

From the above table 2 the problem of street sweeper was 58 percent from asking the questions said the problem of occupational safety quality and not getting timely in addition to these they exposed 90 percent of respondent was answered victim of typhoid,thyphus,commoncold,Asma,T.B.skin aleregic,kideney problem, backbone problem and hand injuries and other different types of disease exposed .In addition to those other questions answered them from the research stated that best practices in society and being based on more than 64% above inputs and proper clothing, careful not the employee which typically 72% of the outstanding problems have been mainly on health and (Typhoid, colds, asthma, TB, headache, kidneys, Orthoses Upper limb pain accidents, kidney, ovarian, kept their jobs done more than 4.00. Item disposal of the accident had been stabbed did not insurance issue for practical workers to see the mutilation of more than 88% of the work bathroom clothing and resting room after working and 42% said did not understand the problem for practical working on waste management..



Fig 3:-Street sweeper working under care and different event



Fig 4:- Problem of cleaning room for workers

Union working problem

Table 3:-MSE Associations

S.no	Questions	Respondent number	Response	%
1	From starting time up to now which problem affect you during working time for collection of solid waste	50	36 yes, I have 14 no, I did	72 38
2	How can you use the safety material during working time	50	31 they did not use special hand cloth(guanet) 19 they used all safety material	62 38
3	After finishing work did you get dressing and resting room?	50	42 No, did not get 8yes,I did get	84 12
4	When the time you stay in cleaning?	50	6 person said from 2-4 hours 44 person said 4-6hours	12 88
5	Which types of solid waste transporting system	50	21 backbone 13 ladder types 6 gari	42 26 12
6	Did you have knowledge on working collecting solid waste	50	32 yes, we have 18 No, did not have	64 36
7	How care for communication of others during working time?	50	21 yes 29 No	42 58
8	How was the work did not short and effective?	50	27 MSE did not use proper working material 23 the human resource management unmanageable	54 46

From the above table 3 the respondent stated that 64 % of the problem of solid waste occurred and observed that improper clothing that was lack of awareness and did not safety material enough and quality and not on time getting. From those respond above said again 72 % health problem like typhoid,cold, care accident,cancer,injuries in different part of the body in addition to this 88 % of the worker said to stay on working more than 4 hours daily and 42% did no get washing hand and different part of the body after working

because of lack of cleaning room and water. So the worker of solid waste collectors and semi transporter from household to some temporary transferring area was improper waste management system to be changed and think other system for changing the occupational safety of workers strictly.



Fig 5:-Problem of health about MSE due to solid waste collection.



Fig 6:-Collection solid waste from dirty rivers without handgloves.



Fig 7:-Solid waste transport to temporary transfer station and no care for different risk



Fig 8:-MSE worker load waste in improper way and eating without washing hands.

Officer working problem

Table 4:- Awareness, Awareness Experts Information analysis

S.no	Question	Participation number	Response	%
1	How car of solid waste workers by themselves from injuries	40	29 Care themselves from different injuries 11 Not care themselves simply ask other for they risk	72.5 27.5
2	Which type of problem you offer during awareness creation of the public	40	21 yes 19 No	52.5 47.5
3	How much change about the safety	40	14 yes	35

	material proper utilization		26 they have known the utilization but they did not apply due to carelessness	65
4	Safety material gave on time	40	19 yes 21 partial fulfill the material but it was not enough	30 70
5	Did offer health problem by working time	40	20 yes like Saince,common cold,Asma 10 typhoid 3 kidney and leg problem 4 dog bit	100

From the above table 4 the officer of awareness creator was respond to those questions as 52% answered health problem exposed and affected like cold,thpheid ,skin injuries, leg problem, kidney problem and 35% changing the awareness of worker day to day improvement.65% did not change because of carelessness and not giving attention for their health. Other problem 30% did not work proper material and 70% they worked on their backbone, pushcarert and other traditional collection material so to be change the solid waste management system to advance the material usable and other safety material proper way to be punished not use proper.

Manager working problem

Table 5:- Manager's Response

s.no	Questions	Participant numbers	Response	%
1	How you said the gift of Safety material quality?	7	1 NO quality 1 yes quality there 5 both quality and late	14.28 14.28 71.42
2	Safety material did not fulfill so which type of problem occurred?	7	6 due to scarcity of safety material we did not work as standard level 1 No, problem I got	90 10
3	How you used the safety material as proper of health safety?	7	5 continues awareness gave 2 Awareness gave, but I did not apply	71.42 28.57
4	You did not used the safety material proper, which types of disease affect you	7	7 different health problem offer like hand injuries and other body parts	100

The respondent from the above table 5 stated that 70% of the respondent said that the working material quality and the time to get as problem and critical.29% also improper utilization of safety and working material and 90% of the work did not work standardized because of the quality and time of getting working and safety material gave problem and 10% did not problem, but the working and safety material did not get on time the problem was two one for under standard working activities and others risk of worker health. So from these research shown that to improve the solid waste collection and other activities to work the two things was important and mandatory. In Addition to this 50% of the respondent had awareness and 50% of the respondent did not have enough knowledge of safe of themselves from danger of solid waste as poor and took more time to aware and gave guide of the work.

Discussion

This study has investigated the patterns of illness and injuries that occur in waste collectors. Based on our findings, we have devised a set of illness and injury prevention guidelines and safety and health recommendations. First, we can observe that most injuries occur in workers in their 50s and older. It was inevitable that workers' physical abilities decline with age, but in addition to these physical changes, there was also mental stress related to aged vision, auditory, and mobile capabilities. Therefore, we can infer that there needs to be a focus on elderly and senior workers with regard to injury and illness prevention [5]. However, because the sanitation industry that employs waste collectors mostly consists of small businesses, there was a lack of organized health and safety protocols. This study also shown that 64 and more % of injuries occur at businesses with 422 employees or fewer, indicating that there was a need for support and management of workplace safety at these small businesses. Choi et al. [3] have already pointed out the need for health and safety education at businesses with > 264 employees, so on the whole there was a need for systematic education with regards to injury prevention of waste collectors. This was all the more important when taking into account the public benefit of proper waste collection. Injuries and other diseases to waste collectors happen most often when workers were electrocuted after slipping on floors. In order to prevent slips on floors, workers must be provided with work shoes equipped with proper traction on the soles. For senior workers, eyesight was the first to deteriorate after the age of 40, with their field of vision increasingly narrowing with age, and contracting pupils unable to transmit as much light as before. Therefore, when work conditions provide insufficient natural lighting (such as early morning or nighttime labor), waste collectors should be provided with lighting equipment and waste collection vehicles should be equipped with lighting capabilities, in order to ensure that there was enough visibility to prevent injuries.

The second most prevalent form of injury and other disease was falling, which usually happens when workers hang from the rear of the truck during transportation or otherwise slip and fall from the truck. Waste collection vehicles must be driven at low speeds, and it needed to be reiterated to workers that there was a high risk of falling when the vehicle was driving at high speeds or passes over a

speed bump, and prevent them from hanging from the back of the vehicle when it was being driven at high speeds. Proper lighting was also necessary to prevent injuries by traffic accidents, and workers must be properly outfitted with reflective gear and safety harnesses. Work-related illnesses amongst waste collectors were mostly musculoskeletal conditions due to damaging postures; therefore, it was important that vehicles be provided with lifts and other necessary apparatus to handle heavy loads. These musculoskeletal conditions were due to handling of heavy waste bags and bins, and repetitive push/pull motions that accompany such tasks; workers must be educated in the proper methods of handling such heavy loads. There may also be a need to restrict the size of waste bags in order to prevent them from becoming too heavy when filled with waste. Awkward postures can be reduced by improving inappropriate work methods or tools [6]. Thus, as Jung et al [7] pointed, an integrated remedy such as providing ergonomically designed work-tools can reduce or prevent musculoskeletal disorders. This study has the following limitations: (12) minor accidents were not included in the analysis because we used data of industrial accidents, which needs > 4 days' convalescence; and [4] due to the limitations of our dataset, the analysis does not cover accidental characteristics or evaluation of accidental risks in the middle of collecting wastes. Thus, a further study regarding evaluation of accidental risks based on frequencies and severities of accidents was necessary. Nevertheless, despite these limitations, this study put its significance on thorough analysis on waste collectors' characteristics regarding to accidents and job-related illnesses' specifications. This work can be used as basis for indication of preventive method plans for waste collectors.

Findings

- a) Exposure of danger from solid waste collector was improper quality and untimely giving of safety and working material
- b) Improper management of solid waste collection was happened in addis Ababa, lideta and others because of lack of awareness for procurement office and buyer of material due to them health problem occurred day to day for workers it was real presented problem and the quality of the material for safety was additional problem for worker like allergic of skin, astma and others
- c) Worker did not have cleaning room after working and did not clothing room before work for their working cloth and did not have cleaning water with related cleaning material as timely this was other factor of health problem of worker
- d) Did not organize system of solid waste management and proper handling of solid waste of public and institution and also did not have strict punishment and enforcement law with responsibility

Conclusion

Workers exposed to solid waste exhibit significant increase in risk of ill health. Physician role and health education could be the key to assure the MSWWs health safety and aware the safety material use and proper handling of solid waste material. In addition to awareness of the worker to buy quality and timing needed material as important attention to standard of work and to advance the awareness of worker how to save themselves and other society by showing the problem and dangerous of solid waste nature. MSWWs were exposed to more occupational health and safety risks than workers in many solid waste workers. In this study, we had shown that MSWWs performing different tasks in waste management differ in risk of acquiring adverse health effects. Participants from 15 work services were evaluated and statistically categorized into two groups (directly and indirectly exposed groups or potential high and low exposure groups). Those not directly engaged in the waste handling such as truck drivers claimed that they used to help collectors and reloading workers during truck loading and evacuation. Moreover, mechanics, welders and technicians stated that they can repair broken vehicle or rolling conveyer while being loaded with waste. These workers did not often put their personal protective clothes and hence tend to handle waste with bared hands and without making use of any tool.

Most of the participants were aware of the importance and timing of hand washing and hygienic practices. Nevertheless, no convenient washing facilities (with warm water and soap) were available near the collection points, work station in landfill site, or for those working in the street. Moreover, lay people of low socio-economic standard do not always practice hand or mouth washing. The high prevalence of accidents and skin injuries revealed in the present study calls for new standardized guidelines and measures to improve work safety in hazardous waste collection, transport and handling. Protection against personal injury was essential for all workers. All risks should be identified and suitable protection from those risks should be provided. Most participants especially those directly involved in waste handling reported receiving job safety and hygiene training. However, this compulsory pre-employment training should be expanded to cover measures to be taken if exposed to biohazards and unexpected medical waste.

Although medical waste was collected and disposed in different settings, observation of medical waste (disposable needles, syringes, blades, IV lines, bandages and blood bags) in the general waste stream was common. This indicates the need for proper handling, containment or destruction of these dangerous materials by users prior to disposal. Campaign must be organized to educate citizens about the importance of sorting waste before disposal. Action must focus on improving and intensifying preventive measures to minimize bioaerosol levels at work stations by installing vacuum cleaning system and enclosing conveyers. Wearing of internationally recommended personal protective dressing should be enforced, making the protection of skin, eyes, eyes and respiratory airway more effective. Special filters should be provided for welding, cleaners and landfill personnel as respiratory protective devices that will significantly reduce the risk of ill health.

Recommendations

- 1) To aware the worker to clothed their safety material before start work and proper handling of their working material

2) Day to day follow up the worker their work and safety material practice

3) To give attention to budget for the work to buy working and safety material quality and timely

4) To minimize the time of working hours

5) To fulfill of resting, cleaning and clothing room for worker as standard

6) To change the collection material to mechanized and technology based

7) Although strongly recommended, personal protective equipment was not regularly used by a considerable number of the participants. Some reasoned that for the shortage in its supply that they can receive pair of thick heavy duty gloves every 3 month, if they are torn during work, not replaced. Hence they put only one pair or use the torn one for minimal protection. This holds true for safety boots and gowns supplied every 1 year. Others (especially technical worker and truck drivers) claimed that they prefer working without wearing gloves as they limit their free movement during work or cause skin irritation and dryness

8) The transfer of two-wheeled container to be hydraulically lifted and emptied by the truck should be carried out by two to three persons instead of one. The hopper should not be over loaded by waste to avoid over spill that is then gathered by bared hands of drivers and transfer workers.

9) Effective personal hygiene must be maintained by provision of adequate including mild soap, towels or even cleansing wipes on collection vehicles and effective skincare regime using mild cleansers and pre-work and after-work barrier skin creams to keep the skin moisturized.

10) Physician should intensify medical supervision and organize health education sessions for diffusing clear job guidelines concerning number of working hours and maximum weight limits for packing, carrying or pulling to avoid muscle and joint strains. They should also consult MSWWS about how to avoid musculoskeletal disorders and educate the correct physical movement while pulling, carrying or pushing heavy objects, also the early signs of joint affection.

11) Future research should elaborate more on these emerging issues and seek the construction of a health risk reduction behaviors models to help protect the health of MSWWS and drive authorities to adopt safer management techniques.

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References

- 1) Abdou MH. Health impacts on workers in landfill in Jeddah City, Saudi Arabia. *J Egypt Public Health Assoc.* 2007;82:319–29. [PubMed]
- 2) Borrello P, Gucci PM, Musmeci L, Pirrera A. The microbiological characterization of the bioaerosol and leachate from an urban solid refuse dump: Preliminary data. *Ann Ist Super Sanita.* 1999;35:467–71. [PubMed]
- 3) Choi ES, Sohn SY, Yi KH. A study on types of municipal sanitation workers' occupational accident by work type. *Korean J Occup Health Nurs* 2011; 20:172e84. [in Korean].
- 4) Dorevitch S, Marder D. Occupational hazards of municipal solid waste workers. *Occup Med.* 2001;16:125–33. [PubMed]
- 5) Gao C, Abeysekera J. A systems perspective of slip and fall accidents on icy and snowy surfaces. *Ergonomics* 2004;47:573e98.
- 6) Gallagher S. Physical limitations and musculoskeletal complaints associated with work in unusual or restricted postures: A literature review. *J Saf Res* 2005; 36:51e61.
- 7) Jung S, Lee KS, Jung MC, Lee I, Jung-Choi K, Bahk J, Kim H. Relationship between prevalence of musculoskeletal symptoms and occupational and personal factors among street cleaners. *J KOSOS* 2010;25:171e81.
- 8) Krajewski JA, Tarkowski S, Cyprowski M, Buczyńska A. Characteristics of jobs and workers employed in municipal waste collection and disposal by the city of Lodz. *Med Pr.* 2000;51:615–24. [PubMed]
- 9) Krajewski JA, Tarkowski S, Cyprowski M. Hazardous health effects in communal waste collection and disposal workers. *Med Pr.* 2000;51:159–72. [PubMed]
- 10) Kuijjer PP, Sluiter JK, Frings-Dresen MH. Health and safety in waste collection: Towards evidence-based worker health surveillance. *Am J Ind Med.* 2010;53:1040–64. [PubMed]
- 11) Salkin IF. Geneva: World Health Organization, Department of Blood Safety and Clinical Technology and Department of Protection of the Human Environment World Health Organization; 2004. Review of Health Impacts from Microbiological Hazards in Health-Care Wastes.
- 12) Statistics Korea. Korean Standard Industrial Classification [Internet]. 2008 [cited 2015 Oct 30]. Available from: http://kostat.go.kr/e_book/kssc/KSIC08/EBook.htm. [in Korean].
- 13) Statistics Korea. Korean Standard Classification of Occupations [Internet]. 2007 [cited 2015 Oct 30]. Available from: http://kostat.go.kr/e_book/kssc/KSCO07/EBook.htm. [in Korean].