Study habits of surgery residents and performance on American Board of Surgery In-Training examinations

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Abstract

Background: The purpose of this study was to evaluate the study habits (SHs) of surgery residents preparing for the annual American Board of Surgery In-Training Examination (ABSITE).

Methods: A validated instrument developed to assess SHs in college students, the Survey of Study Habits and Attitudes (SSHA), was modified slightly for use with residents. The modified SSHA contains 2 subscale scores, work methods and delay avoidance, and a combined overall study habit score. A total of 59 residents from 2 academic general surgical residency programs were administered the modified SSHA. The SSHA scores were correlated to performance on the in-training examination.

Results: There was a small but significant correlation between scores on the modified SSHA instrument and performance on the ABSITE overall ($r = 0.29$; $P < .05$; $r^2 = 0.0841$). Linear-regression analysis showed that the clinical component and overall performance on the ABSITE were significantly predicted by the total SH scores. Overall total ABSITE percent correct scores were significantly predicted by residency levels of training and the overall SSHA scales (delay avoidance and work methods). Together they predicted 63% of the total variance in the overall performance scores. Residency level was the strongest predictor. SH performance accounted for 5.9% of the total variance beyond that contributed by residency level of training.

Conclusions: The correlations of surgical resident ABSITE performance with SSHA scores were on the same order of magnitude as those of college students and academic performance with the original SSHA. Although SH in this study accounted for a measurable yet small contribution to ABSITE performance, this contribution was not enough to consider using the SSHA instrument in its current modified form as a diagnostic and counseling tool. Published instruments not specifically designed for residents may not be tailored enough to measure residents' unique SH. © 2004 Excerpta Medica, Inc. All rights reserved.

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The first in-training examination for a specialty board was created in 1964 by the American Board of Neurological Surgery. The in-training examination was established because of concerns regarding the high failure rate on the certification examination given by this board. Other specialty boards soon followed this example. In 1972, an in-training examination for general surgery residents became available through the American Board of Surgery (ABS). The ABS has offered an annual in-training examination since 1975 to assist program directors with assessing the necessary knowledge for competence. The examination is offered annually through directors of accredited surgery programs in the United States.

The ABS certification process for general surgeons who have completed residency training consists of passing a written qualifying examination before taking the oral certifying examination. To determine the significance and role of the in-training examination in predicting academic performance on the written certification examination, researchers have analyzed the relation between performance on the in-training examination with the qualifying examination [1–3]. Results suggest that resident performance on the

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ABSITE correlates with subsequent performance on the qualifying examination. Wade et al [2] showed that correlation was 0.64 for interns, 0.62 for residents, and 0.46 for chiefs. Total ABSITE scores were found to explain 47% of the variance in the first qualifying examination scores of their residents.

These findings call attention to the way in which residents prepare for this important examination. Surgical residency directors must offer a system of ongoing evaluation and recommendation for both the successful resident as well as remedial education and counseling for those who fail or who start to show signs of academic weakness, particularly at an early stage of training.

The purpose of this study was to evaluate the study habits (SHs) of surgery residents as they prepare for the annual ABSITE examination by using the Survey of Study Habits and Attitudes (SSHA), an instrument developed to assess study strategies. The following research questions were addressed:

1. Do better SHs correspond to better ABSITE scores?
2. Are SHs related to better scores on the clinical or basic science component of the ABSITE examination?
3. Is there an association between SHs and ABSITE performance beyond that contributed by increasing residency level of training?

This pilot study of surgical residents from 2 academic institutions sought to address these questions with the goal of evaluating the SSHA as a diagnostic and counseling tool for surgical residents preparing for their annual in-training examination.

Literature review

The measurement of SHs in adult learners has been studied extensively in college students to build diagnostic and predictive instruments and to study the cognitive processes involved in studying [4–6]. Study strategies have been described as any "cognitive, affective, or behavioural activity that facilitates encoding and storing, and retrieving or using knowledge" [7]. Activities related to the cognitive factor include using mnemonic techniques and drawing inferences from the information. The affective components include managing anxiety and avoiding procrastination. Last, behavioral factors include note taking, highlighting, and reviewing. Entwistle et al [8–10] described "deep" and "surface" approaches. For example, students who study with a deep approach examine the evidence in relation to conclusions and relate new ideas to previous knowledge and experience. In a surface approach, students identify and then memorize what they deem to be the important facts and ideas contained in the text, but they fail to appreciate structure and principles. They also tend to use rote memory. In the "strategic" approach, a subtype of the surface approach,

students demonstrate a calculating approach to their study. They aim for high grades, not for understanding.

In medical education, Arnold and Feihny [11], using the short-form Lancaster Approach to Studying Inventory, assessed the learning approaches and performance of medical students in a 6-year baccalaureate–doctoral program. They found that students who scored high on achievement–motivation (efficient SHs and an extrinsic need to succeed) but low on reproducing orientation (rote memory) and globe-trotting (a fragmented approach) achieved higher grade-point averages (GPAs) in postgraduate year (PGY) 1, PGY2, and PGY4 than their counterparts.

However, there is a need for research in medical education to address the measurement of SHs of residents. Previous studies have sought to identify factors that affect performance and improvement on the ABSITE. Improvement in ABSITE performance was significantly correlated to the amount of study, as measured in hours, as well as to conference attendance [12]. Furthermore, conference attendance, previous performance, probationary status, amount of sleep, and amount of study were found to account for 71% of the variance in ABSITE scores [13]. Wade and Kaminski [14] surveyed surgical residents about the educational methods used to prepare for the ABS examinations such as texts, review courses, and use of Surgical Educational and Self-Assessment Program review questions. They found that residents with higher scores used texts early and attended review courses more frequently. The goal of any effective study instrument would be to comprehensively measure these approaches and constructs of studying in a reliable and valid approach that will serve as a diagnostic, counseling, and monitoring tool.

Methods

Review of study instruments and selection

An extensive review of currently available study instruments was performed to select a study instrument for this research study. The following criteria were used to select an instrument: the important constructs of study skills were measured and matched to our list of constructs; it was available for current use; validity and reliability data were established; it could be administered easily; and it could be scored easily.

A list of constructs deemed important in the evaluation of study skills in residents was made based on input from 3 faculty surgeons and 2 medical educators who regularly counsel surgical residents in this area and from information in the literature (Table 1). Our goal was to select the instrument that best matched the constructs in which we were interested. Turnbough and Christenberry [6], in their analysis of study instruments, thoroughly reviewed and compared study skills measures in terms of standard psychometric properties. They concluded that only the SSHA stood

Table 1
Study habit constructs

Concentration	Examination coping skills
Memorization	Use of resources
Construct relationships	Faculty consultation
Reading techniques	Questioning
Strategic approach	Self-perception of study skills
Study schedule	Instructor-centered versus learner-centered approach
Motivation	Organization
Time management	Self- versus group learning

up to contemporary study skills–measurement standards. In addition, a thorough review by Gordon [15] found 8 different instruments used to assess general study strategies for use with college freshmen including the SSHA [16,17]. Of the instruments mentioned, only 2—1 of which was SSHA Form C—provided information on scoring and interpretation of results. These instruments are used at institutions of higher learning as diagnostic and counseling tools for students and as evaluation instruments for classes that teach study strategies. SSHA Form C was selected based on the criteria previously outlined.

The SSHA in its most current version contains 4 25-item scales: delay avoidance (DA), work methods (WM), teacher approval, and education acceptance. These four primary scales are then grouped to form two subscales, study habits (SH; composed of DA and WM) and study attitudes (composed of teacher approval, and education acceptance). Questions in the subscale related to study attitudes addressed constructs outside the scope of this study. Therefore, only the SH subscale of SSHA Form C was used. All 50 questions in this subscale were then reviewed by an expert panel composed of clinical surgeons, surgical educators, and a group of 5 residents at various levels of training. Minor revisions were made to adapt the instrument for resident use; for example, "student" was changed to "resident," and "teacher" was changed to "faculty." The aim was to retain the construct of the questions as in the original SSHA while making the questions applicable to a resident population. Each item has a corresponding 5-point ordinal scale. The 5 possible responses are rarely (0% to 15% of the time), sometimes (16% to 35% of the time), frequently (36% to 65% of the time), generally (66% to 85% of the time), and almost always (86% to 100% of the time). Scoring of the instrument requires translating the Likert-type responses to "raw scores" per the instrument manual. The maximum raw score per scale is 50. In our modified instrument using 2 scales, the maximum obtainable score was 100. High SSHA scores are characteristic of students who get good grades, whereas low scores are characteristic of students who get low grades [16,17]. The modified SSHA was pilot tested with both residents and faculty to obtain input on interpretation of questions and trouble shooting.

Original instrument psychometrics

Reliability

The original test developers studied the test–retest reliability of SSHA Form C using 4- and 14-week intervals. At the 4-week interval, the test–retest Pearson's product moment correlation coefficients were 0.93 and 0.91 for the DA and WM scales, respectively, and at the 14-week interval, the correlation coefficients were 0.88 and 0.86, respectively. These results provide evidence that the scale scores are sufficiently stable across time. Because only minor changes were made to the original SSHA Form C, similar reliability levels were assumed for the present study.

The internal consistency measure of the original SSHA Form C was computed using the Kuder-Richardson Formula 8 for estimating test reliability (n = 465 college freshmen). Reliability coefficients for the 2 scales of the SSHA (DA and WM) were 0.89 and 0.87, respectively.

Validity

SSHA Form C has been validated in a number of colleges throughout the United States. In 1960, it was administered to 3054 freshmen at 6 colleges. Correlations between SSHA (total score) and GPA for each college were statistically significant and positive for all colleges. Correlations for each scale and GPA and between each scale and the results of the Scholastic Aptitude Test (SAT) are available. The mean correlation between DA and GPA was 0.31 and between DA and SAT was 0.08. The averaged correlation between WM and GPA was 0.32 and between WM and SAT was 0.30. Thus, it may be concluded that each scale is slightly associated with traits that play an important role in academic achievement.

Sample size and description

A power analysis found that 68 subjects would be required to have 80% power to detect a correlation of 0.30 between SSHA and ABSITE scores at $P < 0.05$. Subjects from this study were recruited from 2 academic general surgical residency programs from a large United States city. Both have a 5-year surgical residency program that is university-based and accredited. They both integrate the experiences of a university hospital, a public hospital, and a community hospital. The programs each have a surgical educator actively integrated in their program who oversees activities ranging from curriculum development to resident counseling. The aim of this study was not to compare the surgical programs; thus, the data from the 2 surgical programs was pooled. The sample consisted of a total of 59 surgical residents from PGY1 (first year of training) to PGY5 (last year of training). There were 14 (24 %) PGY1, 12 (20%) PGY2, 18 (31%) PGY3, 6 (10 %) PGY4, and 9 (15 %) PGY5 residents.

ABSITE

The ABSITE is an annual in-training examination sponsored by the ABS and administered to general surgical residents in all 5 years of residency training. It is administered by surgical academic departments as a useful tool to monitor the progress of residents and assure that they acquire the essential knowledge required to practice the specialty of general surgery. Each resident receives a total test score, a clinical management score, and a basic science score. Each score is reported as a "percent correct" score and a "percentile" score as ranked per individual year of training. The ABSITE 2000 scores were used for each participant. The ABS, in its outline of interpretation of results, stated that the SEM is approximately 2% of the percent correct scores for the total test. The SEM is an estimate of an individuals' test score, i.e., a 68% correct score has a theoretical "true score" that would be between 66% and 70%.

Administration of study instrument

Residents were informed of the purpose of the study at an information session. Proctors distributing the survey were available to give instructions and answer questions. The SSHA was administered 1 week before the scheduled ABSITE examination. The instrument was not administered under any time limit.

Research design

A correlational study was conducted to study the relationship between ABSITE scores and scores on the modified SSHA instrument. Neither ABSITE nor SSHA scores have a pass–fail cut-off point. Higher ABSITE scores are characteristic of residents who have a better knowledge base, and high SSHA scores are characteristic of students who get good grades. A multiple regression analysis to predict ABSITE scores (criterion dependent variable) from SSHA subscales (DA and WM) and PGY of training as predictors (independent variables) was performed.

Results

Total ABSITE percent correct scores were roughly distributed normally for the 59 residents (mean score 66.8% correct and SD 9.49). The SSHA scores were also roughly normally (mean score 43.5 [from a maximum of 100] and SD 11.84). For both ABSITE scores and SSHA scores, skewness and kurtosis were not significant.

The internal consistency reliability measure for the modified SSHA scores (n = 59) was computed using Cronbach's alpha. Reliability coefficients for each scale of the SSHA (DA and WM) were 0.77 and 0.82, respectively. The

Table 2
Correlation coefficients between SSHA scale scores and ABSITE percent correct scores

ABSITE	SSHA Scales		
	DA	WM	Study Habits DA and WM
PGY 1–5, n = 59			
Total	0.226	0.285*	0.290*
Clinical	0.217	0.267*	0.275*
Basic science	0.188	0.266*	0.258*

* $P < 0.05$.
ABSITE = American Board of Surgery In-Training Examination; DA = delay avoidance; PGY = postgraduate year; WM = work methods.

reliability of the entire modified SSHA was 0.87. All these measures of reliability were judged acceptable.

Correlation between SSHA scores and ABSITE scores

The Pearson product moment correlation was used to correlate scores from each of the 2 SSHA scales (DA and WM) and from the combined score SH with the total, clinical, and basic science ABSITE percent correct scores (Table 2). The WM subscale correlated significantly with the total (0.285), clinical (0.267), and basic science (0.266) ABSITE scores. The DA subscale correlations were not statistically significant. Overall, the SH score was also significantly correlated with the total (0.290), clinical (0.275) and basic science (0.258) ABSITE scores. Overall, 8.41% of the variance in total ABSITE performance was accounted for by performance on the SSHA ($r = 0.29$).

Predictive analysis of ABSITE performance with study habit score and resident level

The ability of SHs as measured with the SSHA to predict ABSITE ranking was analyzed using linear regression analysis. A predictive analysis using percentiles allows comparative ranking among peers. Both clinical and total percentile rankings were significantly predicted by SH score. The SH score was not a significant predictor of basic science percentile ranking. It most significantly predicted clinical percentile ranking with 14% of the variance in score accounted for by the SH score (Table 3).

Multiple regression analysis was performed to measure the predictability of the SSHA scales, residency level, and the residency level variable squared on ABSITE performance (basic science, clinical, and total scores). The variable residency level squared was used to account for the possible curvilinear association between ABSITE scores and residency level.

Overall, total ABSITE percent correct scores were significantly predicted through residency levels of training and SSHA scales. Together they predicted 63% of the total variance in the overall performance score (Table 4). Resi-

Table 3
Linear regression analysis of ABSITE percentile as dependent variable*
and total study habit (SH) score as independent variable

Total n = 59	Basic science percentile	Clinical percentile	Total percentile
Predictor B (SE)			
SHs (DA + WM)	0.46 (0.28)	0.80 (0.26)	0.70 (0.26)
R^2	0.047	0.14	0.11
F	2.76	9.08	7.34
P value	0.103	0.004	0.009

* Basic science, clinical, and total.

ABSITE = American Board of Surgery In-Training Examination; B = slope; DA = delay avoidance; SE = standard error; WM = work methods.

dency level was the strongest predictor (B = 12.64, and SE = 2.70). Study subscale performance accounted for 5.9% of the total variance beyond that contributed by residency level of training.

Regarding the clinical component of the ABSITE examination, 68% of the variance was accounted for by the SSHA scores and residency level of training. Overall, the 4 predictors were significantly associated with the clinical percent correct ABSITE scores (Table 4). WM and DA study subscales were found to contribute 5.4% of the total variance beyond that contributed by residency level as measured by hierarchical regression.

On the basic science component of the ABSITE examination, the SSHA scores and residency level of training predicted 39% of the variance. Overall, the 4 predictors significantly predicted the amount of basic science percent correct ABSITE scores, accounting for 39% of the variance, with residency level again being the most significant pre-

Table 4
Multiple-regression analysis of ABSITE score as dependent variable*
and DA score, WM score, and residency level as independent variables

Total n = 59	Basic science percent correct	Clinical percent correct	Total percent correct
Predictor B (SE)			
DA	0.20 (0.20)	0.37 (0.17)†	0.30 (0.16)
WM	0.16 (0.18)	0.07 (0.15)	0.11 (0.14)
Residency level	10.31 (3.54)†	15.11 (3.00)†	12.64 (2.70)†
Residency level squared	−1.10 (0.59)	−1.52 (0.49)†	−1.31 (0.45)†
R^2	0.39	0.68	0.63
F	8.67†	28.74†	22.83†
P value	<0.0001	<0.0001	<0.0001
Hierarchical regression			
ΔR^2‡	0.047	0.054	0.059
$F(\Delta R^2)$‡	2.077	4.55†	4.32†

* Basic science, clinical, total.

† $P < 0.05$.

‡ The R^2 difference and corresponding F statistic for the 2-step hierarchical regression analysis (step 1: residency level and residency level squared; step 2: DA and WM scores).

ABSITE = American Board of Surgery In-Training Examination; B = slope; DA = delay avoidance; SE = standard error; WM = work methods.

dictor (B = 10.31, SE = 3.54) (Table 4). The variance contributed by the study scales (DA and WM) was not significant in basic science performance.

The 4 predictors most significantly predicted the clinical component of the ABSITE. The predictor variable resident level squared in the multiple regression model demonstrated that as residency level progressed, ABSITE performance overall improved but then tapered off.

Comments

This study analyzed the relationship between SHs as measured with the modified SSHA to ABSITE scores. The results showed that the modified SSHA instrument performed at the same order of magnitude as has been previously demonstrated by the original instrument in college students. Performance on the study instrument had a small yet significant correlation with ABSITE performance. Furthermore, residency level was found to be the strongest predictor of ABSITE performance. The normal distribution of SSHA scores, with lack of significant skewness or kurtosis, indicates that residents did not succumb to a desirability bias but rather sincerely rated themselves on the study instrument.

The WM scale correlated with ABSITE scores more often than the DA scale. WM constructs include memorization skills, constructing relationships with materials studied, and examination coping skills. DA includes time management, avoiding procrastination, concentration, and preparation required for studying. Furthermore, the total SH score had a small yet significant correlation with ABSITE performance overall as well as with each of its components. The magnitude of the correlation was similar to that seen with college students when correlating study instrument subscale scores to GPAs.

Residency level was the strongest predictor of ABSITE scores in the basic science and clinical subcategories and in overall ABSITE performance. The importance of increasing level of residency training on ABSITE performance has been previously demonstrated, and our results confirm these previous findings [1–3]. Overall performance on the study instrument and residency level predicted ABSITE performance significantly, and the clinical component was the best predicted. The constructs of the 2 SSHA subscales and residency level contribute to a lesser degree to the basic science component of ABSITE performance.

Both percentile ranking and number of percent correct questions on the clinical component of the ABSITE were best predicted by the SSHA. Additional significant variance contributed by study scores beyond the contribution of residency level of training was seen only in the clinical and not in the basic science component. This was also reflected in the overall ABSITE score. The additional significant variance as predicted by the study instrument had a stronger influence on the clinical questions of the examination. In-

tuitively, we would expect that study skills would have a stronger influence on the basic science rather than clinical component. Our results demonstrated the reverse. Perhaps the clinical questions on the ABSITE examining clinical content requires review and studying beyond what is picked up on the wards and operating room. Furthermore, performance on the ABSITE increased with level of training but did so at a decreasing rate.

A few limitations in this study should be noted. First, this study involved only subjects from 2 departments of surgery. These 2 programs were selected as a convenient sample representative of accredited academic surgical training programs dedicated to academic excellence. The goal of this study was to pilot test the modified SSHA in a sample of residents in surgical training. The extensive validity and reliability data of the original SSHA Form C accumulated from college students made it an attractive instrument to pilot test in our population. Second, the small numbers within each PGY group lent itself to an overall analysis rather than a year-by-year analysis. Larger samples would strengthen the conclusions drawn from such a study and would allow for further subgroup analysis. Third, it is possible that the constructs related to the 2 subscales may not be sensitive enough for measurement of the more complex study process required in residency training. A resident's approach to knowledge acquisition is quite different from that of a college student. The college student's exposure to knowledge is formally structured and primarily didactic. Conversely, a resident's approach to knowledge acquisition is a combination of apprenticeship training with some formal didactic components.

Objective examination methods such as those administered by the ABS allow reliable and reproducible evaluation of knowledge gained [3]. This enables program directors, educators, and trainees the opportunity to evaluate their surgical knowledge to monitor progress and recognize "red flags." Remedial programs for residents who score poorly on the ABSITE are not routinely implemented. A more rigorous approach by programs aimed to help weaker residents should be seriously considered. Performance of residents in the various areas may be helpful to program directors in designing their program's learning issues and more specifically may guide future study based on self-performance [18]. Interventions may include negotiating a learning contract with the trainee with the intention of providing a personalized approach to improving one's future performance; assigning a mentor to each resident who might benefit from regular preceptor guidance; regularly reviewing an outlined study plan and providing individualized coaching and guidance with regard to studying; and forming problem-based study groups encouraging residents to discuss challenging problems while promoting the importance of self-study. The ability to evaluate study skills provides the opportunity to objectively provide counseling and to diagnose limitations early.

The modified SSHA did not uniformly correlate with and predict performance on the ABSITE examination. Perhaps surgical residents' methods of studying tap into a more complex approach compared with those of college students. Future research plans may include the analysis of other study instruments in this setting. The Learning and Study Strategies Inventory is also a currently used study instrument that is available and seems to encompass constructs deemed important for surgical residents preparing for examinations. However, one of the drawbacks of this instrument is the lack of validity data available in the original instrument.

The correlations of surgical resident ABSITE performance with SSHA scores were on the same order of magnitude as those of college students for academic performance with the original SSHA, i.e., approximately 8% of the variance accounted for by SH. Furthermore, performance on the modified SSHA accounted for performance on the ABSITE beyond the contribution of residency level, but only to a small degree. Although SH in this study accounted for a measurable yet small contribution to ABSITE performance, this contribution is not enough to consider using the SSHA instrument in its current modified form as a diagnostic and counseling tool. Future studies in this area may be informative in building a better tool to measure residents' study habits.

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