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

sufficiently removed residual contamination prior to exposing endoscopes to high-level disinfection.[3,4] In addition to inspecting each component and the sampling materials for visually apparent evidence of residual contamination, our team conducted rapid indicator tests for blood, protein, and ATP. Multiple types of rapid indicators were used in order to assess various approaches for monitoring cleaning effectiveness and to compare their results. In summary, we found[2] that endoscopes with and without visually apparent debris had levels of blood, protein, and ATP exceeding previously validated benchmarks.[5,6] Although high ATP levels may indicate the presence of viable microbes,[7,8] such results could also reflect the presence of blood or other types of cells.[9] Indeed, we found ATP levels were quite high in every sample that also tested positive for blood.

As noted by Whiteley et al[1] and acknowledged in the limitations section of our article, we did not include the performance of microbial cultures, because the goal was to evaluate multiple rapid indicators and sample collection methods. Furthermore, the value of conducting microbial cultures prior to high-level disinfection seems limited. In a subsequent study conducted by our team (as yet unpublished) we used microbial cultures as one of the indicators of endoscope reprocessing effectiveness.

The main goal of our study was to identify user-friendly materials and methods that could be used to evaluate manual cleaning effectiveness in the clinical setting. The chosen ATP monitoring system provided a numerical result reflecting the amount of ATP present. We found this to be superior to monitoring systems that measure residual protein or blood, which require users to interpret color changes on swabs or dipsticks.

Given the imperative for cost containment and to improve efficiencies on the front lines, we believe it would not be desirable to perform duplicate or triplicate testing as suggested by Whiteley et al.[1] Their concern about variability within and between ATP measuring devices deserves additional study. However, we found that post–manual cleaning ATP and protein levels far exceeded benchmarks for manually cleaned endoscopes and perhaps are less likely to be affected by the degree of variability cited.

Quality assurance in endoscope reprocessing is needed, and rapid indicator testing is an area of growing interest and understanding. ATP testing offers potential, but given its relatively recent application to this field, additional research is necessary to better define its role.

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