

# The Long-Term Career Outcome Study: Lessons Learned and Implications for Educational Practice

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**ABSTRACT** The work of the Long-Term Career Outcome Study has been a program of scholarship spanning 10 years. Borrowing from established quality assurance literature, the Long-Term Career Outcome Study team has organized its scholarship into three phases; before medical school, during medical school, and after medical school. The purpose of this commentary is to address two fundamental questions: (1) what has been learned? and (2) how does this knowledge translate to educational practice and policy now and into the future? We believe that answers to these questions are relevant not only to our institution but also to other educational institutions seeking to provide high-quality health professions education.

## INTRODUCTION

The Long-Term Career Outcome Study (LTCOS) was established by the dean of the F. Edward Hébert School of Medicine in 2005. In a series of articles published previously,<sup>1,2</sup> we have discussed a sample of our educational research findings and some proposed future directions. In this article, results from the work showcased in this current special edition—including LTCOS work that has led to changes in educational practices and policies—is presented. Current and future implications are also discussed. We use the before, during, and after framework,<sup>3</sup> which is consistent with the quality assurance and program evaluation literature, to organize and describe these results, practices, and policies as well as implications. In this article, two fundamental questions are addressed: (1) what has been learned? and (2) how does this knowledge translate to educational practice and policy now and into the future? We believe that answers to these questions are relevant not only to our institution but also to other educational institutions seeking to provide high-quality health professions education. In this commentary, we place special emphasis on the articles in this second special edition; however, readers are encouraged to review the first special edition (*Military Medicine*, September 2012), as well as other LTCOS work that has been referenced throughout this special edition.

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## WHAT HAVE WE LEARNED?

### *Before Medical School (Admissions)*

The associations between admissions data and future performance in medical school, residency, and beyond are of critical interest to medical schools around the globe. The importance of selection is particularly relevant to the Uniformed Services University (USU) where our medical students go on to train in our own military residency programs and serve as staff physicians in our own medical treatment facilities.

Saguil et al<sup>4</sup> demonstrated that Medical College Admission Test (MCAT) scores, although moderately correlated with U.S. Medical Licensing Examination (USMLE) Step 1 scores, were only weakly associated with grade point average (GPA) and USMLE Step 2 Clinical Knowledge and USMLE Step 3 scores. Further, no correlation was found between MCAT scores and USU objective structured clinical examination (OSCE) scores, USMLE Step 2 Clinical Skills subscores, or post graduate year-1 Program Director (PGY-1 PD) performance ratings on our graduates. Thus, although the MCAT is a good proximal predictor of scholastic performance, its utility in predicting more distal, patient-oriented outcomes was not demonstrated. This investigation builds on previous work which has demonstrated that the MCAT is just one of several tools for selecting medical school applicants. That said, care must be taken to not place too much weight on any one examination when choosing individuals for medical school.

In another admissions study, Paolino et al,<sup>5</sup> demonstrated that self-reported clinical and research experience explained little to no variance in medical school and Graduate Medical Education (GME) outcomes. These findings suggest that admissions committees should cautiously view such self-reports when making admissions decisions.

In a recent *Academic Medicine* article, DeZee et al<sup>6</sup> found that most aspects of letters of recommendation (LOR) on application to medical school did not predict medical school

performance. Of students who matriculated at USU, three LOR factors were associated with graduating at the top of the class: being called “the best student,” having the letter written by an employer or supervisor, and having a statement that the writer would promote the applicant from their current role. Only one factor, having nonpositive comments, predicted graduating at the bottom of the class. This research points to several particular factors in LORs that may be used to help identify applicants who are more likely to graduate at the top of the class, provided the applicant is otherwise qualified for admission.

In an investigation that examined before and during medical school measures and their relations with future board certification, Durning et al<sup>7</sup> found several small, but significant associations. In particular, GPA upon matriculation as well as internal medicine clerkship clinical and total points were associated with attaining board certification. This investigation provides additional validity evidence that measures collected before and during medical school for purposes of student evaluation are valuable in assessing future performance, as measured by board certification.

In sum, these findings illustrate some of the evidence and limitations of using individual instruments for selecting medical students. This work as well as work from the previous Special Edition<sup>8,9</sup> has led to a review of the admissions processes at USU. Our findings support the notion of taking a more holistic approach to admissions by weighing each piece of admissions data in the context of the entire admission application.

### **During Medical School**

LTCOS work during medical school has helped shape policies and practices at USU and may help others. Given recent curriculum reform efforts, LTCOS work provides important historical data that can be used to assess the success of curricular revisions. We also highlight a sample of innovations in our medical school curricula to include using art as a means to assess professionalism, blending concept mapping and team-based learning, and using an ultrasound curriculum. Lessons learned during medical school include the following investigations.

In a recent article published in *Academic Medicine*, LTCOS work demonstrated moderate to large correlations between performance on the National Board of Medical Examiners (NBME) Clinical Subject Examinations and later performance on the USMLE Step 2 Clinical Knowledge examination.<sup>10</sup> Additionally, findings from a separate but related study demonstrated that poor performance on these same NBME Clinical Subject Examinations predicted failure on USMLE Step 3. Furthermore, and not surprisingly, poor performance on multiple examinations vastly increased the odds of failing Step 3.<sup>11</sup>

LaRochelle et al<sup>12</sup> found that several preclerkship outcome measures of clinical skills and clinical reasoning were not only associated with clerkship performance but also explained 22% of the variance in average clerkship NBME

subject examination scores and 20% of the variance in final clerkship grades. These same preclerkship outcome measures also predicted future performance at the GME level, where 13.9% of the variance in medical expertise as well as 7.6% of the variance in professionalism were explained by program directors ratings of interns (PGY-1 PD).<sup>12</sup>

One of the first preclerkship outcome measures to be applied longitudinally across the USU curriculum is the Essential Elements of Communication (EEC). The EEC was developed from the Kalamazoo consensus statement on physician-patient communication. USU has adopted a longitudinal curriculum using the EEC as both a learning tool during standardized patient encounters, and as an evaluation tool culminating with the end-of-preclerkship OSCE. LTCOS explored associations between students' EEC OSCE performance at the end of the preclerkship period with later communication skills outcomes in the context of a longitudinal curriculum spanning both undergraduate medical education and GME.<sup>13</sup> These findings provide fairly robust validity evidence for USU's EEC evaluation method: it appears to be a good predictor of students' later performance on communication skills evaluations (Step 2 Clinical Skills and the first year of residency). As such, this tool could be used as a sign of poor performance of communication skills as early as the start of the third-year clerkship where specific interventions can be effectively applied and tested before graduation from medical school.

In another study, Stephens et al<sup>14</sup> explored the association between fitness and medical student performance. Some measures of annual fitness correlated with medical school performance, but the correlations with GPA and USMLE Step 1 were small to moderate. If replicated in larger studies, physical fitness could be another means of detecting concerning trends in performance.

Hemann et al<sup>15</sup> explored the association between being presented at a department of medicine education committee but not receiving any required remediation with those who were never presented and those who required remediation following department of medicine presentation. Overall, this analysis supported the hypothesis that students who are presented because of one or more performance concerns but not required to remediate are more likely to exhibit poor performance at the internship level.

Hemann et al<sup>16</sup> also explored the association between clerkship performance and internship performance as rated by our PGY-1 PD and USMLE Step 3 scores. Unsuccessful clinical performance in the third year of internal medicine remains strongly associated with future poor performance in internship. The strength of the association in the domain of professionalism was particularly striking with internal medicine clerkship “remediators” being 18 times more likely to garner adverse ratings on professionalism during internship. Further, these students were 8.5 times more likely to fail USMLE Step 3.

Four articles addressed recent instrument development work. Capaldi et al<sup>17</sup> explored the feasibility, reliability, and

validity of a novel instrument called the clinical integrative puzzle (CIP) for assessing clinical reasoning. A modest amount of evidence of feasibility, reliability, and validity were found for this new instrument. On the basis of this work, to include the instrument's capability to integrate basic and clinical science understanding in a single assessment, CIPs are now being used in the preclerkship period at USU.

Hemmer et al<sup>18</sup> explored the psychometric properties of a multistep examination for evaluating clinical reasoning. The findings demonstrated feasibility as well as favorable reliability and validity evidence. Based in part on this evidence, this multistep examination continues to be used during the internal medicine clerkship.

Stephens et al<sup>19</sup> explored medical students' attitudes toward the medically underserved (MATSU). Overall, the study found relatively poor attitudes toward caring for underserved populations, but the specific reasons for these attitudes are not clear. Factors such as debt and exposure to underserved populations are important elements to consider.

Finally, Phillips et al<sup>20</sup> developed several survey scales to assess students' motivational beliefs and emotions during medical school. Recent work by LTCOS and others suggests that these so-called noncognitive factors are important predictors of student learning and performance both during and after medical school. This study confirmed several hypothesized relationships between the new task importance and anxiety subscales and a number of adaptive and maladaptive behavioral outcomes, including metacognition, procrastination, and avoidance of help seeking. Finally, comparisons across the 4 years of medical school indicated that some aspects of task importance and anxiety appear to vary in fairly large and statistically significant ways. Overall, these findings provide evidence for the psychometric quality of the new scales, which capture medical students' perceptions of task importance and anxiety—two factors that researchers now appreciate as essential contributors to learning and performance in medical school and beyond.

### **After Medical School (Residency and Practice)**

Research presented in this special issue has resulted in new knowledge about longer-term medical school outcomes. For example, the feasibility, reliability, and validity evidence for a revised PGY-1 PD evaluation form was explored. This new survey was found to contain five factors: "Medical Expertise, Military-unique Practice, Professionalism, System-based Practice, and Communication and Interpersonal Skills." It demonstrated reasonable associations with medical school GPA and USMLE Step assessment scores. The survey appears to be a useful tool for gauging medical graduates' first-year internship performance, and the instrument will continue to serve as a key outcome measure for USU's medical school.<sup>21</sup>

A PGY-3 PD evaluation form was also developed and tested. Results from an exploratory factor analysis sug-

gested several of the same factors as the PGY-1 PD evaluation form.<sup>22</sup> One difference was the finding that the items thought to measure communication and interpersonal skills were included within a single "Professionalism" factor; whereas in the PGY-1 evaluation, "Communication and Interpersonal Skills" and "Professionalism" were two separate factors. This finding suggests that when evaluating PGY-3 trainees, program directors may not differentiate between the various aspects of communication, interpersonal skills, and professionalism. Finally, as expected, medical expertise and professionalism ratings correlated with PGY-1 "Medical Expertise" and several objective measures of student achievement, medical knowledge, and reasoning.

The article by Gilliland et al<sup>23</sup> provided additional evidence to support the notion that USU is meeting or even exceeding its Congressional mandate to develop career-committed medical military leaders. Results from a questionnaire sent to School of Medicine graduates from 1980 to 2001 who have left, retired, or are at the end of their required uniformed service commitment indicated that graduates attained a board certification rate of 95% and over 40% received their certification in a primary care specialty. In regard to military leadership positions, 62.2% have served as a chief of service and 30.1% have served as a clinic director. Operationally, nearly two-thirds had deployed for 30 days or more in support of combat missions and nearly one-third had deployed in support of humanitarian missions. Medals such as the Legion of Merit and Defense Superior Service, typically reserved for senior officer who render outstanding service, were awarded to 13.9% and 2.9% of respondents, respectively.

In an investigation of USU alumni, we queried their stated preparedness for practice using the Accreditation Council for Graduate Medical Education Competencies. Findings suggested that USU is providing a high-quality curriculum overall. Further, USU alumni believe that we are providing an effective military-unique curriculum. Finally, data support USU's success in educating students about leadership and the practice of medicine in austere environments.<sup>24</sup>

Some of the difficulties with measuring specific outcomes often relate to the limitations in our understanding of the construct being explored. Clinical reasoning is an example of such a construct that is not directly observable and thus hard to measure. Two investigations in the "after" phase pertain to clinical reasoning. In the first investigation, we explored differences between faculty and residents on multiple-choice questions using dual process measures (both reading and answering times) to inform the ongoing debate about how expert performance develops and how individuals make the best use of clinical reasoning processes.<sup>25</sup> We had faculty (board-certified internists; experts) and internal medicine residents (intermediates) answer live licensing examination multiple-choice questions (USMLE Step 2 CK and American Board of Internal Medicine Certifying Examination) while being timed. The results indicated that faculty and residents did not differ significantly in reading time, answering

time, or accuracy regardless of easy or hard items. In a second investigation, we explored a new method that combines novel assessment instruments (functional MRI and actigraphy, the latter being used to assess sleep) to determine the impact of sleep on clinical reasoning.

### **TRANSLATING SCHOLARSHIP INTO PRACTICE: “CONNECTING THE DOTS”**

In this section, we address how LTCOS is influencing USU’s educational practices and policies. In doing so, we hope to stimulate further discussion regarding how programmatic evaluation efforts within a medical school can help shape current and future policies, procedures, and faculty development. This section emphasizes findings found in Table I as well as selected examples of work from this supplement. We again highlight the impact of translation by grouping findings into the before, during, and after framework.

#### **Before Medical School (Admissions)**

A number of previous (and current) investigations focus on how we select medical students for our institution.<sup>4-9</sup> To help translate our research into actionable findings, we developed a process where we invite the dean of admissions to participate in LTCOS planning and investigation. Subsequently, the admissions dean provides interim and annual updates of pertinent LTCOS work to the admission committee members. This process gives admission committee members the opportunity to discuss how to best implement LTCOS findings. It also gives them a chance to suggest areas for further investigation. Using this process, we are able to conduct investigations for the purpose of both accreditation and scholarship, and we are able to make findings available to key institutional decision makers. For example, based on LTCOS research, the admissions committee now requests that self-reported clinical experience is supplemented by a clinical letter of recommendation based, in part, on the finding that self-reported clinical experience was not positively associated with future medical school or residency performance. Also, based in part on results from the first special edition, the admissions committee revised their evaluation form (the tertiary reviewer form) of applicants based on study findings highlighted in this special edition.

Our work has shown that the selection of alternates is no longer risky (they perform on par with regularly accepted matriculates), and the relative values of essays and prior self-reported clinical and research experiences are now being balanced against their predictive validity. Further, we have provided evidence of the MCAT’s limited predictive validity in medical school.

#### **During Medical School**

A number of investigations have centered on performance during medical school. We have used survey data from a

clinical reasoning course to revise small-group materials, preceptor orientation materials, content, and outcome measurements. An increasing interest in measuring the process of clinical reasoning has led to innovative approaches for assessing clinical reasoning, such as concept maps and CIPs,<sup>18,39</sup> both of which are directly attributable to LTCOS findings.

LTCOS research has explored the importance of authenticity balanced with cognitive load in two preclerkship courses. These findings have led to direct changes to two USU courses: Introduction to Clinical Reasoning and Integrated Clinical Skills courses. To capitalize on authenticity while being mindful of cognitive load, our students no longer discuss history and physical examination skills independent of clinical reasoning activities. A new combined session format has been introduced whereby students work in very small groups (2–3 students) conducting histories and physicals on standardized patients at our simulation center followed by a discussion of clinical reasoning much like they will be expected to perform during their clerkship years.

Many of our assessments provide “early warning signs” for future performance problems to include preclinical course performance, clerkship performance, promotion committee presentation, performance on NBME shelf examinations, and markers of burnout. We have recently encouraged other clerkships to consider adopting the evaluation framework used in internal medicine, and burnout findings are shaping our new curriculum offerings and student wellness programs.

We have learned that our OSCEs have low correlations with other OSCEs and with multiple-choice examinations. These findings are consistent with educational theory, which has led us to reinforce the need to pay attention to adequate sampling with multiple measures when assessing summative performance. Further, this work has led to revisions in our internship OSCE for USU graduates (and other medical school graduates) who rotate in the National Capital Area. For example, the internship OSCE now utilizes the same EEC rubric for assessing communication skills. Additionally, OSCE stations no longer test individual tasks, but rather foundational skills in history taking, physical examination, and clinical reasoning across multiple domains. In this way, we are better equipped to provide meaningful feedback to our interns early in their PGY-1 training.

#### **After Medical School**

The majority of the findings in Table I relate to medical school outcomes. USU is training career-committed physicians who continue to serve our country following retirement.<sup>40</sup> Additionally, we have a higher board certification rate than U.S. medical schools, and our graduates practice in all 50 states following their service commitment.

We have gathered evidence for a well-recognized medical school outcome measure (PGY-1 evaluation form, PGY-1

**TABLE I.** Recent LTCOS Studies and Their Implications for USU, in Particular, and Medical Education, More Broadly

LTCOS Studies (Years)	Key Findings	Implications
LTCOS USU alumni survey (2013) <sup>26</sup>	—Over 70% of USU graduates stay on active duty until retirement.	—USU is meeting the legislative intent of providing the U.S. military with long-term, career-committed military physicians.
LTCOS long-term study of USU medical school graduates (2012) <sup>27</sup>	—93% of medical school alumni achieve board certification, compared to 88% of graduates from other U.S. medical schools. —71% of medical school alumni still work in the federal government after military separation/retirement; they practice in all 50 states.	—USU graduates are high-quality physicians who continue to serve the country in multiple ways long after their initial service obligation is complete. —Alumni survey is administered by LTCOS every 3–5 years.
LTCOS PGY-1 program director evaluation validation (2005–2013) <sup>22,23,28</sup>	—The PD’s evaluation form has evidence of reliability and validity for assessing the professionalism and expertise of PGY-1 trainees. —Few USU graduates receive below average ratings from PDs.	—This annual form is a well-recognized medical school outcome measure.  —This tool as a key outcome for LTCOS research (matriculation and medical school studies) and accreditation (e.g., LCME, Middle States). —An annual PGY-3 PD evaluation form has been created and deployed.
LTCOS identification and prediction of learner difficulty (2007–2013) <sup>4,10,11,13,29,30</sup> and multi-institutional burnout studies (2008–2010) <sup>31,40</sup>	—Early warning signs of later difficulties in internship include: Preclinical course performance (in selected courses); Clerkship performance (more sensitive and specific than course performance); internal medicine (IM) clerkship is best predictor; Promotions committee presentation (sensitive but not specific); Performance on NBME “shelf” and USMLE examinations. —Burnout is associated with unprofessional conduct and less altruistic professional values among U.S. medical students.	—Many USU assessments can provide “early warnings” of trainees’ future performances, which has financial and potential patient-care implications.  —Other clerkships are encouraged to follow the lead of IM and consider adopting the Reporter, Interpreter, Manager, Educator framework and the use of formal evaluation sessions.  —Burnout findings are shaping new curriculum and student wellness programs.
LTCOS single and multi-institutional studies of IM career choice (2008) <sup>33</sup>	—Students value the teaching during IM clerkships but expressed serious reservations about IM as a career. —Students with more favorable impressions of IM patients, practice environment, and lifestyle are more likely to pursue IM. —Higher grades in a clerkship are associated with specialty selection.	—A national effort to address the factors affecting students’ career choice regarding IM is needed and should include interventions to modify the nature of work and lifestyle in the field.  —Clerkship performance provides a potential tool for educators in counseling students and predicting future specialty match.
LTCOS assessment of admissions criteria and processes (2012–2013) <sup>8,9,34–36</sup>	—Essays (AMCAS and USU-specific) do not predict medical school performance. —Alternates perform on par with regularly accepted matriculants. —Negative comments from tertiary reviewers are more strongly associated with future performance than positive comments.	—Admissions forms and processes have been revised. —The relative values of essays and research/clinical experiences have been balanced against their predictive validity. —The selection of alternates is no longer considered risky.
LTCOS-affiliated studies of instructional authenticity (2011–2012) <sup>37,38</sup>	—Increasing the authenticity of instruction does not significantly improve clinical reasoning performance across most students. —High-performing students may gain some benefits from highly authentic instruction (e.g., videos, virtual patients, and standardized patients).	—Collaborative investigations are underway with AAMC and FAIMER.  —Educators should balance increases in authenticity with factors such as cognitive load and learner experience.  —Revisions are being made to multiple courses based on LTCOS findings to include video instruction, new small group sessions, and the explicit incorporation of theory and novel evaluation instruments.

PD), and we have begun to gather evidence for a PGY-3 evaluation form (PGY-3 PD). The need for additional outcome measures across the medical school continuum has been cited by many, and our PGY evaluation tools are being

used in the Military Health System and have potential for use elsewhere. We have also instituted enhanced leadership components in our field exercises based on leadership findings from our flag officers.<sup>41</sup>

## MOVING FORWARD

We are expanding LTCOS' mission. LTCOS is looking into ways to expand our successful program evaluation efforts to other schools in the university. LTCOS also meets with admissions, promotions, curriculum, curricular reform, and GME committees. We believe that these emerging dialogues will help to shape the data we collect and our future investigations. Furthermore, LTCOS work is being offered as a potential capstone project for our medical students.

Furthermore, LTCOS is partnering with a number of external organizations (e.g., NBME and FAIMER) and with several other institutions as we seek to expand our work's impact in multi-institutional collaborations and investigations. LTCOS members are playing notable roles in our upcoming LCME accreditation, as we have done in prior LCME and Middle States Accreditation visits (indeed, LTCOS has been lauded in the past by both groups).

USU is also starting a new Masters and PhD in Health Professions Education, both of which are part of a faculty development initiative that has been championed by Dr. Jonathan Woodson, Assistant Secretary of Defense for Health Affairs. Students in these degree programs will have the opportunity to work with the LTCOS team, designing and conducting their own scholarly investigations.

A list of additional opportunities that are actively being pursued include the following:

- (1) Expand our use of theory in all programmatic evaluations. Theory does more than justify a study approach; it allows for appropriately targeted exploration and interpretation, and it gives us a framework for understanding how an individual study fits among the totality of educational research.
- (2) Assist with evaluations of the new curriculum. We have established a "baseline" of data through LTCOS investigations, including many of those in this special edition. We are now meeting with curriculum reform leadership to discuss ways to evaluate both the process and outcomes of our new curriculum.
- (3) Build bridges for investigation into GME and beyond. This may lead to additional outcome measures and can inform important questions for our medical school.
- (4) Strengthen the links between research and practice. LTCOS is a group that focuses on scholarship. Through meetings with stakeholders across the continuum where we share findings and discuss new ideas for exploration, we hope that additional work will translate research into practice.
- (5) Conduct prospective investigations. A limitation of LTCOS work is that it is largely retrospective and explores associations as opposed to causal relationships. As our body of work continues to grow, opportunities for prospective explorations of associations that we have uncovered could be sought to determine sources of causation.

- (6) Maintain accountability. We need to continue to explore questions that demonstrate the impact that USU has on the Military Health System and beyond.

In summary, we hope the work of the LTCOS can serve as a model for USU and potentially for others on how research can inform educational processes. Ultimately, we aim to provide tighter links between educational policies and practices and the best available evidence. We owe this to the country and to our past and present service members and their families.

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