



Brief report

Differential laundering practices of white coats and scrubs among health care professionals

L. Silvia Munoz-Price MD^{a,b,c,*}, Kristopher L. Arheart EdD^{b,d}, David A. Lubarsky MD, MBA^e, David J. Birnbach MD, MPH^{b,e}^a Department of Medicine, Miller School of Medicine, University of Miami, Miami, FL^b Department of Epidemiology and Public Health, Miller School of Medicine, University of Miami, Miami, FL^c Jackson Memorial Hospital, Miami, FL^d Division of Biostatistics, Miller School of Medicine, University of Miami, Miami, FL^e Department of Anesthesiology, Miller School of Medicine, University of Miami, Miami, FL

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The role played by health care worker's uniforms on the horizontal transmission of organisms within the hospital is still controversial. To determine the differential laundering practices in regards to white coats and scrubs, we surveyed physicians present at the 3 weekly academic conferences with largest attendance at our hospital (medicine, pediatrics, and anesthesiology). Out of 160 providers, white coats were washed every 12.4 ± 1.1 days and scrubs every 1.7 ± 0.1 days (mean \pm standard error; $P < .001$). Faculty physicians washed their scrubs more frequently than house staff (1.0 vs 1.9 days, respectively, $P = .018$), and no differences were observed among specialties.

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Horizontal transmission of bacterial organisms among hospitalized patients is a major concern.¹ The main vectors of these organisms are thought to be contaminated health care workers' hands.² Thus, major efforts to increase hand hygiene compliance are being implemented worldwide.³ However, recent literature indicates that uniforms worn by health care workers might also play a role in the transmission of pathogens.⁴⁻¹¹ The type of uniforms worn by providers, their differential laundering practices, and their degree of contamination represent controversial questions for hospital epidemiologists. Nevertheless, there are currently no studies showing a different laundering frequency among various uniforms, in particular scrubs versus white coats. Therefore, we aimed to characterize the laundering habits of a group of medical providers with regard to the type of uniform they wore (white coats and/ or scrubs), their specialty (medicine, anesthesiology, and pediatrics), and their seniority (faculty physician, house staff, and medical student).

METHODS

A 9-item, anonymous, self-administered questionnaire was distributed among the 3 weekly departmental conferences with the largest attendance at our hospital (medicine, pediatrics, and anesthesiology). Questions included specialty, seniority (faculty, house staff, or student), use of white coats and/or scrubs during routine patient care, days in between laundering white coats and/or scrubs, and temperature used for washing them. Beliefs explored included the awareness of bacterial contamination of white coats or scrubs and the reasons for wearing white coats. All data collected were directly associated within the duties of the infection control practice at the participating institution. All data were de-identified prior to any analysis. As such, the Institutional Review Board and the Human Subjects Research Office concluded that this study met the criteria for non-human/non-research determination. Furthermore, the Chiefs of Service and the hospital's Chief Medical Officer were notified and in agreement with this anonymous survey ahead of time.

The primary outcome variable was a count of days between washing of white coats or scrubs. To test for differences in washing frequency between garment type (white coats and scrubs) for health care workers in different departments (medicine, anesthesiology, and pediatrics) or provider type (faculty physicians, house staff, or medical student), we used a generalized linear mixed

* Address correspondence to L. Silvia Munoz-Price, MD, LSMP Park Plaza West L-302, 1611 N.W. 12th Avenue, Miami, FL 33136-1096.

E-mail address: smunozprice@med.miami.edu (L.S. Munoz-Price).

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model to perform a repeated measures analysis of variance for an outcome with a Poisson distribution. The between factors were department or provider type and the within factor was garment type. The between and within factors were fixed; the random factor was subject nested within department or provider type. An unstructured covariance matrix was used to represent the correlated covariance structure. Contrasts were used to test for significant differences between garment type within department or provider type and among departments or provider types within garment type. Separate analyses were run with department and provider types using all data and then for a subset of providers who wore their uniforms only during patient care. Test results significant at 2-tailed probability $\leq .05$ were considered to be statistically significant. SAS 9.2 (SAS Institute, Inc, Cary, NC) was used for all analyses.

RESULTS

Questionnaires were answered by 160 health care providers: 42 from the Department of Medicine, 77 from the Department of Anesthesiology, and 41 from the Department of Pediatrics. Either white coats or scrubs were used during patient care by 51% and 83% of respondents, respectively. One-third of providers reported wearing both scrubs and white coats concomitantly during patient care.

Overall, white coats were washed every 12.4 ± 1.1 days and scrubs 1.7 ± 0.1 days (mean \pm standard error; $P < .001$). Four people referred washing their white coats every 90 or more days (up to 12 months); however, 90% of the respondents laundered their white coats at least once a month. Results based on individual departments and provider types are presented in Table 1. Subgroup analysis looking only at providers who actually wore the specific garment (either white coats or scrubs) during patient care showed that white coats were washed every 9.5 ± 0.9 days and scrubs every 1.6 ± 0.1 days ($P < .001$) (Table 1, section A. By type of provider). Among all the staff who wore uniforms during patient care, faculty physicians washed their scrubs more frequently than house staff (1.0 vs 1.9 days, respectively, $P = .018$). When comparing laundering frequencies of white coats versus scrubs, either by department or profession, scrubs were washed more frequently than white coats ($P < .001$ for all comparisons; Table 1, section B. By academic departments).

Water temperature used by health care providers to wash their garments included cold (11%), warm (21%), and hot (52%); 11% did not know the temperature they used, and 6% dry-cleaned their white coats. The 2 most frequent reasons for wearing white coats included looking and feeling like a doctor (29%) and the capacity of carrying multiple objects in their pockets (25%). Other reasons included staying warm (12%), compliance with uniform policy (12%), and protection from patient's bacteria (11%). A total of 145 respondents (90%) acknowledged being aware that their uniforms were potentially contaminated with hospital pathogens.

DISCUSSION

Our survey showed that health care workers laundered their white coats less frequently than their scrubs. Seniority played a role in our results, given that faculty physicians laundered their scrubs more frequently than house staff. Furthermore, most of our providers wore their white coats to symbolize their profession or to hold objects; this particular finding is similar to what was previously reported by Treacle et al.⁸ Moreover, only half of our providers used hot water for laundering their uniforms. This latter finding is particularly interesting given the recent article by

Table 1

Laundering frequencies of white coats and scrubs by type of provider and academic department

A. By type of provider						
Uniform	All providers			Comparison P values		
	Faculty	House staff	Student	F vs H	F vs St	F vs St
White coats	12.8 \pm 2.0	12.6 \pm 1.6	11.4 \pm 2.4	.941	.669	.693
Scrubs	1.3 \pm 0.2	1.9 \pm 0.2	1.8 \pm 0.4	.061	.150	.946
W vs S (P)	<.001	<.001	<.001			
Only providers who see patients in uniform						
Uniform	All providers			Comparison P values		
	Faculty	House staff	Student	F vs H	F vs St	F vs St
White coats	9.9 \pm 1.8	8.4 \pm 1.1	13.2 \pm 2.6	.453	.293	.062
Scrubs	1.3 \pm 0.2	1.9 \pm 0.2	1.8 \pm 0.4	.012	.004	.360
W vs S (P)	<.001	<.001	<.001			
B. By academic department						
Uniform	All providers			Comparison P values		
	Medicine	Anesthesiology	Pediatric	M vs A	M vs P	A vs P
White coats	8.7 \pm 1.4	16.7 \pm 2.1	11.1 \pm 1.9	.002	.302	.051
Scrubs	1.9 \pm 0.4	1.5 \pm 0.2	1.7 \pm 0.3	.275	.642	.569
W vs S (P)	<.001	<.001	<.001			
Only providers who see patients in uniform						
Uniform	All providers			Comparison P values		
	Medicine	Anesthesiology	Pediatric	M vs A	M vs P	A vs P
White coats	9.0 \pm 1.2	10.1 \pm 2.6	10.1 \pm 1.6	.699	.558	.979
Scrubs	1.9 \pm 0.3	1.4 \pm 0.2	1.9 \pm 0.3	.105	.900	.105
W vs S (P)	<.001	<.001	<.001			

A, Anesthesiology; F, faculty; H, house staff; M, medicine; P, pediatrics; S, scrubs; St, student; W, white coats.

NOTE. All values represent days. Mean \pm standard error. Uniform equals white coats for the row depicting white coats and scrubs for the row with scrubs.

Lakdawala et al showing poor effectiveness of low-temperature domestic laundry on the decontamination of uniforms.¹⁰

The role of uniforms on the horizontal transmission of pathogens within the hospital is a fascinating and still controversial topic. Although unexplored, white coats and scrubs seem to be perceived—and therefore laundered—differently by the staff. We hypothesize that this difference might be related to the degree of direct contact of scrubs with the provider's skin. However, the degree of contamination of uniforms as a function of number of days of wear has previously not been characterized. Our group recently published data showing that bacterial contamination of health care worker's hands is associated with bacterial contamination of white coats¹¹; interestingly, this same association was not found between hands and scrubs.¹¹ We now show that white coats are laundered less frequently than scrubs; however, education of health care workers on laundering practices is not actively being performed. As a general recommendation for providers, white coats should be laundered whenever dirty or soiled with body fluids and on a regular basis (ie, once or twice weekly). Moreover, they should be washed in hot water and/or with bleach to reduce or eliminate any possible pathogens. Further studies are necessary to objectively determine how often white coats should be laundered.

References

- Boucher HW, Talbot GH, Bradley JS, Edwards JE, Gilbert D, Rice LB, et al. Bad bugs, no drugs: no ESKAPE! An update from the Infectious Diseases Society of America. *Clin Infect Dis* 2009;48:1-12.
- Allegranzi B, Pittet D. Role of hand hygiene in healthcare-associated infection prevention. *J Hosp Infect* 2009;73:305-15.
- Pittet D, Allegranzi B, Storr J. The WHO Clean Care is Safer Care programme: field-testing to enhance sustainability and spread of hand hygiene improvements. *J Infect Public Health* 2008;1:4-10.
- Wiener-Well Y, Galuty M, Rudensky B, Schlesinger Y, Attias D, Yinnon AM. Nursing and physician attire as possible source of nosocomial infections. *Am J Infect Control* 2011;39:555-9.

5. Butler DL, Major Y, Bearman G, Edmond MB. Transmission of nosocomial pathogens by white coats: an in-vitro model. *J Hosp Infect* 2010;75:136-47.
6. Loh W, Ng VV, Holton J. Bacterial flora on the white coats of medical students. *J Hosp Infect* 2000;45:65-8.
7. Perry C, Marshall R, Jones E. Bacterial contamination of uniforms. *J Hosp Infect* 2001;48:238-41.
8. Treakle AM, Thom KA, Furuno JP, Strauss SM, Harris AD, Perencevich EN. Bacterial contamination of health care workers' white coats. *Am J Infect Control* 2009;37:101-5.
9. Burden M, Cervantes L, Weed D, Keniston A, Price CS, Albert RK. Newly cleaned physician uniforms and infrequently washed white coats have similar rates of bacterial contamination after an 8-hour workday: a randomized controlled trial. *J Hosp Med* 2011;6:177-82.
10. Lakdawala N, Pham J, Shah M, Holton J. Effectiveness of low-temperature domestic laundry on the decontamination of healthcare workers' uniforms. *Infect Control Hosp Epidemiol* 2011;32:1103-8.
11. Munoz-Price LS, Arheart KL, Mills JP, Cleary T, Depasquale D, Jimenez A, et al. Association between bacterial contamination of healthcare worker's hands, white coats, and scrubs. *Am J Infect Control* 2012;40:e245-8.