significantly in Allegheny County, Pittsburgh.[28] We acknowledge that the 30% figure for assessing risk may not be 100% sensitive or 100% specific, but given the high mortality rate for hospital-acquired Legionnaires' disease, a cut-point derived from clinical experience is reasonable. Moreover, this strategy has proven to be effective in prevention of hospital-acquired Legionnaires' disease.

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DOI of original article: http://dx.doi.org/10.1016/j.ajic.2014.07.018
Conflict of interest: None to report.

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http://dx.doi.org/10.1016/j.ajic.2014.06.032

Response to commentary on "Assessing risk of health care—acquired Legionnaires' disease from environmental sampling: The limits of using a strict percent positivity approach"

To the Editor:

We appreciate the commentary from Pierre et al[1] regarding our article published in the *American Journal of Infection Control* in 2012.[2] One of our goals was to start a discourse on the utilization of 30% prevalence of *Legionella* in a hospital water system as a reliable decision point for determining the risk of Legionnaires' disease and subsequent interventions, and we welcome the opportunity to discuss this important issue further. As shown in our article, and will be further demonstrated in this response, this 30% cut-off has been adopted and referenced by various government agencies and peer-reviewed journal articles without critical evaluation since its emergence in 1983. Given its ambiguous evolution and the significance that has been apportioned to it, it was necessary and prudent

to evaluate the validity of this metric. Our study was the first and only systematic effort to do so.

First, there is nothing presented in this commentary by Pierre et al that validates the use of the 30% cut-off. In fact, Pierre et al states that "It would be an oversimplification to assume that a single number could serve as a precise and absolute indicator of risk for disease occurrence." This is exactly our point and the reason why we have such concern over the use of this metric. Although Pierre et al at first acknowledge the 30% cut-point to be an inadequate proxy of Legionnaires' disease risk, they nonetheless subsequently state that the cut-off should be used as "a decision point for proactive preventative actions" with no further supporting information provided. Although we appreciate the attempt at a standardized approach for instituting preventative actions, the 30% cut-point falls short of being an effective risk indicator or an actionable decision point.

The crux of the Pierre et al commentary is based on a selective review of the peer-reviewed articles we included in our analysis. They stated that they reviewed 20 of the studies we used in our analysis. However, our article included an analysis of 31 peer-reviewed articles. Why did the commentators not critique all 31 articles included? We can only assume they did not find issues with the 11 articles excluded from their critique. For discussion sake, let us assume that Pierre et al are correct and drop those studies and perform a reanalysis on the remaining 11 studies (we do not concede this point, but just for discussion). What do those remaining 11 studies show? They show a low sensitivity for the 30% cut-off (78%), which is a finding consistent with the full 31 article data set. This means that based on the analysis of the 11 articles the commentators did not find issue with, 22% of the time hospitals had <30% of sites testing positive for *Legionella*; however, they had cases of Legionnaires' disease present.

This selective approach to critiquing our article extended beyond just failing to include an appropriate discussion of 11 of the 31 articles we analyzed. Pierre et al also used several articles as both evidence for and against the 30% cut-point position. Pierre et al first cite 3 studies as supporting their position ("The 30% cut-point was found to be predictive in other surveys of Legionnaires' disease") and then judge these studies as being inadequate when they critiqued our use of the data presented in the very same articles.[3-5]

Pierre et al attempt to offer support for the use of a 30% cut-point by highlighting purported success in Allegheny County, which uses the 30% cut-point: "After implementing this approach, hospital-acquired Legionnaires' disease decreased significantly in Allegheny County, Pittsburgh." However, this is in contrast with the recent Veterans Affairs (VA) Inspector General's report, which noted the following: "Within Pennsylvania, rates of legionellosis are highest in the southwest corner of the state, and particularly high in and around Allegheny County, which includes Pittsburgh. In 2010, the rate was 5.3 per 100,000 in Allegheny County and 3.8 in the 5 adjacent counties."[6] In addition, the most highly publicized LD outbreak in recent years occurred in Allegheny County in the VA Pittsburgh Health Care System. The VA Pittsburgh Health Care System also uses a 30% cut-point for determining risk, and they had 21 probable or definite cases of healthcare-acquired Legionnaires' disease from 2011-2012.[6] During the outbreak in 2012 identified by the VA, the environmental sampling shows that water samples were taken 11 times from February-December and not once did the number of locations testing positive for *Legionella* exceed 30% positive.[6] However, during that time, 13 clinical cases of LD were identified, 4 of which were confirmed to be health care acquired.[6]

Pierre et al further argue that the 30% cut-point is relied on by several guidance documents and state that "Numerous hospitals and public agencies worldwide have adopted some variation of the 30% cut-point approach," and "The Allegheny County Health Department, the VA Healthcare System, the New York and Maryland Department of Health and many European countries have adopted a proactive approach." The fact that many institutions test their water systems as part of a proactive approach does not, by itself, support that the 30% cutoff is valid. Our article, and their commentary, is not about the value of routine testing, it is about whether the 30% cut-off should be used. Simply because it is adopted or referenced by several agencies does not make it valid.

Further, what we found in our analysis is that there is not truly widespread acceptance of the 30% cut-point, but rather a series of self-citations, including many by the authors of the commentary (Fig 1). Of the 16 peer-reviewed articles we found that reference the 30% cut-off,[3,4,7-20] 9 were written by the authors of the commentary.[7,9-16] Of the remaining 7, 2 of them cite many of those same articles,[18,20] 3 cite the Allegheny County Health Department (ACHD) guidance document,[3,4,17] and the last 2 cite studies written by the authors of the commentary, which then reference their own previous study.[8,19]

As for the government guidance documents, the ACHD guidance document,[21] as we pointed out in our article, only cites the original study by Best et al[9] from 1983 as evidence to support the use of the 30% cut-off. The ACHD task force, of which one of the commentators was a part of, even acknowledged the arbitrariness of the 30% cut-point: "The task force recognizes the arbitrariness of the 30% figure, although there is some data to support its use as a cut-point for decision making; this figure may be modified in the future with continuing research."[21] The data the ACHD referred to is the Best et al study. Interestingly, the article by Best et al, also coauthored by the commentators, also acknowledges the weakness of the 30% cut-point, "in our institution, site positivity of 30% seemed to be a 'grey' area with respect to occurrence of disease."[9] Unfortunately, this weak foundation has not been widely recognized and was cited, viewed as reliable, and incorporated into other guidance documents; then, those guidance documents were cited by others (eg, New York State cites ACHD, and Maryland cites both Best et al and ACHD).[22,23] None of these guidance documents provide any new data or analysis supporting the 30% cut-point; they all rely on the original data from Best et al or ACHD's citation of Best et al. As for the VA guidance document,[24] it only cites 2 articles when referencing the 30% cut-point, both authored by the commentators.[7,25] One of the articles was written in 2003 and cites Best et al as supporting evidence. From there, many peer-reviewed papers cite ACHD, Best et al, or each other, creating the perception that there is widespread acceptance based on many independent data points.

The commentary by Pierre et al also contains several inaccurate statements or misunderstandings of our article. For example, Pierre et al wrote, "The authors assessed whether the >30% culture positivity predicted the occurrence of hospital-acquired within only one month of these culture results for that month (not for that one year as evaluated by Stout et al). This was a major deviation from the established protocol." Using a month-month analysis is in fact the exact protocol that was originally established by these same investigators in 1983; that original article, on which all of this is based, used a month-month analysis.[9] However, Pierre et al now declare that this no longer meets their newly defined fundamental criteria. To demonstrate that our findings hold regardless of how the commentators attempt to parse the data (again not conceding that Pierre et al are correct in their assertion), even if we reanalyze the data with these newly defined criteria of the commentators and only include studies with annual data, the sensitivity of the 30% metric is 64%. This is unacceptably low and consistent with the original analysis of 31 studies in our original article.

Pierre et al conclude the following: "given the high mortality rate for hospital-acquired Legionnaires' disease, a cut-point derived from clinical experience is reasonable; moreover, this strategy has proven to be effective." We strongly disagree on both points. In

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