large that physician anesthesiologists serve.[2] Our program, as we suspect many others have, is focusing educational preparation for the BASIC exam over the two years of clinical base and clinical anesthesia year 1 training, an acknowledged potential benefit and goal.

Both the editorial and article discuss the small effect size (two points in scaled score) in this initial evaluation of the examination process restructure. In the mixed effects model, residents with in-training examination scores were considered, thus implying that a large proportion not taking the in-training examination during the clinical base year and any resident not sitting for subsequent in-training examinations was not accounted for. The method similarly confirms that only residents "who maintained a regular progression of training level" were included. Thus, it is likely that residents lost from the program through attrition (whether for medical knowledge, professionalism, or another competency) may have affected the small signal. This and an additional unintended consequence of the new examination structure is explored.

1. Most programs have incorporated success on the BASIC examination as an objective milestone measure of medical knowledge and many are offering residents only two unsuccessful opportunities, in the summer and fall of the rising clinical anesthesia year 2 year. As such, any deficiency will be apparent *prior* to the next spring in-training examination in the clinical anesthesia year 2 year and any loss of residents (who would naturally be presumed also to be poor performers on the in-training examination) may have *de facto* resulted in an apparent improvement in the cohort's second compared in-training examination score.
2. Similarly, with appropriate increased academic attention and focus on the BASIC exam, it is likely that many clinical base and clinical anesthesia year 1 residents are more committed to the higher stakes first certification BASIC examination, which has implications for successful maturation through the program. The more specific curriculum for the BASIC exam and time required for preparation may unintentionally distract attention from the preceding in-training examination, which for many programs is not a high-stakes examination for satisfactory academic progress. Thus, the in-training examination in the clinical anesthesia year 1 year as the first comparison point may be artificially lower, this also appearing to accentuate the "improvement" in the subsequent in-training examination.

Addition of the BASIC exam as the first step in anesthesiology resident certification appears to be appropriate and useful to residents and programs in the milestone era. Optimism for objective markers of success should remain restrained, however, until the impact of unintended consequences in resident exam preparation priorities and residents missing from the in-training examination through attrition are accounted for. We eagerly anticipate continued distribution of data from the American Board of Anesthesiology on these and other certification processes.

Competing Interests

The authors declare no competing interests.

Evan G. Pivalizza, M.D., Omonele O. Nwokolo, M.D., Semhar J. Ghebremichael, M.D., Travis H. Markham, M.D., Sara Guzman-Reyes, M.D., Sam D. Gumbert, M.D., George W. Williams, M.D. UTHealth McGovern Medical School, Houston, Texas (E.G.P.). evan.g.pivalizza@uth.tmc.edu

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In Reply:

The letter from Pivalizza *et al.* confirms that residency programs do respond rapidly to changes in certification requirements.[1] The program directors at this relatively large residency program suggest that both attrition of residents earlier in their training and changes to the curriculum could impact the conclusions about knowledge acquisition in the study by Zhou *et al.*[2] The letter suggests that these factors, especially attrition of residents who likely had lower in-training examination scores, may have contributed to higher in-training examination scores in clinical anesthesia year 2, potentially tainting the "acceleration of knowledge" argument.[2] Information about the training outcomes of residents who do not successfully pass their BASIC exam, either on initial or further attempts, could help alleviate the concerns regarding the representativeness of the resident cohort.

The more important question that this letter, the original article by Zhou *et al.*,[2] and the editorial[1] all allude to is, "What measures would confirm that the changes in examination resulted in increased knowledge acquisition?" As noted in our editorial, if certification requirements stay the same, the ultimate outcome measure would be that a cohort of graduates would be more successful in their first attempt following the move to administering BASIC and ADVANCED examinations.[1] Ideally, this cohort would need to include and account for those residents who entered training but were not allowed to take the ADVANCED examination because they were unsuccessful in passing the BASIC examination.

The letter by Pivalizza *et al.* also highlights an additional implied outcome that will result from a change in the certification requirements. The first certification requirement

now occurs early in training; residents who do not pass the BASIC examination would be more likely to leave (or be dismissed from) training prior to completing residency. The remaining residents who have passed their BASIC examination are more likely to be successful in their initial attempt to pass the ADVANCED certification examination, leading to a greater proportion of residents successful on their first attempt to become certified. From a patient safety perspective, this may be a desirable long-term outcome, because a prior investigation by Zhou *et al.* indicated that anesthesiologists who obtained their certification on the first attempt had a lower likelihood of having an action against their medical license than those who required more than one attempt.[3] Under previous certification rules, the initial certification examination occurred after residents had successfully completed their training. Prior to the change in certification, residents who did not successfully pass their written examination could enter practice and potentially never achieve certification.

Residency programs and program directors are likely to be the first to identify the desirable as well as the unintended consequences of changes in certification. It is hoped that additional investigations from residency programs will follow the letter by Pivalizza *et al.* and provide information about how the introduction of the BASIC examination impacts training, certification, and patient safety outcomes.

Competing Interests

The authors declare no competing interests.

David J. Murray, M.D., John R. Boulet, Ph.D. Washington University School of Medicine, St. Louis, Missouri (D.J.M.). murrayd@wustl.edu

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In Reply:

We appreciate the interest in our publication[1] and the opportunity to respond to these two Letters to the Editor.

Dr. Pivalizza and colleagues have questions about our methodology and inclusion criteria, and we would like to clarify. Their first question related to not accounting for those residents who did not take the in-training examination in their clinical base year in the analysis. There were actually two different models employed in the analysis of changes in in-training examination scores from the clinical base year to the clinical anesthesia year 1, and from the clinical anesthesia year 1 to year 2. The latter analysis (and our main conclusion) did not depend upon whether the residents had taken the in-training examination during their clinical base year. Second, given the study question of in-training examination score increment, residents who did not take the in-training examination in both clinical anesthesia years 1 and 2 could not be analyzed, and concerns were raised regarding the possibility of those who had failed the BASIC examination leaving training before taking the in-training examination in their clinical anesthesia year 2, thus biasing the composition of the cohort. We note that three failures of the BASIC examination are required for mandatory extension of training, and that for the 2013 cohort, only 0.2% failed twice. Thus, we think it is unlikely that this factor significantly affected the analysis. Dr. Pivalizza and colleagues also question whether preparing for the BASIC examination may have distracted residents from preparing for the preceding in-training examination, lowering in-training examination performance at clinical anesthesia year 1 and biasing toward an increase in performance from clinical anesthesia year 1 to year 2. As shown in table 1 and figure 2 of our article,[1] there is no evidence that the introduction of the staged examination system in the 2013 cohort was associated with lower in-training examination scores at clinical anesthesia year 1; indeed, the 2014 cohort had higher in-training examination scores at clinical anesthesia year 1. Finally, it is our perspective that what constitutes a "small" effect size is a matter of interpretation. The in-training examination performance of clinical anesthesia year 2 residents after the introduction of the staged examination system was similar to that of clinical anesthesia year 3 residents in the traditional examination system; we leave it to the readers to judge the significance of this finding.

Dr. Berman is concerned with "exam fatigue" associated with the introduction of new examination components in the primary certification process, and its potential to contribute to psychologic distress in residents. We appreciate his raising this important issue, given that a variety of studies have shown that residents in training can exhibit high levels of stress and burnout.[2,3] Each of the physician directors of the American Board of Anesthesiology is a practicing anesthesiologist, well aware of the demands of training and practice. Consideration of the impact of changes in the certification process on residency training is an essential factor in American Board of Anesthesiology decisions. Dr. Berman questions the clinical significance of improved in-training examination performance. Our prior work has shown that in-training examination performance is a significant predictor of achieving timely board certification,[4] and that board certification (or rather the lack thereof) predicts relevant outcomes such as disciplinary actions against the medical licenses