

## Healthcare waste management at primary health centres in Mon State, Myanmar: the comparisons between hospital and non-hospital type primary health centres

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### ABSTRACT

Improper healthcare waste management (HCWM) poses a serious public health problem worldwide. Primary health centres (PHCs) provide public health and medical care services as the basic structural and functional units of healthcare services in Myanmar. However, no study has been conducted in Myanmar about HCWM at PHCs. This study aims to assess the practice of HCWM at PHCs in Mon State, Myanmar. A cross-sectional study was conducted in all ten townships in Mon State, Myanmar. In total, 93 PHCs (71 non-hospitals and 22 hospitals) were selected using simple random sampling. The observational checklist which was developed based on the World Health Organization's standard guideline procedure of HCWM was used to determine the practice of HCWM at PHCs. Binary logistic regression was used for final data analysis. The burning in pits method was used as the final disposal method of healthcare waste in 78.5% of PHCs. Non-hospital type PHC were more likely not to have colour coding system for HCWM (odds ratio [OR] 7.54; 95% confidence interval [CI] 2.15–26.52), did not have equipment for accidental spillage of healthcare waste (OR 3.92; 95% CI 1.3–11.77) and did not have separate staff for HCWM (OR 8.27; 95% CI 2.77–24.64), relative to hospitals. Non-hospital type PHCs practices poorly on the colour coding for waste segregation, assigning separate staff for HCWM, and possessing equipment for accidental spillage of healthcare waste than hospital type PHCs. The Ministry of Health and Sports should issue technical guidelines of safe HCWM as a compulsory policy for both hospitals and non-hospital type PHCs.

Keywords: healthcare waste management, healthcare waste, medical waste, primary health centres, Mon State

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### INTRODUCTION

Improper healthcare waste management (HCWM) poses a serious public health problem

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worldwide. Approximately, 5.2 million people, including children, die every year due to waste-related diseases.<sup>1</sup> Healthcare waste (HCW) carries higher risk of infection and injuries than other types of waste.<sup>2</sup> An epidemiological study indicated that infected needle-stick injuries can increase the risks of acquiring HBV, HCV and HIV.<sup>2</sup> The direct and indirect consequences of improper HCWM includes intentional reuse of disposable materials, air pollution, and production of toxic emissions due to inadequate burning of medical waste, which lead to significant impacts on the environment.<sup>3,4</sup>

In addition, the disposal methods impact directly on the individuals who are working in the healthcare facilities and on their community.<sup>4,5</sup> Multi-use medical devices and single-use medical devices require safe disposal methods.<sup>6</sup> In Bangladesh, 80% of HCW was reportedly disposed of improperly by throwing away with general waste, burying and burning in open spaces without any precautions.<sup>7</sup> HCW contains infectious and hazardous agents that can pose health risks to those exposed.<sup>2,4</sup> Hence, improper HCWM could lead to infections such as HIV, HBV, HCV, and other viral infections via contaminated sharp waste.<sup>2</sup>

HCW includes all waste from healthcare research facilities, and laboratories.<sup>8</sup> According to the World Health Organization (WHO), HCW is categorized by hazardous HCW and non-hazardous HCW. Hazardous HCW includes sharps, pathological, infectious, pharmaceutical and cytotoxic, chemical and radioactive waste. Waste that does not cause any particular biological, chemical, radioactive or physical hazard is classified as non-hazardous waste. In addition, HCW includes waste produced from minor or scattered sources, including home dialysis, self-administration of insulin, and recuperative care.<sup>8</sup> In total, 75% to 90% of general HCW produced in healthcare activities were non-hazardous waste. The remaining 10% to 25% were hazardous waste that can cause a variety of environmental and health risks due to improper HCWM.<sup>2,3,8,9</sup>

The practices of HCWM greatly vary by country.<sup>10</sup> Many Southeast Asian countries are facing significant challenges to handle HCW due to low socio-economic conditions and, lack of HCWM regulation, training, and treatment technologies.<sup>11</sup> A number of healthcare facilities in developing countries do not appropriately manage their HCW. Particularly, infectious and hazardous wastes are not effectively segregated.<sup>10,11</sup> The amount of HCW in developing countries is increasing due to the expansion of healthcare systems and healthcare services.<sup>12</sup> To improve HCWM, an evidence-based regulatory framework is needed. It would be used to evaluate the appropriateness of HCWM according to its compliance with the regulation.<sup>11</sup>

HCW should be segregated according to the standardized procedures, which will reduce HCW related threats to healthcare workers, disposal cost and the cost of treatment.<sup>13,14</sup> Proper management of HCW requires a combination of proper waste handling during generation, collection, storage, transportation and treatment.<sup>15,16</sup> Identification of the causes of mismanagement and creation of supportive measures in the system are essential to develop HCWM procedures and guidelines.<sup>13,15</sup> Safe HCWM procedures should be reflected in budget allocation for HCWM, proper disposal methods, treatment guidelines and technologies including colour coding practices.

Primary health centre (PHCs) are the basic structural and functional units of health care services.<sup>9</sup> In Myanmar, township hospitals, station hospitals, urban and rural health centres and their sub-centres provide primary health care services under the guidance of township health departments, as a back bone of the country's health system.<sup>17</sup> The PHCs produces a considerable amount of HCW per years. However, no study on HCWM at PHCs level has been conducted in Myanmar. The colour coding practices of HCW at PHCs have not been reported. Therefore, this study assessed the current situation of HCWM at PHCs in Mon State, Myanmar. The findings of this study will be submitted to the Ministry of Health and Sports, Myanmar. They will be expected to be applied in the development of National standard operating procedures (SOPs) or guidelines for HCWM in healthcare facilities.

## MATERIALS AND METHODS

### *Study subjects*

A cross-sectional study was carried out in all ten townships in Mon State, Myanmar from June to August, 2016. Mon State is located in the South Myanmar, which consists of two districts, namely Mawlamyaing and Tha Hton. These districts make up ten townships, namely, Mawlamyaing, Chaung Zone, Kyaikmayaw, Mudon, Thanbyuzayut, Ye, Paung, Tha Hton, Belin and Kyaikhto. Among them, Chaung Zone Township is located at Belu Island. According to the 2014 census, Mon State with a population of more than two million, was the fourth most population dense area (167 people per square kilometer).

In Mon State, 407 PHCs provide health services; eight township hospitals, 27 station hospitals, 66 rural and urban health centres and 306 sub-centres. Among the 407 PHCs listed by State Public Health Department, 105 PHCs were selected by simple random sampling. Excluding 12 (11.4%) PHCs not accessible during the survey period due to weather conditions, the remaining 93 PHCs were selected for this study. All selected PHCs responded to this study.

### *Study measures*

A checklist based on direct observation was used to determine the practice of HCWM of PHCs. The checklist contained 21 items as checking points was developed by referring to the WHO guideline of safe management of wastes from healthcare activities.<sup>3</sup> The checklist included minimum required level of safe management of waste from healthcare facilities.

The checklist was pre-tested at ten PHCs in Dekhina Thiri Township, Nay Pyi Taw, the Union Territory. A researcher corrected inconsistencies before finalizing the checklist. The modified checklist was used in this study. In each PHC, the HCWM practices were observed by a researcher using the checklist. It took approximately 30 to 45 minutes to check activities of HCW handling at each PHC.

### *Data analysis*

Data were coded, entered and analyzed using Statistical Packages for Social Science (SPSS) software program version 24.0 (IBM SPSS Inc.). Frequency distribution and percentage were used for categorical variables. After that, chi-squared and Fisher's exact test were used. A logistic regression model was applied to estimate unadjusted odds ratio (OR) and 95% confidence interval (CI).

### *Ethical considerations*

The Ethical Committee for Human Research of the University of Public Health, Yangon, Myanmar, approved this study [Reference no. Ethical (4/2016)]. Before visiting the PHCs, the objectives of the study were explained to the responsible persons of each PHC. If the responsible persons agreed to participate after reading the informed consent form, they were requested to sign the form and the PHC was included in the study. Individual names and confidential information on PHCs were not recorded, and were being analysed anonymously.

## RESULTS

As shown in Table 1, a total of 93 PHCs (71 non-hospitals and 22 hospitals) were studied. Among them, 35.5% of PHCs belonged to Tha Hton District and 64.5% belonged to Mawlamyaing District. The estimated area of each site was between 2,401 and 40,000 square-feet for 55.9%

of PHCs, and 43.0% of PHCs disposed of 11 to 100 kilograms of HCW per month. About half of PHCs (55.9%) provided health services to less than ten patients per day. It was also found that 88.2% of PHCs did not have supporting facilities for HCWM. Burning in pits was used in 78.5% of PHCs, as final disposal method of HCW including sharps.

Table 2 presents practice of healthcare waste management at primary health centres. In total, 95.5% of hospital type PHCs, and 74.6% of non-hospital type PHCs reported to have proper containers for HCW ( $p = 0.037$ ). Regarding usage colour coding on HCWM, 36.4% of hospital type PHCs, and 7.0% of non-hospital type PHCs practiced the proper labelling practices on HCWM ( $p = 0.002$ ). Hospital type PHCs (54.5%) assigned separate staff to handle HCWM, while only 12.7% of non-hospital type PHCs assigned separate staff to handle HCWM ( $p < 0.001$ ).

As shown in Table 3, non-hospital type PHCs were more likely not to have colour coding system for HCWM (OR 7.54; 95% CI 2.15–26.52), did not have equipment for accidental spillage of HCW (OR 3.92; 95% CI 1.3–11.77), and did not have separate staff for HCWM (OR 8.27; 95% CI 2.77–24.64). There were no significant differences in other practices between non-hospital and hospital type PHCs, although the OR was greater than three for proper containers for HCW (OR 7.13), proper containers for general waste (OR 3.65), proper labelling on waste containers (OR 3.72), clearly defined procedures for HCWM (OR 7.00), and disinfection before final disposal (OR 5.45).

## DISCUSSION

To the best of our knowledge, this is the first study to examine the factors associated with the current practice of HCWM at PHCs in Myanmar. The PHCs were categorized into hospital type PHCs and non-hospital type PHCs. The study revealed that non-hospital type PHCs were more likely not to have colour coding system for HCWM, did not have equipment for accidental spillage of HCW, and did not have separate staff for HCWM compared to hospital type PHCs. It was also shown that 78.5% of PHCs used burning in pits as their final disposal method of HCW including sharps, and 8.6% of PHCs used incineration as the final disposal method. In total, 32.4% of non-hospital type PHCs, and 54.5% of hospital type PHCs had sufficiently supported personal protective equipment (PPE) by State Health Department where adequate usage of PPE was observed.

The findings showed that the non-hospital type PHCs were nearly eight times more likely not to practice colour coding for HCWM than hospital type PHCs. This indicated that the WHO waste segregation method which recommended using a colour coding system was inadequately applied in non-hospital type PHCs setting. This result was in line with the study conducted in community-level clinics in Shan State of Myanmar, where only 6.0% of health facilities practiced colour coding for waste segregation.<sup>18</sup> Previous studies reported that only 10.0% of health facilities practiced colour coding in Tanzania<sup>19</sup> and 75.0% of public and 33.3% of private hospitals used colour coding for HCWM in Pakistan.<sup>20</sup>

The assignment of separate staff for HCWM was an important factor to practice HCWM at PHCs level. This study revealed that non-hospital type PHCs were eight times more likely not to have separate staff for HCWM than hospital type PHCs. This may be because non-hospital type PHCs produce less HCW than hospital type PHCs. In addition, non-hospital type PHCs may have less opportunity to access the updated information on HCWM. Although the risk of acquiring infection may be smaller in non-hospital type PHCs than in hospital type PHCs due to limited number of patients, the risk in non-hospital type PHCs should not be ignored. According to WHO, one person should be designated for the handling of HCW where HCW are produced.<sup>3</sup>

**Table 1 Characteristics of primary health centres in Mon State, Myanmar (N=93)**

Characteristics	Non-hospitals		Hospitals		Total	
	n	(%)	n	(%)	N	(%)
<b>Districts</b>						
Tha Hton District	24	(33.8)	9	(40.9)	33	(35.5)
Mawlamyaing District	47	(66.2)	13	(59.1)	60	(64.5)
<b>Townships</b>						
Paung Township	6	( 8.5)	3	(13.6)	9	( 9.7)
Tha Hton Township	8	(11.3)	1	( 4.5)	9	( 9.7)
Belin Township	3	( 4.2)	3	(13.6)	6	( 6.5)
Kyaik Hto Township	7	( 9.9)	2	( 9.1)	9	( 9.7)
Mawlamyaing Township	9	(12.7)	1	( 4.5)	10	(10.8)
Kyaikmayaw Township	8	(11.3)	2	( 9.1)	10	(10.8)
Mudon Township	8	(11.3)	2	( 9.1)	10	(10.8)
Thanbyuzayut Township	7	( 9.9)	3	(13.6)	10	(10.8)
Ye Township	9	(12.7)	1	( 4.5)	10	(10.8)
Chaug Zone Township	6	( 8.5)	4	(18.2)	10	(10.8)
<b>Daily number of patients (number/day)</b>						
-10	50	(70.4)	2	( 9.1)	52	(55.9)
11-20	15	(21.1)	6	(27.3)	21	(22.6)
21-30	4	( 5.6)	7	(31.8)	11	(11.8)
31-40	1	( 1.4)	3	(13.6)	4	( 4.3)
40-	1	( 1.4)	4	(18.2)	5	( 5.4)
<b>Estimated area of compound (sq-ft)</b>						
-2400	16	(22.5)	0	( 0.0)	16	(17.2)
2401-10000	27	(38.0)	0	( 0.0)	27	(29.0)
10001-40000	22	(31.0)	3	(13.6)	25	(26.9)
40001-	6	( 8.5)	19	(86.4)	25	(26.9)
<b>Average of monthly total waste (kg/month)</b>						
-10	37	(52.1)	0	( 0.0)	37	(39.8)
11-100	33	(46.5)	7	(31.8)	40	(43.0)
101-	1	( 1.4)	15	(68.2)	16	(17.2)
<b>Supporting facilities for HCWM*</b>						
No	63	(88.7)	19	(86.4)	82	(88.2)
Yes	8	(11.3)	3	(13.6)	11	(11.8)
<b>Final disposal methods</b>						
Burial in pits	6	( 8.5)	0	( 0.0)	6	( 6.5)
Burning in pits	59	(83.1)	14	(63.6)	73	(78.5)
Incineration	3	( 4.2)	5	(22.7)	8	( 8.6)
Municipal plan	2	( 2.8)	2	( 9.1)	4	( 4.3)
Open burning	1	( 1.4)	1	( 4.5)	2	( 2.2)

\*healthcare waste management

Table 2 Practice on healthcare waste management at primary health centres (N=93)

Characteristics	Non-hospitals		Hospitals		p-value
	n	(%)	n	(%)	
<b>Proper containers for waste</b>					1.000
No	3	( 4.2)	0	( 0.0)	
Yes	68	(95.8)	22	(100.0)	
<b>Proper containers for HCW*</b>					0.037
No	18	(25.4)	1	( 4.5)	
Yes	53	(74.6)	21	(95.5)	
<b>Cleaning materials for HCWM</b>					0.192
No	7	( 9.9)	0	( 0.0)	
Yes	64	(90.1)	22	(100.0)	
<b>Segregation of HCW from other waste stream</b>					0.193
No	24	(33.8)	4	(18.2)	
Yes	47	(66.2)	18	(81.8)	
<b>Different containers according to types of HCW*</b>					0.214
No	32	(45.1)	6	(27.3)	
Yes	39	(54.9)	16	(72.7)	
<b>Proper container for infectious waste</b>					0.035
No	14	(19.7)	0	( 0.0)	
Yes	57	(80.3)	22	(100.0)	
<b>Proper container for sharp waste</b>					1.000
No	15	(21.1)	5	(22.7)	
Yes	56	(78.9)	17	(77.3)	
<b>Proper container for general waste</b>					0.142
No	19	(26.8)	2	( 9.1)	
Yes	52	(73.2)	20	(90.9)	
<b>Proper labelling on waste containers</b>					0.087
No	67	(94.4)	18	(81.8)	
Yes	4	( 5.6)	4	(18.2)	
<b>Clearly defined procedure for HCWM</b>					0.138
No	70	(98.6)	20	(90.9)	
Yes	1	( 1.4)	2	( 9.1)	

(Table 2 continues to next page)

(Table 2 continued)

Characteristics	Non-hospitals		Hospitals		p-value
	n	(%)	n	(%)	
<b>Colour coding on HCWM</b>					0.002
No	66	(93.0)	14	(63.6)	
Yes	5	( 7.0)	8	(36.4)	
<b>Final disposal for segregated waste</b>					0.754
No	13	(18.3)	3	(13.6)	
Yes	58	(81.7)	19	(86.4)	
<b>Storage area for waste awaiting disposal</b>					0.754
No	58	(81.7)	19	(86.4)	
Yes	13	(18.3)	3	(13.6)	
<b>Disinfection before final disposal</b>					0.084
No	69	(97.2)	19	(86.4)	
Yes	2	( 2.8)	3	(13.6)	
<b>Equipment for accidental spillage of HCW *</b>					0.014
No	38	(53.5)	5	(22.7)	
Yes	33	(46.5)	17	(77.3)	
<b>Hand washing facilities</b>					0.109
No	9	(12.7)	0	( 0.0)	
Yes	62	(87.3)	22	(100.0)	
<b>Separate staff for HCWM</b>					<0.001
No	62	(87.3)	10	(45.5)	
Yes	9	(12.7)	12	(54.5)	
<b>Sufficient support for personal protective equipment</b>					0.079
No	48	(67.6)	10	(45.5)	
Yes	23	(32.4)	12	(54.5)	
<b>Sufficient Usage of personal protective equipment</b>					0.079
No	48	(67.6)	10	(45.5)	
Yes	23	(32.4)	12	(54.5)	

\*healthcare waste

**Table 3 Odds ratio (OR) and 95% confidence interval (CI) of non-hospitals for poor practice of healthcare waste management relative to hospitals (N=93)**

<b>Poor management</b>	<b>OR</b>	<b>95% CI</b>
<b>Proper containers for HCW *</b>	7.13	0.89-56.87
<b>Segregation of HCW* from other waste stream</b>	2.30	0.70-7.55
<b>Different containers according to types of HCW*</b>	2.19	0.77-6.24
<b>Proper container for sharp waste</b>	0.91	0.29-2.87
<b>Proper container for general waste</b>	3.65	0.78-17.14
<b>Proper labelling on waste containers</b>	3.72	0.85-16.36
<b>Clearly defined procedure for HCWM</b>	7.00	0.60-81.23
<b>Colour coding on HCWM</b>	7.54	2.15-26.52
<b>Final disposal for segregated waste</b>	1.42	0.37-5.52
<b>Storage area for waste awaiting disposal</b>	0.70	0.18-2.74
<b>Disinfection before final disposal</b>	5.45	0.85-34.99
<b>Equipment for accidental spillage of HCW*</b>	3.92	1.30-11.77
<b>Separate staff for HCWM</b>	8.27	2.77-24.64
<b>Sufficient support for personal protective equipment</b>	2.50	0.94-6.64
<b>Sufficient Usage of personal protective equipment</b>	2.50	0.94-6.64

\*healthcare waste

The Ministry of Health and Sports of Myanmar may consider assigning a separate staff member for HCW handling in PHCs as a compulsory policy for all levels of health facilities where HCW are produced. HCW handling is a fundamental issue since it can pose a potential health risk to the health workforce.

Regarding equipment for accidental spillage of HCW, 17 hospital type PHCs and 33 non-hospital type PHCs among the 93 PHCs possessed that equipment. The study showed that non-hospital type PHCs were four times more likely not to have equipment for accidental spillage of HCW than hospitals. For dangerous spillage of hazardous chemicals or infectious HCW, cleaning procedures need to prevent transmission of infection. A possible reason for this finding may be lack of consensus to accept responsibility for use of equipment for accidental spillage of HCW.



Since hospitals type PHCs produce more HCW than non-hospital type PHCs, the priority might be lower for the provision and/or there may be inadequate PPE in non-hospital type PHCs. Regardless of the type of health facilities (hospital type PHCs or non-hospital type PHCs), the necessary PPE should be readily available at all times.

As described above, 78.5% of PHCs used a method of burning in pits as their final disposal of HCW including sharps. Most of the pits were not fenced and the sharp waste was mixed with general waste during burning, even though segregation was performed. As a result, the wastes were incompletely burnt, possibly leading to the risk of transmitting infections due to breakdown of those wastes in the shallow pits.<sup>20,21</sup> Moreover, in the studied PHCs, many of the incinerators were made without chimneys and/or chimney drain. In addition, those incinerators did not have a waste feeding and ash removing door. Burning was the major waste disposal mechanism in most PHCs but most of the incinerators were working poorly, such as running with low temperatures, and improper emission control systems, which may lead to severe environmental pollution to the surrounding areas. The burning of pharmaceuticals and cytotoxic drugs needs to be carried out in well-functioning incinerators at proper and standard temperatures with facilities for emission control.<sup>22,23</sup> The PHCs should have the incinerators working appropriately and enforce proper maintenance procedures.

In this study, PPE was sufficiently supported in 37.6% of PHCs where adequate usage of PPE was observed. It implied that the PHCs that were not provided with PPE had never used PPE. The possible reasons for non-use of PPE may be lack of provision of PPE, lack of knowledge about hazards due to unsafe HCWM, or dislike of using PPE because it is uncomfortable.<sup>24</sup> PPE should be made up of locally adaptable things. Moreover, State Health Department need to provide safe handling of HCW training, encourage proper and consistent use of PPE, and provide hand washing materials and facilities.

This study had several limitations. First, PHCs were selected depending on accessibility of PHCs during the survey period. Among 105 PHCs randomly selected from all ten townships in Mon State, 11.4% of PHCs were difficult to reach due to weather conditions. Second, the sample size was small, and the subjects were sampled from only Mon State, which may limit generalizability to other States and Regions of Myanmar. Third, in this study only the category of PHCs (hospital and non-hospital types) was considered as a factor to explore the practice of healthcare waste management due to small sample size. Further study may consider to increase the sample size and include other possible factors such as average number of waste, daily number of patients, and supporting facilities for HCWM. Last, this study did not collect and evaluate the actual costs of HCWM information of each PHC. In this study, one researcher conducted the survey with a checklist through observation, so the results are relatively objective and there is no inter-observer variation in the data.

This study was conducted in PHCs, basic functional units providing healthcare services in Myanmar, in order to explore the current situation of HCWM at the PHCs level. The study findings might be applicable for the development of National SOPs or guideline for HCWM in healthcare facilities in Myanmar. In addition, this study can be used as an initial step for further studies such as longitudinal and qualitative studies to obtain more information to find effective solutions for safe HCWM.

In conclusion, this study provided useful information on the current practice of HCWM at PHCs in Mon State, Myanmar. It revealed that non-hospital type PHCs had worse practice on colour coding for waste segregation, no separate staff assigned for HCWM, and no equipment for accidental spillage for HCW. Furthermore, a majority of the PHCs used burning in pits as their final disposal method of HCW, and displayed insufficient usage of PPE. The State Health Department need to provide HCWM training and sufficient PPE to all PHCs in Mon State. At

the National level, the Ministry of Health and Sports should issue technical guidelines for safe HCWM and SOPs as a compulsory policy for all healthcare facilities.

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### COMPETING INTERESTS

The authors declare that no competing interests exist.

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