BRIEF REPORT



## **Regulated Medical Waste Reduction in the Dermatology Clinic**

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### ABSTRACT

*Introduction*: The disposal of regulated medical waste (RMW) in the healthcare setting can be both costly and environmentally harmful. Prior studies have found large amounts of waste disposed of in RMW containers are inappropriately placed. Few studies to date have investigated the efficacy of waste reduction practices in the dermatology setting.

Divya K. Sharma and Lilia C. Murase are contributed equally to this work.

**Prior Presentation:** Data from this study were previously presented at the American Academy of Dermatology 2024 Annual Meeting on March 8, 2024 in San Diego, CA. Data from this study has not been published in manuscript form elsewhere.

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J. S. Barbieri Department of Dermatology, Brigham and Women's Hospital, Boston, MA, USA *Methods*: This study aims to evaluate the effectiveness of a practice-wide intervention in reducing RMW in the outpatient dermatology setting. By performing daily waste audits and two concurrent educational interventions, the amount of RMW produced and percent of appropriately placed RMW will be measured. Further analysis will occur by comparing pre-intervention values to post-intervention values.

**Results:** The percentage of waste properly placed in RMW containers prior to any intervention was 11%. Following both educational interventions, the percentage of waste properly placed in RMW containers increased by 56.1% (CI 43.7–68.5%) and the percentage of total waste produced that was identified and disposed of as RMW decreased by 6.0% (95% CI 1.2–10.8%).

*Conclusion*: Our study provides practical data for dermatology providers to make small

J. E. Murase Department of Dermatology, University of California, San Francisco, San Francisco, CA, USA J. E. Murase (⊠) 701 East El Camino Real (31-104), Mountain View, CA 94040, USA e-mail: jemurase@gmail.com changes which can result in significant reductions of regulated medical waste, potentially providing benefits to the environment and cost-savings.

**Keywords:** Medical waste disposal; Regulated medical waste; Waste reduction; Dermatology clinic; Medical waste; Dermatology

### **Key Summary Points**

The disposal of regulated medical waste (RMW) produces harmful pollutants and, if performed unnecessarily, can contribute to greater practice management costs

This study sought to determine the effectiveness of educational interventions to reduce unnecessary production and disposal of RMW in an outpatient dermatology setting

Our intervention led to a significant increase in the proportion of RMW properly placed as well as a significant decrease in the total volume of RMW produced

A simple, educational intervention can be implemented by dermatology practices to reduce unnecessary RMW and provide environmental and financial benefits

## INTRODUCTION

Regulated medical waste (RMW), also known as "red bag waste," is healthcare-generated waste unsuitable for disposal via municipal solid waste systems because of the presence of infectious or pathogenic materials. The disposal of RMW is often performed via incineration or autoclaving; both techniques are costly and result in emission of potent pollutants and carcinogens, such as dioxins, furans, lead, mercury, cadmium, and particulate matter [1, 2].

Prior studies have found reducing regulated medical waste results in significant cost-savings [3–6]. For instance, researchers from the

University of Alcalá performed a large-scale study to evaluate the effects of a hospitalwide intervention to reduce RMW and found this intervention resulted in a cost-savings of 125,205 euros [3]. Another initiative performed by researchers at Duke University found an initiative to improve proper disposal of waste in 35 operating rooms led to a yearly savings of 28,932 dollars [4]. The literature suggests nearly 80% of contents disposed of in RMW containers are improperly placed, underscoring the need for initiatives to properly dispose of RMW [5, 7]. Likewise, a study assessing an intervention on medical waste handlers from Egypt found significant increases in knowledge of proper RMW practices following said intervention [6].

Prior interventional studies in reducing RMW have largely been educational and performed in the inpatient setting [8]. For instance, a systematic review and meta-analysis of health care waste management improvement initiatives found that out of 27 articles in the literature, 19 included educational interventions while the rest utilized management interventions focused on changing policies, processes, and guidelines [8]. The same review found 24 out of 27 studies were performed in the inpatient setting, with the rest performed in primary healthcare centers or a dental clinic [8]. Compared to other medical specialties, dermatology is positioned uniquely as it is primarily outpatient based but can involve numerous procedures and treatments which result in the production of substantial amounts of RMW. Very few studies to date have focused on interventions to reduce RMW in the field of dermatology [9]. Herein, we aim to describe the effects of an educational intervention to reduce RMW in an outpatient dermatology practice through waste audits including quantitative measurements.

## **METHODS**

Our study was performed at a private, outpatient dermatology practice in California, USA, and involved two educational interventions to reduce RMW. Thus, our study duration was 30 days and was split into three phases: (1) a pre-intervention phase lasting 15 days, (2) a post intervention phase after the first intervention lasting 5 days, and (3) a final post-intervention phase after the second intervention lasting 10 days. During the full course of our study, RMW and non-RMW containers were weighed in total and had their contents stratified and further weighed as RMW and non-RMW following each clinic day. Additional data points collected included whether a waste container was placed in an examination room or treatment (procedurally oriented) room as well as the distance between RMW and non-RMW containers in each room (close to or far from one another).

To define RMW in our study, the definitions from the RMW Programs and Procedures of Vermont and New York State were used (Table 1) [5, 10]. The educational interventions in our study consisted of two 30-min sessions involving all staff within the medical practice and were focused on providing cases and examples of proper RMW disposal practices (Fig. 1). Specifically, photographs of used clinic items which belong in RMW containers were provided and compared to their counterparts. To minimize measurement bias, the contents of each waste container were measured by a single author through the study (LCM). Additionally, to limit observer bias, waste containers were only measured at the end of a clinic day when all staff had left the facility. Statistical analysis included an unpaired, two-sample *t*-test to compare proper waste segregation before and after interventions as well as a regression model to explore the influence of room type and orientation of waste containers on proper waste segregation.

This article does not contain any new studies with human participants or animals performed by any of the authors. This study is exempt from IRB approval and in accordance with the Declaration of Helsinki.

### RESULTS

The percentage of waste in each RMW bin that was appropriately placed prior to the first intervention (days 0-15) was 11%. After the first intervention and before the second (days 16-20), it was 28.2%, showing a 17.2% increase (CI: 2.8–31.5%). After the first intervention and on to study completion (days 16-30), the percentage of appropriately placed waste in RMW bins was 55.6%, a 44.6% increase (CI: 33.2–56.0%) from the pre-intervention 11%. The percentage of appropriately placed RMW prior to the second intervention (days 0-20) was 13.3%. After the second intervention (days 21-30), it was 69.4%, revealing a 56.1% increase (CI: 43.7-68.5%). Figure 2 represents the trends of this outcome over the course of the study.

Of the total waste produced by the dermatology practice on each day, the percentage placed in RMW containers prior to the first intervention (days 0–15) was 10.5%. After the

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	Regulated medical waste	Non-RMW	
Gloves	*Only if dripping/soaked with blood	Х	
Gowns*	*Only if dripping/soaked with blood	Х	
Masks*	*Only if dripping/soaked with blood	Х	
Gause and dressings	* Only if dripping/soaked with blood	Х	
Any additional items soaked with blood	Х		
Any items exposed to nasal secretions, sputum, tears,		Х	
urine, sweat, or vomitus			

 Table 1
 Definition of regulated medical waste

\*Personal discretion of each physician was used to determine what is RMW in unique situations (e.g., secretions from patients with known communicable disorders)

# Stop! Does it belong?



Red bin

White bin



Fig. 1 Appropriate RMW disposal training document



**Fig. 2** Percentage of waste appropriately placed in RMW containers: the educational interventions took place at days 15 and 20

first intervention and prior to the second (days 16–20), it was 4.4%, reflecting a 6.2% decrease (95% CI: 1.6–13.9%). Following the first intervention to study completion (days 16–30), the percentage of total waste placed in RMW containers was 3.5%, a 7.1% decrease (95% CI: 2.5–11.6%) from the pre-intervention value. Finally, after the second intervention until study

Be mindful when you dispose of trash! **Red bin** waste is only for materials that are **SOAKED in blood**.

### Inappropriate red bin waste disposal





**Fig. 3** Percentage of total clinic waste disposed of in RMW containers: the educational interventions took place at days 15 and 20

completion (days 21–30), the percentage of total waste placed in RMW containers was 3.1% compared to 9.1% prior to the second intervention (days 0–20). This represented a 6.0% decrease (95% CI: 1.2–10.8%). The trend of this outcome is shown in Fig. 3.

Additionally, rooms with bins that were close to each other had 11.5% (95% CI: 0.6–22.4%)

more waste placed in the appropriate bin. Treatment rooms had 18.6% (95% CI: 6.8–30.3%) more waste placed in the appropriate bins. Based on available data on carbon emissions and cost of RMW disposal, it was estimated that for a 10-physician practice, this intervention would be expected to reduce carbon emissions by ~ 200 kg/year and costs by ~ \$1000/year.

### DISCUSSION

Very few studies to date have evaluated the efficacy of an intervention to reduce RMW in the outpatient dermatology setting. As mentioned earlier, most RMW reduction-focused studies are performed in hospitals and larger scale settings. One study by Wolstencroft et al. [9] investigated the effects of an intervention on reducing excessive biopsy tray waste in an academic dermatology department, finding the average number of wasted supplies in biopsy kits was reduced from 10.1 to 1.6. Our study expands on these findings by performing an analysis focused on waste containers rather than biopsy trays. Moreover, the setting of our study differs from Wolstencroft et al.'s in that it was performed in a private practice dermatology clinic.

Overall, our study found an educational intervention is markedly effective in reducing excess RMW. Moreover, our study found that a second educational intervention resulted in even greater rates of proper RMW disposal than the first alone. This finding suggests when performing interventions such as ours, repetition and consistent educational reminders can produce more impactful results. Our study also highlighted that having RMW and non-RMW containers placed close to one another is associated with further improvement in the appropriate disposal of RMW waste. One potential explanation for this finding may be that having waste containers close to one another can allow providers to visualize both types of waste receptacles, granting time for a thoughtful decision. Finally, treatment rooms (in which more dermatologic procedures occurred) had a greater percentage of proper waste disposal than examination rooms. One potential etiology for this finding may be that when more waste is produced, such as in dermatologic procedures, providers and staff are more cognizant of proper waste disposal practices.

Future studies can expand on our results by performing a lengthier analysis as well as controlling for diseases seen in each examination room on a certain day. For instance, analyses performed over longer periods of time will allow insight into the sustainability of such interventions. Moreover, additional investigations in this area may also be performed for specific dermatology subspecialties such as dermatopathology, Mohs micrographic surgery, pediatric dermatology, and inpatient dermatology.

## CONCLUSION

The proper and safe disposal of RMW is a crucial part of any healthcare system or practice. Our study provides data to support the efficacy of a brief educational intervention as well as minor logistical practice changes in reducing excess RMW in the outpatient dermatology setting. The regulation of waste produced in the medical setting is largely performed by state environmental and health departments. Furthermore, each hospital and practice may have its own specific guidelines for waste disposal. As many of these practices and institutions may alter such guidelines with input from stakeholders including dermatologists and dermatology providers, data on initiatives and processes to reduce excess waste such as ours can be fundamental to making meaningful, sustainable changes within the field.

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*Data Availability.* Data are available from the authors upon request.

#### Declarations

*Conflict of Interest.* Jenny Murase is an Editorial Board member of Dermatology and Therapy. Jenny Murase was not involved in the selection of peer reviewers for the manuscript or any of the subsequent editorial decisions. Misha Rosenbach is the co-Chair of the AAD's Expert Resource Group on Climate Change/ Environmental Issues; he is speaking on behalf of himself and not the Academy. The authors have no other financial conflicts of interest that are pertinent to declare.

*Ethical Approval.* This article does not contain any new studies with human participants or animals performed by any of the authors. This study is exempt from IRB approval and in accordance with the Declaration of Helsinki.

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