Furthermore, the actual text of the Centers for Disease Control and Prevention guidelines cited by Bartek et al indicates that SSIs occurred even when head attire was “worn by personnel during the operation and in the operating suites,” which would be consistent with the findings by Davis et al cited earlier in this letter. Our group would respectfully submit regulations do not truly fit the literature as suggested in the “WHERE DO GUIDELINES COME FROM—AND WHY FOLLOW THEM?” segment of Bartek et al’s manuscript.

Notes

Disclaimers. The views expressed in the submitted article are the authors’ own and not an official position of the institution to which they belong.

Potential conflicts of interest. The authors have no conflicts of interest to disclose. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

George Williams, Navneet Grewal, Robert Wegner, Daniel Contreras, and Velvet Patterson

Division of Critical Care Medicine, Department of Anesthesiology, University of Texas Health Science Center at Houston (UTHealth), McGovern Medical School, Houston

References

- Centers for Medicare & Medicaid Services. State operations manual. Appendix A: survey protocol, regulations and interpretive Guidelines for Hospitals. HHS § 482.51. Available at: https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/som107ap_a_hospitals.pdf. Accessed 29 December 2017.
- American College of Surgeons. Statement on operating room attire. Available at: <https://www.facs.org/about-ac/s/statements/87-surgical-attire>. Accessed 8 April 2016.
- ASA Committee on Occupational Health Task Force on Infection Control. Recommendations for infection control for the practice of anesthesiology, 3rd edn. Available at [https://asahq.org/~media/sites/asahq/files/public/resources/asa%20committees/recommendations-for-infection-control-for-the-practice-of-anesthesiology-\(1\).pdf?la=en](https://asahq.org/~media/sites/asahq/files/public/resources/asa%20committees/recommendations-for-infection-control-for-the-practice-of-anesthesiology-(1).pdf?la=en). Accessed 29 December 2017.
- Cowperthwaite L, Holm RL. Guideline implementation: surgical attire. *AORN J* 2015; 101:188–97.
- Association of Surgical Technologists. AST standards of practice for surgical attire, surgical scrub, hand hygiene and hand washing. Available at: http://www.ast.org/uploadedFiles/Main_Site/Content/About_Us/Standard_Surgical_Attire_Surgical_Scrub.pdf. Accessed 13 April 2008.
- Srisuttiyakorn C, Somboonna N, Tongsimma S, Deekaw P, Wilantho A. Diversity of bacterial communities on the facial skin of different age-group Thai males. *PeerJ* 2017; 5:e4084.

- Davis CH, Kao LS, Fleming JB, Aloia TA; Texas Alliance for Surgical Quality Collaborative. Multi-institution analysis of infection control practices identifies the subset associated with best surgical site infection performance: a Texas Alliance for surgical quality collaborative project. *J Am Coll Surg* 2017; Aug 16; pii:S1072-7515(17)31665-4.

Correspondence: G. W. Williams, Department of Anesthesiology, University of Texas Health Science Center at Houston, McGovern Medical School, 6431 Fannin, MSB 5.020, Houston, TX 77030-1501 (George.W.Williams@uth.tmc.edu).

Clinical Infectious Diseases® 2018;67(9):1470–1

© The Author(s) 2018. Published by Oxford University Press for the Infectious Diseases Society of America. All rights reserved. For permissions, e-mail: journals.permissions@oup.com. DOI: 10.1093/cid/ciy366

Reply to Williams et al

TO THE EDITOR—We thank Dr. Williams and his colleagues for their response to our article [1] titled, “Regulations Regarding OR Head Attire Appear Discordant with Literature” and their additional review of the regulations regarding operating room (OR) attire and specifically head attire, the guidelines on which those regulations are meant to be based, and the literature on which the guidelines are meant to rest. We agree with their supposition: it seems that somewhere along the pathway of policy development, we have gone astray.

As we highlighted in the section “WHERE DO GUIDELINES COME FROM—AND WHY FOLLOW THEM?” in our original article, each hospital is expected to develop their own policies and the more those policies follow national guidelines, the less suspect regulatory bodies such as the Joint Commission are. Nevertheless, every regulatory body—including accreditation organizations and payers such as the Center for Medicare and Medicaid Services (CMS)—has given hospitals themselves some level of autonomy to decide the rules by which they themselves will be judged. Williams et al raise a key point in their comment: the Association of periOperative Registered Nurses (AORN) guidelines are but one of many (e.g., the American College of Surgeons, American Society of Anesthesiologists, and the Association of

Surgical Technologists, all of which were referenced in Williams et al). In fact, CMS itself made this point on page 25 of a document [2] (it’s quite long) outlining their guidelines for hospitals and ambulatory surgical centers, promoting “standards and recommendations promoted by or established by nationally recognized professional organizations” and then listing many of the organizations named above [2]. Despite the existence of many other guidelines addressing the topic of operating room attire and perhaps due to the fact that AORN’s prescription is the most detailed, the AORN guidelines seems to have carried the most weight among hospitals nationwide.

Also, as Williams et al noted, since we wrote the original “Naked Surgeons” article, there have been research studies and updated recommendations that strengthen one of our central points: that the data to support anything so stringent (other than a preposterous proposition for nudity for which, with great sarcasm, we named our original article) is just not there. One large study found that substituting bouffants for surgical skull caps did not reduce surgical site infections (SSIs) in neurosurgical cases [3]; another found “no association between the type of surgical hat worn and the incidence of postoperative wound events following ventral hernia repair” [4]; a third found that “implementation of stringent operating room attire policies do not reduce SSI rates” further noting that, “A study to prove this principle further would be impractical to conduct” [5]; and finally, the most up-to-date air sampling study that we know of comparing surgical skull caps to bouffants found that “disposable style bouffant hats should not be considered superior to skull caps in preventing airborne contamination in the operating room” [6]. In fact, Lisa Spruce, the author AORN’s “Back to Basics” article [7], which helped spawned this debate, wrote, “there is no conclusive evidence that wearing a head covering can help prevent surgical site infections” but continued on by recommending that “the potential benefits to patients when compared with the risks

suggest that “perioperative team members should cover their heads, hair, and ears in the semirestricted and restricted areas to provide the best possible protection for surgical patients” [8]. As noted in our original article, we agree with the first statement but disagree with the latter.

Maybe, just maybe, covering the nape of the neck and all hair with a more-permeable-than-a-surgical-skull-cap bouffant actually would reduce SSIs, and the evidence just hasn’t matured enough yet. It’s possible. However, this seems not to be the case; in the face of limited, if any, benefit to patients, there are notable costs including those associated with changing behavior and enforcing this new behavior. In prioritizing “Bouffants over skull caps at all costs!”, there are countless opportunity costs—we ought to direct our attention to interventions that will benefit patients *and* that have broad agreement among the medical community. Time and effort are limited resources and thus should be directed to high-value endeavors. Some possibilities include: more attention to surgical safety checklists and teamwork and communication in the OR [9–12] and control of perioperative glucose [13–15]. Furthermore, as Williams et al argue, the regulations around OR head attire ought to reflect a consensus of the guidelines, which seems to agree with our stance.

Note

Potential conflicts of interest. The authors have no conflicts of interest to disclose. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

Francis Verdial, Matthew Bartek, and
E. Patchen Dellinger

Department of Surgery, University of Washington School of
Medicine, Seattle

References

1. Bartek M, Verdial F, Dellinger EP. Naked surgeons? The debate about what to wear in the OR. *Clin Infect Dis* 2017; 65:1589–92. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/28575168>. Accessed 30 June 2017.
2. Services C for M&M. Revised Guidance Related to New & Revised Regulations for Hospitals,

Ambulatory Surgical Centers (ASCs), Rural Health Clinics (RHCs) and Federally Qualified Health Centers (FQHCs), 2015.

3. Shallwani H, Shakir HJ, Aldridge AM, Donovan MT, Levy EI, Gibbons KJ. Mandatory change from surgical skull caps to bouffant caps among operating room personnel does not reduce surgical site infections in class I surgical cases: a single-center experience with more than 15 000 patients. *Neurosurgery* 2018; 82:548–54. Available at: <https://academic.oup.com/neurosurgery/article-lookup/doi/10.1093/neuros/nyx211>.
4. Haskins IN, Prabhu AS, Krpata DM, et al. Is there an association between surgeon hat type and 30-day wound events following ventral hernia repair? *Hernia* 2017; 21:495–503.
5. Farach SM, Kelly KN, Farkas RL, et al. Have the recent modifications of operating room attire policies decreased surgical site infections? A NSQIP review of 6517 patients. *J Am Coll Surg* 2018; doi:10.1016/j.jamcollsurg.2018.01.005.
6. Markel TA, Gormley T, Greeley D, et al. Hats off: a study of different operating room headgear assessed by environmental quality indicators. *J Am Coll Surg* 2017; 225:573–81. doi:10.1016/j.jamcollsurg.2017.08.014.
7. Spruce L. Back to basics: surgical attire and cleanliness. *AORN J* 2014; 99:138–46. doi:10.1016/j.aorn.2013.10.013.
8. Spruce L. Surgical head coverings: a literature review. *AORN J* 2017; 106:306–16.e6.
9. Lingard L, Regehr G, Orser B, et al. Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication. *Arch Surg* 2008; 143:12–7; discussion 18. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/18209148>.
10. Haynes AB, Weiser TG, Berry WR, et al. Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. *BMJ Qual. Saf* 2011; 20:102–7. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/21228082>. Accessed 23 August 2011.
11. Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 2009; 360:491–9. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/19144931>.
12. De Vries EN, Smorenburg SM, Van Putten AA, Meijer PP, Boermeester MA. The surgical patient safety system (surpass) checklist ensures timely administration of antibiotic prophylaxis. *Surg Infect (Larchmt)* 2009; 10:248–9. Available at: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=emed9&AN=70001894>.
13. Allegranzi B, Zayed B, Bischoff P, et al. New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective. *Lancet Infect Dis* 2016; 16:e288–303. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S147330991630398X>.
14. Berrios-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for disease control and prevention guideline for the prevention of surgical site infection, 2017. *JAMA Surg* 2017; 152:784. Available at: <http://archsurg.jamanetwork.com/article.aspx?doi=10.1001/jamasurg.2017.0904>.
15. de Vries FE, Gans SL, Solomkin JS, et al. Meta-analysis of lower perioperative blood glucose target levels for reduction of surgical-site infection. *Br J Surg* 2017; 104:e95–105.

Correspondence: E. P. Dellinger, University of Washington School of Medicine, 1959 NE Pacific St, Seattle, WA 98195-6410 (patch@uw.edu; patch@u.washington.edu).

Clinical Infectious Diseases 2018;67(9):1471–2

© The Author(s) 2018. Published by Oxford University Press for the Infectious Diseases Society of America. All rights reserved. For permissions, e-mail: journals.permissions@oup.com. DOI: 10.1093/cid/ciy367

Effect of Confusing Symptoms and Infectiousness on Forecasting and Control of Ebola Outbreaks

To THE EDITOR—The devastating impact of the 2013–2016 Ebola outbreak emphasizes the need for effective management of invading pathogens. Mathematical modeling is increasingly used to optimize interventions during outbreaks [1–3]. A 2015 review [4] demonstrated that the incubation and latent periods differ for Ebola, because dry symptoms precede wet symptoms that accompany infectiousness. The authors suggested that accounting for this difference is likely to have implications for models of Ebola intervention strategies. We tested this assertion and found that carefully differentiating between symptoms and infectiousness will not always change forecasts significantly. By fitting models to data collected during an outbreak, the estimated values of disease transmission parameters can compensate for errors driven by incorrect assumptions about the underlying epidemiology. In some scenarios, forecasts can be accurate even if “wrong” epidemiological models are used.

To demonstrate this principle, we considered 2 epidemiological models of Ebola (Figure 1A). In the first (the commonly used susceptible-exposed-infectious and symptomatic-removed (SEIR) model [5–7]), symptoms and infectiousness coincided exactly, but the second (the susceptible-exposed-uninfectious and symptomatic-infectious and symptomatic-removed (SEUIR) model [5]) accounted for the mismatch between symptoms and infectiousness. A “data set” for the start of a hypothetical outbreak was generated using the realistic SEUIR model, producing data on the daily numbers of symptomatic cases