Reviewer's report

**Title:** A comparative trial of bleach versus pulsed xenon ultraviolet light for reducing environmental *Clostridium difficile* contamination on high-touch surfaces in *Clostridium difficile* isolation rooms

**Version:** 2  
**Date:** 6 May 2014

**Reviewer:** Jonathan Otter

**Reviewer's report:**

**Major comments**

1. The real question is whether the change in level of contamination before vs. after bleach or PX-UV is significantly different. The stats methods used do not answer this question, which is particularly important in light of the large difference in baseline counts. A general linear model (GLM) would allow you to compare the effect of sample location, and bleach vs. PX-UV on quantitative *C. difficile* counts, which would adjust baseline counts. This study applied similar methodology: Havill NL, Moore BA, Boyce JM. Comparison of the microbiological efficacy of hydrogen peroxide vapor and ultraviolet light processes for room decontamination. Infect Control Hosp Epidemiol 2012; 33: 507-512.

2. Other studies have shown that UV systems are significantly less effective out of direct line of sight. Did you evaluate whether the impact of bleach or PX-UV varied across the 5 sites? If not, this should be done somehow (a GLM approach outlined above would do this).

3. You analysed the data by mean CFU only. You should also compare the proportion of sites that were contaminated with Cdiff in pre-post in the two arms.

4. Do the authors have any way of separating out the effect of the activated H2O2 pre-clean from the PX-UV disinfection?

5. ‘It takes approximately 45 minutes to clean a room with bleach and 15 minutes with PX-UV, resulting in staff savings.’ This is not quite true. What was the total room turnaround for PX-UV (including pre-cleaning) vs. bleach? A recent study of PX-UV found that turnaround time was 60 mins for bleach and 50 mins for pre-cleaning plus PX-UV (Jinadatha et al. Evaluation of a pulsed-xenon ultraviolet room disinfection device for impact on contamination levels of methicillin-resistant *Staphylococcus aureus*. BMC Infectious Diseases 2014, 14:187.)

**Minor comments**

6. Abstract: ‘The purpose of this study was to investigate whether PX-UV was equivalent to bleach for decontamination of surfaces in *C. difficile* isolation rooms.’ Was this your a priori hypothesis (that there would be no difference) or
was this the results? The stated aim of the study is different in the methods: ‘The purpose of the current study was to compare the efficacy of bleach and PX-UV…’

7. ‘PX-UV disinfection appears to be at least equivalent to bleach in the ability to decrease environmental contamination with C. difficile spores.’ Should this be ‘PX-UV disinfection appears to be non-inferior to bleach in the ability to decrease environmental contamination with C. difficile spores.’?

8. ‘Pulsed xenon ultraviolet (PX-UV) is a means of quickly producing germicidal UV that has been shown effective against C. difficile.’ The cited reference does not support this statement.

9. ‘PX-UV light may have greater efficacy than other forms of UV, such as mercury UV, against C. difficile because of the broad spectrum produced within the UVC range and a greater intensity [11-13].’ Quite a bit of conjecture involved in this. Consider something more moderate like: ‘The relative capacity of the various available UV systems to inactivate C. difficile spores has not yet been evaluated’.

10. ‘…the same five surfaces…’ or adjacent surfaces?

11. How were the rooms apportioned to bleach or PX-UV? Randomised?

12. ‘The PX-UV device contains a xenon flash lamp that emits a broad spectrum of light covering the germicidal, or UV-C, spectrum of 200 - 280 nm as well as the visible light spectrum.’ This sentence is repeated.

13. ‘Alternatively, samples demonstrating growth were sub-cultured to supplemented C. difficile agar, incubated anaerobically, compared with C. difficile spores (ATCC 43598), and subjected to Gram staining for confirmation.’ I don’t understand this sentence. Do you mean that you used 2 different methods to confirm the presence of Cdiff? If so, why?

14. What surface area was sampled using the sponges? Was this standardised?

15. Line 192. Equivalent or non-inferior?

16. ‘Environmental cleaning with HPV’ This should be ‘Room disinfection using HPV…’

17. ‘In staff time, HPV costs approximately $175 per room’. This study considered both equipment costs and staff time to derive a cost per use. Cost per use will depend on usage (obviously). In a low use setting (like the one evaluated by Doan et al. – 10.6 uses per month), any automated room disinfection system will work out expensive. Indeed, PX-UV (Xenex) would work out more expensive than HPV if using the same equation as Doan et al and using the $3000 per month lease figure published in the ECRI report for Xenex PX-UV (ECRI. Enhanced environmental disinfection systems. Health Devices 2011; 40: 150-162), the cost per use for PX-UV would be $283 (excluding staff time).

18. ‘The time taken for disinfection is between 2 to 4.5 hours’. Closer to 2 hrs for

**Level of interest:** An article of importance in its field

**Quality of written English:** Needs some language corrections before being published

**Statistical review:** Yes, and I have assessed the statistics in my report.

**Declaration of competing interests:**

I am employed part-time by Bioquell.