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Brief Report

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Abstract

Objective: Rinsing only with water or washing with soap and water are common methods of skin decontamination for skin contaminated during a chemical hazard release. The null hypothesis was that a 15-minute water irrigation (decontamination method 1) would not be superior to decontamination using a microfiber towel, followed by a wet wipe (Signature Select Softly Flushable Tissue Better Living Brands LLC, Pleasanton, CA), followed by using another microfiber towel (decontamination method 2).

Methods: A simulated contaminant (Magic Fluorescent Glow Paint for Face and Body, iLC Shenzhen Fulimei Technology Co. LTD, Shenzhen, the People's Republic of China) was applied to the dorsal skin of each subject's forearms. Then, photographs of these subject's skin were taken before and after decontamination of the simulated contaminant by using either decontamination method 1 or 2. Each of the subjects underwent both decontamination methods in separate trials, with each subject using one forearm for decontamination method 1 and their other forearm for decontamination method 2. Discrete points of contamination were quantified on the photographs that were taken with the skin illuminated by ambient visible light or ultraviolet light (395nm, Roceei ultraviolet flashlight, China).

Results: Under visible light, no residual contamination was seen by inspecting photographs taken after decontaminating with either method. Under ultraviolet light, less visible contamination was seen by inspecting photographs taken after decontaminating with method 1 than after decontaminating with method 2.

Conclusion: In this study, skin decontamination with water irrigation was superior to skin decontamination without water irrigation.

Rinsing only with water or washing with soap and water, followed by rinsing with water, are common methods to decontaminate human skin contaminated during a chemical hazard release. This is especially true in emergent situations when firefighters, hazardous materials technicians, paramedics, those on hospital decontamination teams, or other front-line workers need to decontaminate patients with commonly available water or soap and water¹. There is concern that excess rinsing with water or soap and water could cause subjects to experience the “wash in effect,” i.e., enhancing absorption of chemical contaminants into and/or through the skin. This wash in effect could possibly increase local and/or systemic toxicity². Because rinsing only with water or washing with soap and water, and then rinsing with water, are commonly used because of their familiarity and availability, we wanted to test the null hypothesis that a 15-minute water irrigation (decontamination method 1) would not be superior to decontamination using a microfiber towel, followed by a wet wipe, followed by another microfiber towel (decontamination method 2). This study was determined by the Institutional Review Board at the University of Arizona not to meet criteria for designation as human subject research.

Methods

Three people with different skin pigmentation, light, medium, and dark, consented for this study. All three individuals were male, ranging between 30 to 50 years of age. They were photographed under ambient visible light using a standard penlight and ultraviolet light (395nm, Roceei ultraviolet flashlight, China), both at the same fixed distance, using a 5 x 5 cm grid divided into nine squares on the dorsum of both of their mid forearms. This was done first without any application of simulated contaminant at a specific location marked on the individuals' forearms

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to allow photography at the same sites. Then, 1.5mL of simulated contaminant (Magic Fluorescent Glow Paint for Face and Body, iLC Shenzhen Fulimei Technology Co. LTD, Shenzhen, the People's Republic of China) was painted on the 5 x 5 cm grid divided into nine squares on the subjects' forearms using the linear motion of the experimenter's index finger.

This paint's ingredients are water, glycerin, paraffinum, liquidum (mineral oil), PEG-80, sorbitan laurate, stearic acid, triethanolamine, acetyl alcohol (acetic acid), and phenoxyethanol. This paint was allowed to dwell on each subject's skin for 90 seconds. Then, each subject's forearm was decontaminated with a 15-minute water irrigation (decontamination method 1), specifically placing their arm under running tap water at 73 degrees Fahrenheit for 15 minutes while resting their arm across the sink to control the distance from the faucet. The following day, Magic Fluorescent Glow Paint for Face and Body was painted onto each subject's other forearm and allowed to dwell on their skin for 90 seconds. Then, this other forearm of each subject was decontaminated using a dry microfiber towel (Auto Cloths Microfiber, Schroeder & Tremaine Inc., St. Louis, MO), followed by a wet wipe (Signature Select Softly Flushable Tissue Better Living Brands LLC, Pleasanton, CA), followed by a dry microfiber towel (Auto Cloths Microfiber, Schroeder & Tremaine Inc., St. Louis, MO) (decontamination method 2). Specifically, decontamination method 2 used the first dry microfiber towel in a clean room, quarter-fold procedure to remove visible paint, using this towel in a rotary, clockwise motion, followed by using the same motions with the wet wipe, followed by using the same motions again with another dry microfiber towel. Decontamination method 2 was done over the course of two minutes. For decontamination method 2, a clean area of the microfiber towel and wet wipe was used with each skin contact by folding the towel or wet wipe over before each time they were applied to the skin. After each method of decontamination, photographs were taken for intra-individual comparison. Photographs were all taken at the same distance from the skin with the same magnification to avoid variability that could confound results. After these photographs, subjects dried their arms with paper towels.

Results

Visible, discrete points of contamination within the nine squares of the 5 x 5 cm grids were counted on the photographs taken with each subject's skin illuminated by ambient visible light or ultraviolet light. Please see the [Photographs](#) and [Table](#). Under ambient visible light, no residual contamination was seen by inspecting photographs taken after decontaminating with either method. Under ultraviolet light, less visible contamination was seen by inspecting photographs taken after decontaminating with method 1 than after decontaminating with method 2.

Discussion

Our null hypothesis was incorrect that that a 15-minute water irrigation (decontamination method 1) would not be superior to

decontamination using a microfiber towel, followed by a wet wipe, followed by another microfiber towel (decontamination method 2). In this study, decontamination method 1 was superior to decontamination method 2 as demonstrated by non-overlapping confidence intervals ([Table](#)). Further studies may reveal whether combining various methods of skin decontamination are superior to an individual method of skin decontamination. More study is needed to determine which method or methods are superior for chemicals with physicochemical properties that are different than the simulant contaminant used in this study.

Limitations

This study has several limitations. The sample size is small. The simulated contaminant (Magic Fluorescent Glow Paint for Face and Body, iLC Shenzhen Fulimei Technology Co. LTD, Shenzhen, the People's Republic of China) may or may not be physiochemically similar to chemicals that may contaminate patients during a chemical hazard release. Therefore, this paint may or may not be comparable to a specific chemical contaminant on a patient's skin. Counting the discrete points of contamination detected by inspecting photographs using visible ambient light or ultraviolet light to illuminate the skin after decontamination is an intuitive measure of quantification; however, this method has not been validated. For example, other observers may perceive or count different numbers of discrete points of contamination. We did not use multiple observers to count discrete points of contamination; therefore, we cannot determine kappa values to determine inter-rater variability. Only subjects' dorsal forearm skin was painted and decontaminated in this study, so these results are not necessarily generalizable to other areas of skin on the body, such as the thin skin of the eyelids.

Conclusions

In this study, skin decontamination with water irrigation was superior to skin decontamination without water irrigation.

Authors contributions. Dr. Shirazi conceived this study. Dr. Shirazi, Dr. Aizenberg, and Ms. Whalen designed the study, and acquired the data. All authors analyzed and interpreted the data. All authors helped draft and revise the work and approved this submitted manuscript for publication and are accountable for this work.

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Competing interests. None

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Photographs

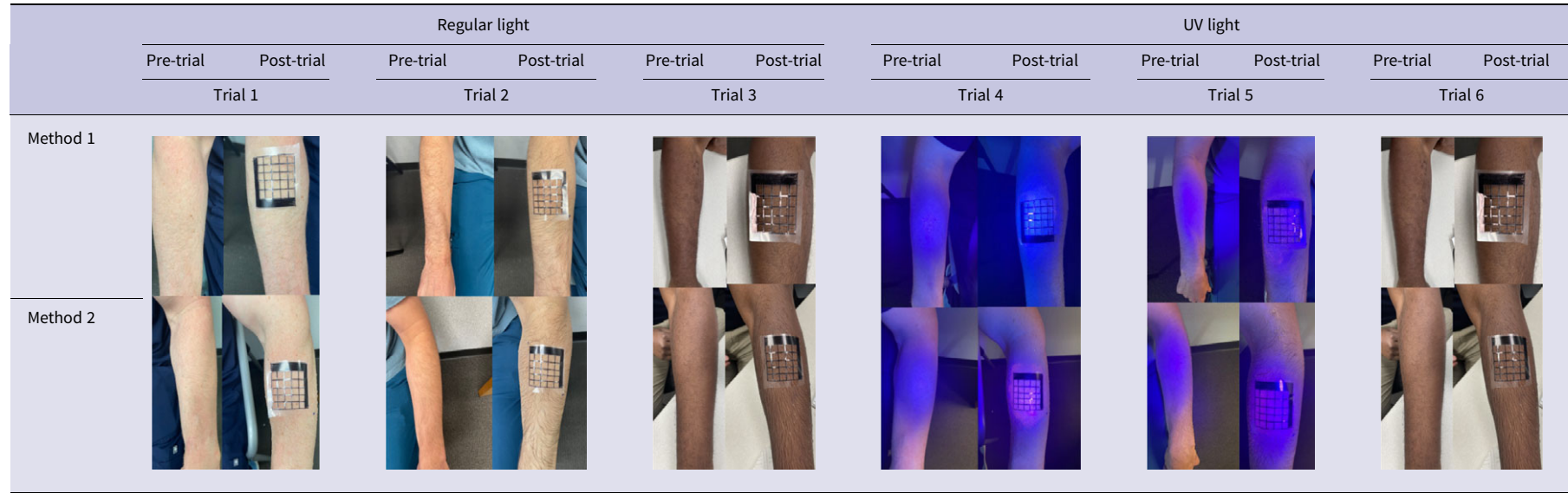


Table. Discrete points of contamination detected by photographs using visible ambient light or ultraviolet light to illuminate the skin after decontamination method 1 or 2

Subject number & mean values among the 3 subjects	Discrete points of contamination detected by photographs using visible ambient light to illuminate the skin after decontamination		Discrete points of contamination detected by photographs using ultraviolet light to illuminate the skin after decontamination	
	Method 1 (n)	Method 2 (n)	Method 1 (n)	Method 2 (n)
Subject 1	0	0	39	76
Subject 2	0	0	23	85
Subject 3	0	0	20	52
Mean among the 3 subjects with 95% confidence intervals	0	0	27 CI 95%: 27 +/- 9.4 [17.6–36.4]	71 CI 95%: 71 +/- 15.7 [55.3–86.7]