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Response to Comment on "Ebola Virus Persistence in the Environment: State of the Knowledge and Research Needs"

We appreciate the comment by Lantagne and Hunter[1] on our recent brief review "Ebola Virus Persistence in the Environment: State of the Knowledge and Research Needs"[2] and the opportunity for clarification on this controversial topic. The issues raised by Lantagne and Hunter are primarily due to a perceived misrepresentation of the state of knowledge that may fuel public fear and a poor differentiation in our manuscript between resource-rich and resource-poor scenarios. We readily acknowledge the need to differentiate between resource-rich and resource-poor scenarios and that such scenarios should be taken into account when issuing treatment recommendations. Our manuscript was primarily targeted toward resource-rich scenarios, such as in the United States; however, the broader point remains that waste disposal recommendations for each situation should be more carefully evaluated based upon risk.

With regard to accurate representation of the state of knowledge, our manuscript was motivated largely by the broader community's inability to answer questions regarding Ebola virus persistence in the environment. Put succinctly, the theme of our brief review was "while environmental exposure is not the dominant exposure route, available data suggests that it is imprudent to dismiss the potential of environmental transmission without further evidence".[2] In the absence of such data, we advocate using the precautionary principle. Specifically, this manuscript was motivated by statements that Ebola virus would be rapidly inactivated in the environment, with a notable lack of strong evidence. For example, a World Health Organization informational quiz states, "In water, the Ebola virus is deactivated in a matter of minutes. Viruses aren't as resistant outside the body as bacteria are. Rather, they depend heavily on the cells of their host—animal or human—for survival".[3] This statement is not verifiably true, and it was within the context of such anecdotes that we developed our report.

One of the major points raised by Lantagne and Hunter was that of "selective reporting", specifically of Ebola virus persistence on surfaces. In this discussion, we noted that "An investigation of Ebola virus in fomites within an isolation ward found only two of 33 samples to test positive for Ebola virus, leading the authors to conclude that the risk from infection via fomites is low when proper procedures are followed."[2,4] Lantagne and Hunter specifically question the exclusion of surface survival data from a manuscript by Piercy et al.[5] For the data in question, Piercy et al. state "An initial recovery experiment showed that no virus could be recovered from any substrate stored at room temperature (results not shown). All results reported are for +4°C. Neither MARV nor ZEBOV could be recovered from metal substrate at any time."[5] We note that Piercy et al. did not give a timeline for the tests conducted. We also note that viral survival was not specifically detailed, but rather recovery, which may suggest methodological issues. We are grateful for the opportunity to clarify this point.

Some of Lantagne and Hunter's critiques are incorrect. Lantagne and Hunter incorrectly state that we reference a paper on SARS surrogates to support our recommendation of utilizing enteric virus survival as a conservative estimate for Ebola virus survival. This statement was used to demonstrate that enveloped viruses are not inherently rapidly inactivated in liquid or feces. The case for recommending enteric viruses as a more conservative estimate of Ebola virus survival was laid out using enteric virus survival data. The estimated basic reproduction number for this outbreak, rather than previous outbreaks, is 1.7−2.0, not less than 1.[6] We clearly referenced the likelihood that Ebola virus survival would decrease in environmental waters compared to cell culture media: "In general, persistence would be expected to decrease in water or wastewater compared to cell culture media due to increased external stresses."[2] Finally, we disagree with the statement "readers of their letter could be left—incorrectly—with the impression that liquid wastes from Ebola patients presently pose a substantial risk to the wider community."[1] First, while the portion of this statement regarding risk may be true, this risk remains unquantified. Second, as noted above, we clearly state that "environmental exposure is not the dominant exposure route".[2]

Our goal and intent was not to stoke public fears but to highlight knowledge gaps behind current recommendations and to spur a research agenda forward. The academic literature is the appropriate venue for such discussions. We appreciate Lantagne and Hunter's acknowledgment of our proposed research agenda, and we also agree that disinfection studies of Ebola virus, as well as many other studies, are necessary and warranted as well. We also appreciate the opportunity to clarify points within our manuscript. As we work to fill in existing knowledge gaps, we highlight the need to confront proper treatment and handling of all liquid medical waste, both in resource-rich and resource-poor scenarios.

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Notes

The authors declare no competing financial interest.

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