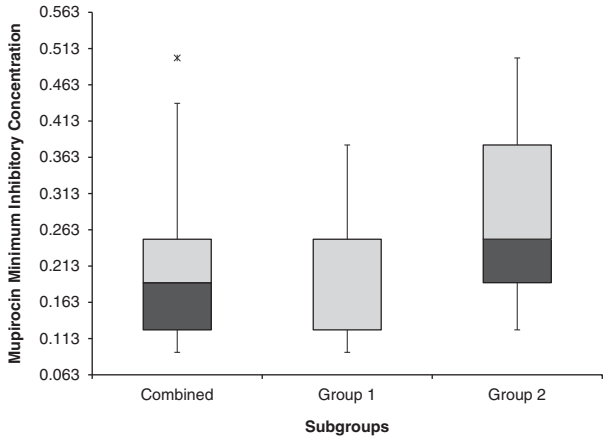

FIGURE 1. Box-and-whisker chart of mupirocin-susceptible, methicillin-resistant *S. aureus* isolates. Left to right: combined groups 1 and 2; group 1, tissue isolates; group 2, nares isolates.

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Sampling Plans for Use of Rapid Adenosine Triphosphate (ATP) Monitoring Must Overcome Variability or Suffer Statistical Invalidity

Reply to Visrodia

To the Editor—We write with respect to the article by Visrodia et al.[1] on using a commercial rapid adenosine triphosphate (ATP) device for validation of cleaning of flexible gastroendoscopes. The importance of timeliness in quality assurance testing in this device area is critical owing to the time pressures on the use of the gastroendoscopes by clinical staff involved in patient care. The work is a useful additional contribution to this growing field of use for ATP devices.[2]

Nonetheless, we highlight concerns with 2 aspects of the method adopted within the work by Visrodia et al.[1] First, this work, like earlier references, utilizes only a single brand of rapid ATP device with acknowledged manufacturer support. The recommendations on "validated" relative light units (RLU) are entirely device specific and exclude other commercial devices. And, whilst the ATP/RLU readings in Visrodia et al.[1] may seem dramatic (some > 100,000 RLU), the work lacks evaluation of microbial presence that could anchor the study against a quantitated standard.[3]

Second, the work does not address any of the major published criticisms of the use of ATP systems as they are currently configured. Several authors have commented on the dangers of overstating the usefulness of these commercial ATP devices, the risks of alternative sources of ATP, the lack of correlation with specific pathogens of concern, the amount of ATP present within any particular cells or bacterial species, and the measurement variability that undermines statistical measures applied to the research.[4–7]

In this regard, and of specific concern in terms of method in Visrodia et al.,[1] is the way that ATP measurements and samples were obtained—for example, samples from the brush and flush sampling were divided into only 2 parts, with one part apparently used for a single ATP test and the other part tested for protein residues. The entire sample set of

ATP testing appears to be without duplicates or preferably triplicate testing. Reliance by Visrodia et al.[1] upon the sample means of groups of singular ATP readings is undermined by the knowledge of variability where the standard deviation can be as high as 40% of the data mean for the individual brand of device used.[8] The authors themselves note the risk of singular testing in the body of the discussion: "to sample more than one… and to use more than 1 rapid indicator," but we wonder how the statistical assumptions hold valid without multiple (replicate) samples taken for the ATP testing.

We also note 2 problems with the scaling of all commercial ATP devices. First, the scale of RLU is completely relative and cannot be used interoperatively between differently branded devices.[2,3] Second, the variability for each of the brands is so high that without a sampling approach that accounts for multiple samples at any one point, the ability of the scientists involved to meaningfully apply statistical methods renders the article subject to first principle flaws.[9] Reporting the RLU readings on a log scale is not the same as taking multiple samples, identifying the median value, and then log plotting the data. Perhaps this was done, but it remains unclear within the text.

We feel obliged to inform those who may be reliant upon the work to take care in not applying the work using one brand of ATP device to another brand of ATP device, as noted in the commentary by Petersen.[10] Likewise, we caution against relying on the statistical positioning in the field use of ATP without an appropriately constructed sampling plan to account for inherent variability. This overlay of concern will continue to apply until all ATP device manufacturers can agree to a commonly applicable scale that minimizes the impact of variability, no matter what the assignation given to the replacement reading scale.

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Reply to Whiteley et al

To the Editor—We appreciate the commentary by Whiteley et al[1] on our study in which several rapid indicators were used to detect residual contamination in gastrointestinal endoscopes following manual cleaning.[2] The authors raise several concerns about an adenosine triphosphate (ATP) measuring device used in our study, including our use of a single commercially available ATP device, our reliance on only 1 ATP test per component sampled, possible variability in ATP results, and the inability of ATP monitors to identify specific microbes or quantify colony counts.[1] Indeed, rapid indicator testing in endoscope reprocessing is a relatively new arena, and more research is undoubtedly needed to evaluate the utility of various devices and determine the association between residual organic debris, viable microbes, and patient outcomes.

Our study was a small pilot project designed to evaluate materials and methods that could be used to assess endoscope cleaning effectiveness. At that time, we sought to determine whether the recommended practice of visual inspection was an adequate standard for verifying whether manual cleaning had