Reviewer's report

Title: Evaluation of a hand-held far-ultraviolet radiation device for decontamination of Clostridium difficile and other healthcare-associated pathogens

Version: 1 Date: 27 January 2012

Reviewer: Scott Curry

Reviewer's report:

The authors have reported the first assessment of the potential value of far-UV portable disinfection devices in disinfection of hospital surfaces contaminated with organisms of epidemiological significance (C. difficile, VRE, MRSA); they provide an excellent context of the limitations of earlier-generation UV-C disinfection units in their introduction. In the first paragraph of the background section, however, the authors may wish to clarify (as they have shown in their own previous work) that existing disinfection strategies such as the use of strong oxidizing agents (5000 ppm hypochlorite) are often "suboptimal" more because of failure of human housekeeping personnel to use them properly than because they are not effective against C. difficile spores and other organisms. The corrosive effects of effective disinfectants are also a rationale for the development of UV disinfection.

Specific comments:

1. (major compulsory revision): The repeated use of "> 3-4 logs" and the like in describing the results of the log10 reductions in surface contamination is both colloquial and imprecise in the context of a disinfection manuscript. For almost all of the analyses in this report, there is a sufficient N such that mean and standard deviations of the relevant log10 reductions taken out to two significant digits should be reported. If the distribution of the log10 reductions is non-normal, the medians should replace the means, but I presume from the use of the parametric t-test in Table 1 that these log reductions have been formally tested for normality. The CFU recovered for MRSA in Table 1 should be rounded to 28.2.

2. (major compulsory revision): In the methods section under the heading "Preparation of C. difficile spores, MRSA, and VRE strains," the authors need to clarify the medium used to enumerate C. difficile spores (and less essentially, for VRE and MRSA) in the serial dilutions.

3. (discretionary revision) In the methods section under the paragraph under "Reduction of pathogens by the Sterilray device," a clarification of how the nine 20 mcl droplets (some containing extremely high cfu concentrations) were collected from the Petri dish cover after UV irradiation would be helpful. Was this again by swabbing or by flooding the cover with a known volume of diluent and plating it? Were control experiments done to assess the efficiency of whatever
recovery method was devised?

4. (discretionary revision) In the latter half of the methods paragraph under the heading "Reduction of C. difficile on keyboards and portable medical equipment," clarification about the sampling process would help. For example, the authors state that the inoculum is $10^4 - 10^5$ spores in 10 mcl, but it is not clear how this inoculum could be counted if picked up on a swab then plated directly to CDBA unless it were first agitated in a known volume of diluent. Were the swabs also inserted into their Amies medium carriers before plating in the lab, allowing further dilution into that medium? There is a line here about "as described previously," but there is no citation to further clarify this method or prior experiments validating the efficiency of inoculum recovery.

5. (discretionary revision) As hinted at above, I certainly agree with the limitations of the direct plating method that the authors point out in the last paragraph of the discussion section. Unless the lab personnel collecting the cultures were blinded to the pre- and post- Sterilray status of swab-sampled surfaces during both the collection and planting, however, there is the additional possibility of sampling bias in this study if more vigorous swabbing and/or plating of pre-disinfection surfaces occurred. There is also a serious implication of the authors' observation that the swab method has a sensitivity problem given the work of Trevor Lawley demonstrating that the infective dose for CDI in the mouse model is in the range of 1-5 spores/cm2. Any method that does not result in complete disinfection of C. difficile from environmental surfaces may be inadequate. Because the issue of incomplete disinfection with existing hypochlorite and peroxide disinfectants is partly one of incomplete adherence to 10-minute contact times, the authors may want to comment more specifically on the future potential of UV-C devices to be used synergistically to accelerate the kill times of existing disinfectants. If future such studies are planned, it would be helpful to see side-by-side efficacy comparisons with existing disinfectants if the results are to be externally valid as effectiveness research.

**Level of interest:** An article of outstanding merit and interest in its field

**Quality of written English:** Acceptable

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

**Declaration of competing interests:**

I declare that I have no competing interests.