Journal of Environmental and Occupational Science
www.jenvos.com
DOI: 10.5455/jeos.20150920025053

Original Research

ScopeMed

Mercury disposal practices: Differences in awareness and attitude in students from government and private run nursing colleges

Rajnarayan Tiwari, Shruti Patel, Annie Soju, Prarthana Trivedi, Deepak Purohit

National Institute of Occupational Health,Meghani Nagar, Ahmedabad, India

Address for correspondence:
Rajnarayan Tiwari,
National Institute of Occupational Health,Meghani Nagar, Ahmedabad, India
rajtiwari2810@yahoo.co.in

Received: July 13, 2015
Accepted: September 10, 2015
Published: October 23, 2015

ABSTRACT

Background: Mercury is seen as one of the leading environmental contaminants in the world as it is toxic even in trace amount and can travel long distance from the original source of emission. **Objective:** To assess the differences in knowledge, attitude and practices of student nurses from government run and private run nursing colleges regarding ill effects of mercury and its safe disposal. **Setting:** This cross sectional study included 409 students from government run and 131 from private run nursing colleges of Ahmedabad were included in the study. Interview technique was used as a tool for data collection on predesigned questionnaire. **Results:** Significantly higher proportion of private group participants responded that mercury is a neurotoxic substance causing harm to central nervous system. 21.4% participants from private group were unaware about the hazardous nature of mercury waste as compared 14.9% in the government group and the difference was statistically significant ($X^2=7.79$, df=2, $p=0.02$). In the private group significantly lower workplaces had colored boxes for segregation of wastes ($X^2=37.58$, df=2, $p<0.001$) and significantly lower proportion participants received training on biomedical waste management ($X^2=47.48$, df=2, $p<0.001$). **Conclusion:** There is a need to impart knowledge regarding mercury and other harmful chemicals and their safe disposal to health care workers.

KEY WORDS: Mercury disposal, student nurses, waste segregation, Neurotoxicity, India

INTRODUCTION

The problem of mercury is transboundary and global in nature. Mercury is seen as one of the leading environmental contaminants in the world as it is toxic even in trace amount and can travel long distance from the original source of emission [1]. Mercury is a shiny, silver white liquid metal and can evaporate to form colourless, odourless mercury vapours. In a health care set up, mercury is used in varied instruments like thermometers, sphygmomanometers, barometers, etc.

The elemental or liquid form is mostly found in health care products such as thermometers, sphygmomanometers, Miller-Abbot tubes, oesophageal dilators, dental amalgam and so on. However, both organic and inorganic forms are used in staining solutions, preservatives, mercury batteries, fixatives, vaccines and so on [2,3]. In 2002, the annual consumption of mercury principally in the manufacture of thermometers and sphygmomanometers in India was around 15 tons [4].

Broken and obsolete mercury containing devices are often the source of mercury waste at many hospitals. Health care workers including nurses are exposed to mercury through spillage of mercury from these broken equipments. A 2004 study from India reports monthly breakage of around 70 thermometers in a 300-500 bedded hospitals, and an approximate release of 3 kg of mercury annually into the environment by an average sized hospital [5].

Exposure to elemental mercury can occur by breathing mercury vapour, eating or swallowing contaminated food or drinking or having skin contact with liquid mercury. However inhalation is the main route of concern because 80% of inhaled mercury is absorbed. The Central Nervous System (CNS) is probably the most sensitive target organ for mercury vapour exposure, which can affect different areas of the brain, resulting in a variety of symptoms which can include memory loss, headache, sleeplessness, irritability and tremor [6,7].

The exposure prevention among health care workers including nurses can be successfully achieved by providing awareness about proper use, handling and disposal of mercury. Moreover, mercury free alternatives are available for most of the mercury based products. Though many countries have shifted to these alternatives, in India the shift is not that remarkable and the mercury based products are still used in the health care set-up.

This study was carried out to compare the knowledge and practices of student nurses of government run and private run nursing colleges regarding the harmful effects caused by mercury exposure, awareness about safe mercury disposal practices and practices adopted at workplace for disposal mercury spillage(s).

MATERIAL AND METHODS:

This comparative cross sectional study was carried out among student nurses of final year nursing graduation course from four government run and three private run nursing colleges in and around Ahmedabad. In the study the students from government run nursing colleges were termed as "government group" while the students from private

run nursing colleges were termed as "private group". The purpose of the study was explained to the study participants and the interview technique was used as a tool for data collection on predesigned questionnaire (Appendix 1). The questionnaire included questions regarding occurrences of mercury spillage(s) at workplace, knowledge regarding organs affected by mercury exposure and the practice(s) followed for disposing the hazardous and mercury waste. The "came across spilled mercury," meant that the participant came across spilled elemental mercury while "training on BMW management" meant training on appropriate disposal of mercury spillage and waste. The statistical analysis was carried out using SPSS 15.0 and included calculation of percentages and proportions and application of test of significance such as chi-square.

RESULTS

The present study included 409 student nurses from four government-run nursing colleges and 131 student nurse from three private run nursing colleges. 90.7% of nurses were females in government group while only 86.3% were females in private group. The mean age of government group was 20.4 ± 1.11 years while that of private group was 21.6 ± 1.73 years. The difference was statistically highly significant ($t=78.4$; $df=1$; $p<0.001$)

Table 1 depicts the knowledge regarding mercury exposure and its health effects in the study subjects. Most of the participants stated that the mercury containing equipments/ instruments which they handle at their workplaces include thermometer and sphygmomanometer. However 9.1% in government group and 11.3% in private group did not know the mercury containing equipments and mentioned such instruments which actually do not contain mercury at all like stethoscope, spirometer, etc. About the physical appearance of mercury 4.9% of government group and 12.7% of private group participants incorrectly responded that mercury is non-volatile. Similarly, 11.2% government group and 7.0% private group participants did not know the physical appearance of mercury. Though 8.4% in private group either considered mercury as non hazardous or were unaware about the hazardous nature of mercury it was statistically non-significantly higher than government group. Significantly higher proportion of private group participants responded that mercury is a neurotoxicant causing harm to central nervous system. Equal proportion of participant in both groups experiences breakage of mercury containing instruments at their workplace and considered mercury spillage as moderate or high risk. But importantly 15.2% in government group and 16.8% in private group considered spillage as no or minor risk.

Table 1. Knowledge regarding mercury exposure and its health effects

Characteristics	Responses [N (%)] Government group (n=409)	Private group (n=131)
Instruments where mercury is used#		
Sphygmomanometer	359(87.8)	112(85.9)
Thermometer	384(93.9)	123(94.4)
Don't know	37(9.1)	18(11.3)
Appearance of mercury#		
Liquid at room temperature	146 (35.7)	31 (26.8)
Heavy metal	201 (49.1)	88 (64.8)
Volatile	48 (11.7)	13 (12.7)
Non-volatile	20 (4.9)	16 (12.7)
Don't know	46 (11.2)	10 (7.0)
Which type of waste Hg waste is?		
Hazardous	385 (94.1)	120 (91.6)
Non-hazardous/ Don't know	24 (5.9)	11 (8.4)
Do you think Hg pose a health hazard		
Yes	370(90.5)	115(87.8)
No	27(6.6)	14(10.7)
Don't know	12(2.9)	2(1.5)
System which is affected by Hg#		
Cardiovascular system	31 (7.6)	22 (16.9)
Respiratory system	112 (27.4)	43 (30.9)
Central Nervous system*	57 (13.9)	37 (23.9)
Kidneys	99(24.2)	48(29.6)
Reproductive system	45(11.0)	18 (11.3)
Skin	123 (30.1)	34 (22.5)
Don't Know	50 (12.2)	4(1.4)
Breakage of Hg instrument		
Yes	250(61.1)	76(58.0)
No	159(38.9)	55(42.0)
Seriousness of Hg spill		
No risk	15(3.7)	6(4.6)
Some risk	47(11.5)	16(12.2)
Moderate risk	54(13.2)	27(20.6)
High risk	220(53.8)	60(45.8)
Emergency	73(17.8)	22(16.8)

#Multiple responses

Table 2. Knowledge and practice towards disposal of spilled mercury

Characteristic	Responses [N(%)]	
	Government group (n=409)	Private group (n=131)
Mercury should be disposed with general waste*		
Yes/ Don't know	61(14.9)	28(21.4)
No	348(85.1)	103(78.6)
How spilled mercury should be disposed off		
Incorrect practice	46(11.2)	21(16.0)
Correct practice	363(88.8)	110(84.0)
Did you use PPE		
Yes	311(76.0)	103(78.6)
No	98(24.0)	28(21.4)
Which PPE#		
Gloves	198(48.4)	74(46.5)
Mask	95(23.2)	21(8.5)
Apron	28(6.8)	5(4.2)
Others	49(11.9)	12(12.7)
Don't Know	183(44.7)	50(46.5)
Do you segregate hazardous waste from general waste		
Yes	315(77.0)	96(73.3)
No/ Don't know	94(23.0)	35(26.7)
Are there coloured boxes at your workplace for waste segregation*		
Yes	386(94.4)	103(78.6)
No	20(4.9)	15(11.5)
Don't know	3(0.7)	13(9.9)
Do you segregate Hg waste from general waste		
Yes	270(66.0)	76(58.0)
No/ Don't know	139(34.0)	55(42.0)
Did you receive any training on BMW management*		
Yes	352(86.1)	76(58.0)
No	57(13.9)	55(42.0)

*Statistically significant #Multiple responses

Knowledge and practice towards disposal of spilled mercury are shown in Table 2. 21.4% participants from private group as compared 14.9% in the government group responded that mercury should be disposed of with general waste. The difference was statistically significant (X^2=7.79, df=2, p=0.02). This suggests that they are unaware about the hazardous nature of mercury waste. More proportion of private group participants mentioned that they did not segregate mercury and hazardous waste from general waste as compared to government group but the difference was statistically non-significant (X^2=2.92, df=2, p=0.23 and X^2=2.37, df=2, p=0.31 respectively). In the government group statistically highly significantly places (X^2=37.58, df=2, p<0.001) had colored boxes for segregation of wastes as compared to private group. About 11.2% and 16% participants in government and private group respectively were practicing wrong methods of disposing the mercury spillage such as brooming it out, wiping with cloth or running it out in the drain. About three fourth of participants in both the groups took precaution and used personal protective equipments while disposing the mercury spillage and gloves, mask and apron were the common ones to be used. Interestingly significantly lower proportion of private group participants received training on biomedical waste management including mercury disposal methodology as compared to government group (X^2=47.48, df=2, p<0.001).

DISCUSSION

The present study was conducted with the aim to assess the awareness and practices of student nurses from government run and private run nursing colleges regarding mercury hazards and its disposal. Most of the nurses were females in both the groups suggesting that nursing is still considered as female profession thereby more females pursuing it. These nurses were in the final year and as per the curriculum of Nursing Council of India apart from classroom teaching they are also posted in different wards to serve the patients.

While providing nursing care to the patients they frequently handle mercury containing equipments such as thermometers and sphygmomanometers. Despite this 9.1% government group and 11.3% private group participants did not know about the instruments containing mercury. This could be attributed to less opportunity for the student nurses from private run nursing colleges to interact with the patients as the patient turnover of hospital attached to these nursing colleges is comparatively much less than the government run hospitals. Further higher proportion of private group suggested mercury as non hazardous and did not know the physical appearance of mercury particularly the volatility. This is important because it is spillage which favors the inhalation route of exposure to mercury. This could be due to the fact that higher proportion of private group did not come across spillage due to breakage of mercury containing

equipments and thus have never seen mercury. Other investigators have also reported ignorance about physical appearance of mercury in study subjects [8-10].

Mercury is a common neurotoxicant affecting primarily the central nervous system and other systems. Majority of the students considered mercury as a harmful substance but 10.2% considered it as non harmful for health. Significantly higher proportion (23.9%) of private group participants correctly knew the body system affected by mercury toxicity as compared to government group (13.9%).

The study participants had comparatively better practice for proper disposal of mercury waste and the precautions taken during its disposal but still more students from private run nursing schools practiced incorrect methods of disposing the mercury waste such as brooming it out, wiping with hand or cloth, draining it out in the drain and disposing with general waste as compared with students from government run nursing colleges. This is significant as this may result in the environmental exposure to mercury. A recent study in similar occupational group reported that the knowledge about mercury hazard was only between 20-40% [11].

Though according to the Biomedical Waste Management Act (1998) the colored boxes for waste segregation should be provided in all health care set ups, significantly lower private health care set up had such colored boxes at workplace as compared to government run health care facilities. Also significantly lower proportion ($X^2=47.48$, df=2, $p<0.001$) of private group participants received training on biomedical waste management including mercury disposal methodology as compared to government group. This might have affected the practices followed for the segregation of hazardous waste and mercury from the general waste. Further the study highlights that despite the commitment of various hospitals to be mercury free, mercury containing products are still preferred by health care professionals. The likely reasons are availability, affordability, convenience in use and better patient acceptability.

Thus there is a need to impart knowledge regarding mercury and other harmful chemicals and their safe disposal to health care workers and strict implementation of biomedical waste management act more importantly in a private run health care facilities to prevent the occupational exposure while handling and environmental exposure while disposing off the mercury waste. The present study concluded with imparting education regarding mercury, its health effects and the appropriate method for its safe disposal.

REFERENCES

1. Singh P. Delhi Government to fund mercury awareness campaign by Toxics Link in Capital's schools. Toxic Alert. Issue 8, January, 2008. From http://enews.toxicslink.org/ update-view.php?id=8, 2008. [Last cited on 31.03.2015].
2. Clarkson TW, Magos L, Myers GJ . The toxicology of mercury – current exposures and clinical manifestations. NEJM. 2003; 349(18):1731-1737.
3. Shaner H. Becoming a mercury Free Facility: A Priority to be achieved by the Year 2000. Chicago, IL: American Society for Healthcare Environmental Services. 1997.
4. Agrawal R , Wankhede K. Mercury in India: Usage and Releases. From http://www.toxicslink.org/docs/06035_publications-1-33-2pdf. 2002 [Last cited on 31.03.2015].
5. Agrawal A, Singh R, Mahesh P. Lurking Menace: Mercury in the health care setting. New Delhi, India: Toxics Link. 2004.
6. Castoldi AF, Onishchenko N, Johansson C, Coccini T, Roda E, Vahter M, et al. Neuro-developmental toxicity of methylmercury: Laboratory animal data and their contribution to human risk assessment. Regul Toxicol Pharmacol. 2008; 51(2): 215-29.
7. Monnet-Tschudi F, Zurich MG, Boschat C, Corbaz A, Honegger P. Involvement of environmental mercury and lead in the etiology of neurodegenerative diseases. Rev Environ Health. 2006; 21(2): 105-17.
8. Lee R, Middleton D, Caldwell K, Dearwent S, Jones S, Lewis B, et al. A Review of Events That Expose Children to Elemental Mercury in the United States. Environ Health Perspect. 2009; 117:871–878.
9. Patel S, Tiwari RR, Murarka S, Kumar S. Knowledge and attitude regarding mercury handling and disposal in students. Waste Manag Res. 2011; 29: 714-726
10. Zeitz P, Orr M, Kaye W. Public health consequences of mercury spills: Hazardous Substances Emergency Events Surveillance System, 1993–1998. Environ Health Perspect. 2002; 110:129–132.
11. Halder N, Peshin SS, Pandey RM, Gupta YK. Awareness assessment of harmful effects of mercury in health care set-up in India: A survey-based study. Toxicol Ind Health. 2013 May 22. [DOI: 10.1177/0748233713488237]

Source of Support: Nil, Conflict of Interest: None declared