BASIC SCIENCE CURRICULUM DURING RESIDENCY: JUSTIFICATION BASED ON IN-TRAINING EXAMINATION SCORES

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The American Board of Surgery is increasing its emphasis on competency in surgical basic science as part of residency training. The 1991 American Board of Surgery In-Training Examination (ABSITE) contained 135 questions designated as basic science to assess residents' knowledge. We reviewed the separate progression of scores in clinical and basic sciences at Wayne State University (WSU) surgical residency and nationally through the 1991 ABSITE report. Regression analysis of WSU data yielded a slope (%correct answers per postgraduate year) of 5.3 for clinical and 2.4 for basic science scores (P < 0.001 by t-statistic applied to regression slopes). These data imply a progression of knowledge during residency but at a significantly slower rate for basic science. The national data confirm this trend, although we were unable to evaluate it statistically. This situation illustrates the need for organized teaching of clinically relevant basic science as part of a residency curriculum.


Key words: basic science; resident education; in-training examination

Medical training and practice increasingly require a thorough knowledge of the basic medical sciences. Recent advances in physiology, biochemistry, immunology, molecular biology, and microbiology demand knowledge of these fields for the successful clinical practice of medicine.

The American Board of Surgery (ABS) has recognized the importance of basic science knowledge during surgical training by introducing basic science questions on the In-Training Examination (ABSITE). There is also increased emphasis on basic science on the ABS qualifying examination. Residency programs have responded to this demand with didactic sessions, curriculum guides, research rotations, additional texts, or combinations of these to facilitate the acquisition of basic science knowledge.

The purpose of this study was to assess surgical residents' performance on the basic science portion of the ABSITE as a measure of basic science knowledge acquisition during residency.

METHODS

The 1991 ABSITE contained 90 questions in the area of clinical management and 135 questions of primarily basic science content including anatomy, physiology, biochemistry, pathology, immunology, and bacteriology. Individual resident responses are reported separately for clinical and basic sciences.

The ABSITE scores of all the surgical residents at Wayne State University were blindly included in the analysis. The Wayne State University surgical residency is a large training program situated in Detroit, MI. As part of the Wayne State residency program, basic science is stressed during conferences and on rounds. However, there is no didactic basic science teaching program.
The absolute number of correct answers for each of the basic and clinical portions of the examination was converted to percent correct answers. The scores were grouped by year and analyzed by linear regression, and the differences were analyzed using the t-statistic applied to linear regression.

Data on national trends were obtained from the American Board of Surgery Standardized Report to program directors. These results are reported as mean and standardized score; thus statistical evaluation is limited to identifying trends in the data.

RESULTS

Wayne State University scores. The residents' correct responses to clinical questions showed a progression from the first to the fifth year. The mean percent correct scores were plotted against year (Table 1) and analyzed by linear regression. The rate of increase in correct responses for clinical questions yielded a slope of 5.3 (%correct/yr; Fig. 1). Correct responses to basic science questions also increased as the residents progressed through the residency (Fig. 2). Plotting of the basic science responses against year yielded a slope of 2.4 (Fig. 1). The progress of basic science knowledge was significantly less than the clinical knowledge as reflected by correct responses on the ABSITE scores ($P < 0.001$).

Slope analysis reveals a break in basic science scores that occurs between the second and third years of residency.

### TABLE 1

<table>
<thead>
<tr>
<th>PGY</th>
<th>$n$</th>
<th>Mean % Correct Answers</th>
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<tbody>
<tr>
<td></td>
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<td>Basic</td>
</tr>
<tr>
<td>1</td>
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<tr>
<td>5</td>
<td>9</td>
<td>75</td>
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Scores for the basic and clinical portions of the American Board of Surgery In-Training Examination (ABSITE) are grouped by nos. ($n$) of residents per postgraduate year (PGY).

National averages. The nationwide data reveal trends similar to the Wayne State University experience, with a progression of correct responses to clinical and basic science questions. When graphically represented, the percentage of correct responses to clinical questions appears to increase at a greater rate than that of responses to basic science.
EDUCATIONAL EXPERIMENTS

questions (Fig. 3). As in the Wayne State University data, a break in basic science scoring is noted between the second and third years of residency.

DISCUSSION

The ABSITE has been offered yearly since 1975 by the ABS to "test the general level of knowledge which has been attained by residents regarding the fundamentals and the basic sciences related to surgery." (9) The original intent of the Board was to define the content domain of basic knowledge necessary for competent practice of surgery (3, 6, 7). The ABSITE could serve as a tool to assess the weaknesses of individual residents in regard to the Board Qualifying Examination at a time early enough to allow correction of deficits. However, correlation with the qualifying examination pass rates has varied, with correlation coefficients ranging from 0.48 to 0.79 (4, 8, 13). Also, scores on the ABSITE do not necessarily correlate with evaluations of resident performance by surgical staff (11). Finally, the examination was designed to allow program directors to assess the relative academic strength of their program and respond accordingly.

The ABS has placed increased emphasis on basic science knowledge as reflected by recent ABSITE examinations. In fact, the board has strongly considered the establishment of a separate basic science qualifying examination to be taken and passed during the surgical residency before the clinical qualifying examination. The idea was recently abandoned because of multiple factors in favor of increased basic science content on the single qualifying examination. Since 1990, the basic science portion of the ABSITE has been formalized and scored separately to reflect this basic science emphasis (1).

Although scaled to the third-year resident, the ABSITE has been a useful measure of the acquisition of knowledge during residency when year-to-year scores are examined (3, 9). The data reported herein reflect the anticipated progression of clinically relevant information through the surgical training period. This trend is similarly reflected by the national averages for each postgraduate year.

Unfortunately, the acquisition of basic science knowledge, as evidenced by correct answers on the basic science portion of the ABSITE, progresses at a significantly slower rate. These data are also confirmed by the national information, showing a decreased rate of progression on the ABSITE basic science questions (2). Analysis of slope data from both series reveals a break point in basic science performance between the second and third year of residency. Numerous explanations may account for this reduction in basic science test performance. There is increased emphasis on clinically relevant knowledge, especially during the senior years of residency; selective academic progression may be reflected by this bias in emphasis (12). Alternatively, the deterioration in basic science performance may reflect a loss of basic science skills, knowledge, and especially interest acquired during medical school. This would suggest that little basic science knowledge is gained during residency, and most of the residents' fund of basic science knowledge is only that remembered from medical school.

However, basic science scores do increase during surgical residency. This basic science proficiency on the ABSITE may not solely reflect an increase in knowledge; rather, it could indicate a test familiarization phenomenon. Residents may respond to repeated yearly questions in basic science subhead-
ings with pretest short-term memorization; thus the improvement in testing may be without true comprehension. This same familiarization, however, would be valid on the clinical portion also, making it a useful control.

If the majority of surgical residents’ basic science knowledge is remembered from the first or second years of medical school, then this information is at least seven years outdated for graduating surgical residents. With the pace of science developments, this may be inadequate knowledge for entering surgical practice. Increasing emphasis of basic science on the Board qualifying examination may also demand emphasis in these areas to guarantee success. Finally, and perhaps most importantly, without continued interest and emphasis of the basic sciences, the surgeon may tend to ignore them indefinitely. New fields and information, originating with basic science developments, will be inaccessible or incomprehensible to surgeons without this orientation.

There is a place for increased emphasis on basic science learning during residency. This requires a commitment from both residents and faculty. Organized programs have been developed for teaching clinical knowledge; these may be modified to facilitate the teaching of basic science (10). Organized textbook review has been found effective in increasing overall in-training scores before the emphasis of basic science knowledge (5). An organized plan of directed reading of surgical physiology and basic science might have similar effects. This program should include study of surgery and medicine, immunology, biochemistry, physiology, microbiology, molecular biology, genetics, pharmacology, and pathology. Ultimately, a format resembling the clinically oriented Selected Readings in Surgery could be utilized. The basic science departments of medical schools affiliated with residency programs usually represent an untapped resource. Invitation of speakers from these departments or a series of didactic presentations may both inform and incite interest. Research conferences also fulfill the same goals.

The Wayne State surgical residency program is responding to the need for basic science education by allowing residents to spend one or two years of research in basic science laboratories. This allows the resident to acquire research expertise and increase science knowledge overall in a learning environment free from the clinical demands of residency. Furthermore, a basic science didactic reading program has recently been established. Further study is necessary to define the optimal mechanism for the acquisition of basic science knowledge for the surgical resident.

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