Improving Medical Student Performance on Clinical Skills Exams

by

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ABSTRACT

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Background: *Clinical Skills Exams were created in an effort to determine the readiness of medical students to enter into residency. These exams place students in a simulated patient encounter and grade them on their proficiency in handling that encounter. The National Board of Medical Examiners (NBME) instituted the United States Medical Licensing Exam: Step 2 Clinical Skills (CS), a Clinical Skills Exam, as part of the pathway to licensing physicians.*

Local Problem: *UT Southwestern (UTSW) has noticed a rise in the number of students failing CS. The grading of CS is confidential; therefore, it has been difficult for UTSW to assess which students are at risk for failure. Through the initiation of the school administered clinical skills examination, The Objective Structured Clinical Exam (OSCE), UTSW was able to correlate poor performance on the exam with an increased likelihood of failure on the CS. This correlation has also been demonstrated in other studies. However, information on what factors lead to improved student performance on a clinical skills exam was lacking.*

Methods: *We reviewed 236 student records for the class of 2020 to ascertain what extracurricular clinical experiences students had taken in advance of the exam. We used bivariate and multivariate analysis to determine which of these experiences significantly impacted a student's OSCE exam score. The OSCE uses the same published grading criteria as the CS and is treated by the university as a proxy for the CS. The students are graded in three categories: Integrated Clinical Encounter (ICE), Spoken English-Language Proficiency (SEP) and Clinical Interpretation Skills (CIS). They are graded by their standardized patients and by faculty members overseeing the exam. The scores for each encounter are then averaged together to create a student's final*

score. We grouped the score into three categories for bivariate analysis: High Pass, Low Pass, and Fail. We then analyzed the number of students that fell in each category. We also used a separate computerized exam, the Clinical Data Interpretation (CDI) Exam, to ensure a representative sample. Box Plots, Chi Square, and multivariate analysis were used to analyze our data. We chose to use Box plots to examine the distribution of the data, and give us a starting point for analysis. From there chi-square analysis provided us with information on which intervention had the most significant effect on OSCE Scores. Finally multivariate analysis was performed to search for interaction between the interventions, and to check for a linear relationship between MOSCE and OSCE scores.

Interventions: *Mock OSCE (MOSCE), Student-Run Free Clinic (SRFC) Volunteering, and Thee Longitudinal Outpatient Orientation Clerkship (LOOC)*

Results: *As SEP scores were well above 90% for all students and no significant findings were discovered in our initial box plots, it was dropped from further analyses. Our box plots suggested a positive association of OSCE CIS and ICE subcomponent scores taking the MOSCE. This association proved to be statistically significant by linear regression, multivariable regression, and multivariable analyses. There was insignificant association of OSCE exam with participation in an SRFC by Chi Square analysis. These results may have been insignificant due to insufficient study power.*

Conclusion: *Based on these results, it appears that taking the Mock OSCE examination is associated with improved student performance in both the CIS and the ICE subcomponents of the OSCE. In light of these findings, we suggested making the Mock OSCE more widely available to all UTSW students for the 2018 administration of the exam.*

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Introduction

Every year, thousands of medical students apply to residency, and they are expected to be clinically competent enough to see patients by the first day of their residency. Throughout medical school students are often tested on their ability to respond to clinical scenarios in a multiple-choice format. In reality however, healthcare does not come in such a convenient format. To be a competent physician a resident is expected to gather a coherent history, formulate an appropriate plan based on that history, and compassionately communicate that plan with the patient. Clinical skills exams were created to judge whether or not a student possessed these essential skills before they enter residency.

To standardize the way students are assessed, the National Board of Medical Examiners created the USMLE Step 2 CS. Their stated goal: "… [to assess] the ability of examinees to apply medical clinical knowledge, skills, and attitudes essential for the provision of patient care under supervision and includes an emphasis on health promotion and disease prevention. The CS examination aspires to ensure the foundation for the safe and effective practice of medicine. The CS examination uses standardized patients to test medical students and graduates on their ability to gather information from patients, perform physical examinations, and communicate their findings to patients and colleagues."[1] Clinical skills examinations test medical students' clinical skills in several areas, broadly categorized by the USMLE into Communication and Interpersonal Skills (CIS), Integrated Clinical Encounter (ICE), and Spoken English Proficiency (SEP). The CS is graded pass/fail, based on the averaged score of the twelve simulated patient scenarios. It has very high stakes: Medical students must spend $1,285 each on this exam, there

are only five testing sites available in the United States, and tests must be taken in a brief four-month optimal testing window. According to the NBME, approximately 4% (N=844) of first-time test takers and 10% (N=78) of repeat test takers failed the 2017 exam.[1] The likelihood of a student matching to their preferred residency program is greatly decreased by failure of this exam: 70% of Residency program directors cited failure of a USMLE exam as an important factor in consideration of which students to interview.[2] Over the past few years, there has been a progressive increase in the number of University of Texas Southwestern Medical School (UTSW) students that have failed their CS examinations. Therefore, we became interested in assessing what was leading to these failures and how we could best intervene.

As a simulation of the CS examination, UTSW created the OSCE. This exam provided UTSW with a rough estimate of how a student would perform in a simulated patient encounter identical to CS. Prior literature has demonstrated that performance on locally-administered clinical skills exams did not correlate with performance on Step 2 Clinical Knowledge (CK) portion of the licensing exam or any multiple choice medical school exam, but such clinical skills examinations did capture the qualitative measures tested in the CS examination. [3]

Data from UTSW and a study by Dong et. Al, show that performance on examinations with the OSCE format can be correlated with CS Exam performance.[4,5]. In a 2017 study by Dong et. al OSCE scores in the specialties of Family Medicine and Ob/Gyn were examined with the hope of establishing their predictive validity for performance on future examinations (Step 2 CS, CK, and Step 3). This study examined 850 Uniformed Services University of health sciences students. The study's observation period encapsulated the classes of 2007 – 2011 and as all applicants

were military students, it was able to obtain performance evaluations from 88% of residency program directors. This allowed them to compare not only standardized test scores but also grades and feedback given by their evaluating physicians after the first year of residency (PGY-1). They used Clerkship OSCE scores from family medicine and Ob/Gyn as their performance measures.

Dong et. al found that scores were weakly correlated to Step 2 CS performance with bivariate analysis, but there were stronger correlations to be found in the student's post graduate year. They found that students scoring in the bottom ten percent of Ob/Gyn OSCE examinees had about 5 times higher risk of receiving a poor evaluation on professionalism. There were similar findings found with analysis of the family medicine OSCE scores as well. Their conclusion was that OSCEs may be more predictive of performance in a student's post graduate year, and that due to the weak correlation with standardized tests, that OSCEs may be a better measure of student performance than standardized tests were.

Unfortunately Dong et al. did not report the Chi-square analyses for student's performance on OSCE vs. performance on Step 2 CS and CK. However, the authors of the study report that it was the first of its kind to attempt to measure the predictive validity of OSCE scores to student performance. It was a large study with a powerful conclusion: it is possible that university-held OSCE scores are a better measure of a student's clinical competence.

In academics there is a large central debate over the role of standardized testing. It is meant to serve as an objective measure of a student's performance relative to his/her peers and to establish a benchmark for where a student is in their education. However, one of the biggest

criticisms of standardized tests like CS is that rather than test a student's actual skill in a real-world setting, they simply test the student's ability to take the exam. It is possible then that the only interventions capable of improving our students' scores are those that increase familiarity with the test itself. The aforementioned Dong study provides conflicting evidence for this claim. OSCE scores only weakly correlate to the CS, but they provide compelling evidence for their ability to measure performance outcomes in a resident's first year. While there are a number of studies dedicated to correlating OSCE performance with standardized test scores [3,5-9] few if any outside of the 2017 Dong study attempted to tie those to competence outside of the testing environment.

In medical education, assessments are geared towards ensuring medical students are clinically competent and can be trusted with patient care. Therefore, standardized tests in medicine have much higher stakes. This in turn increases the necessity to have them accurately assess which students are not prepared for the clinical encounter with a patient. For the author, the ideal clinical skills exam is one that ensures passing students meet minimum requirements for working in the healthcare setting. These are getting a coherent and complete patient history, performing a focused physical examination based upon that history, and producing a rational plan of action with a reasonable differential diagnosis.

UTSW's goal is to train highly skilled physicians and clinical skills examinations are meant to be a measure of a student's progress to that goal. All students experience the UTSW medical curriculum, but not all of them go on to do well on their OSCEs or to pass step 2 CS. Therefore, it was important to identify the factors that contributed to these students' underperformance.

When a student underperforms on an OSCE, administration remediates the student in their weak areas to prevent failure in Clerkship Rotations or CS Exam. It is believed this intervention is effective, however this is a tertiary intervention, which cannot occur until the student takes the OSCE a full year and a half into medical school. The effect this remediation has on a student's performance has not been formally studied at this time. To better understand the factors that go into a student's OSCE performance it was necessary to look at the opportunities each student could choose in preparation for it. We chose to examine the extracurricular clinical opportunities the students had and investigated the impact they may have had on a student's performance.

The OSCE exam is a simulation of the clinical environment and also of the Step 2 CS examination. It follows then that students with more experience in the clinical environment should obtain higher scores on the OSCE, and in turn those with increased clinical experience should be able to obtain a higher score on Step 2 CS. The 2017 Dong T. et al study found that OSCE scores correlated with scores on the CS, Step 3 and beyond [5]. Granting validity to this line of reasoning.

To explore which interventions were effective, we analyzed optional, extracurricular, clinical experiences that take place before the OSCE to determine which were best associated with student success on the OSCE. These interventions were the Mock OSCE (MOSCE), student-run free clinics (SRFCs), and the Longitudinal Outpatient Orientation Clerkship (LOOC). The Peer-led MOSCE had been shown to improve student performance on OSCE examinations [10,11] and was available to a limited number of students. Clinical Experience has been shown to improve

performance in patient communication and clinical reasoning [12], which are skills assessed by an OSCE examination. It had also been demonstrated that medical students who take OSCE examinations at the end of their clinical rotations do significantly better than those who take them before, further supporting the idea that clinical experience yields improved OSCE scores. [7]

Our study sought to further delve into the OSCE examination itself. We hoped to discover what specific factors lead to a student's underperformance on a clinical skills test like the OSCE. Using that information, we planned to improve student performance and reduce failures on clinical skills examinations.

Rationale

Our goal was to produce more clinically competent medical students that perform well on the CS examination using the knowledge gathered from the current interventions and to expand on the most effective ones. As each intervention is thought to increase a student's skill in handling patients, and the OSCE is thought to assess that skill, we hypothesize students who took advantage of these extracurricular clinical experiences would perform better than those who did not.

Aim

Our project aimed to improve the overall student performance on the CIS and ICE sections of the OSCE by an average of 5 percentage points while decreasing the variability of scores. The next OSCE was in Fall 2018, so our project was active from January 2 - December 2, 2018. We adjusted this aim to: reduce the number of failures on the OSCE's CIS and ICE sections to zero by December 2, 2018.The process begins when the student starts at UTSW medical school and ends when they take the OSCE exam during the first semester of their second year. This is

important because OSCE scores are a measure of the clinical expertise; therefore, improved scores indicate better-trained physicians, who should perform better on the USMLE Step 2 Clinical Skills examination. This aligns with UTSW's goal of training highly skilled physicians.

Method

We used a natural experiment study design, where self-selected students volunteered for a variety of pre-OSCE, optional clinical experiences. Our independent variables were dichotomous indicators of whether a student participated in the experience(s). In some cases, when available, we also used continuous indicators for performance level, like number of times a student volunteered at a free clinic. Our dependent variable was the students' performance on the subcomponents of the OSCE. We used a measure of clinical reasoning as a variable to try to adjust for selection bias, described more below.

The UTSW OSCE examination is a near-complete simulation of the CS exam and has been described elsewhere[13,14] Its method of using multiple patient encounters to assess a student's performance has been found to be internally valid, even if some stations are more difficult than others. [15]

We used the Clinical Data Interpretation (CDI) test as an independent measure of clinical skills, specifically clinical reasoning; students took this test shortly after the OSCE. Scores from the CDI should best correlate with the ICE component of the OSCE, as this CS component includes an assessment of clinical reasoning. The CDI was administered as a low stakes test. That is, students' grades are not impacted by their CDI score, and they could take it at their leisure by a deadline.

We created a process map that outlines each optional clinical experience offered by UT Southwestern to medical students (Figure 1). This figure also serves as a consort diagram,

listing the approximate percentage of students out of the total class of 2020 (N=232) participating in each experience during their three pre-clerkship semesters.

Optional Clinical Experiences

The optional clinical experiences included in this study are SRFC, the MOSCE, and LOOC. A description of each intervention is provided below.

Student-Run Free Clinics (SRFCs)

While at an SRFC, students interact with real patients under the guidance of a senior medical student and an attending physician. Working with a senior medical student has been shown to enhance the medical students' clinical competence and confidence when dealing with patients in a clinical encounter.[10] The students are expected to write a coherent note and give an organized presentation to the attending physician. There are currently eight SRFCs. Each of the SRFCs at UTSW offers a different teaching format that is tailored to that clinic's patient population. The dataset captured student participation in SRFCs as both dichotomous (participated, did not participate) and continuous (number of times participated) variables in separate analyses.

Longitudinal Outpatient Orientation Clerkship (LOOC)

LOOC is an opportunity for students to care for patients in an outpatient setting in advance of their clinical rotations. They work with a preceptor in his/her clinic one-half day each week during two Pre-Clerkship semesters. They learn patient care strategies as well as clinical skills for their particular patient. At this time, very few students (24 in the class of 2020) took

advantage of this opportunity due to limited funding and preceptor availability. The dataset captured participation in LOOCs as a dichotomous variable (participated, did not participate).

Mock Objective Standardized Clinical Exam (MOSCE)

The MOSCE is set up to simulate the OSCE. It used SPs and students participating in the MOSCE were provided with feedback on their performance and were exposed to the format of the OSCE. The dataset captured MOSCE participation in both dichotomous and continuous (score on subcomponent) variables.

Clinical Data Interpretation (CDI) Test

The CDI is represented as a continuous variable in the form of a percentage. The CDI is a simple percentile based on the number of correct answers out of 71 questions.

Analysis

The OSCE and CDI scores were our dependent variables. For some analyses, we grouped OSCE scores into three ordinal variables: High Pass, Low Pass, and failure. We considered any student with a passing score at or above the 20th percentile of the group of passing students a "High Pass." Any passing student below the 20th percentile in the passing group was considered "Low Pass." We defined failure as scoring below the usual OSCE cut-off levels for the CIS and the ICE. OSCE scores were also analyzed as continuous variables for linear and multivariate regression and two-sample t-tests. We characterized the optional clinical experiences as dichotomous variables (either a student participated or did not).

We used box-plots to assess the distribution of our data. We followed this with chi-square analyses and then MANOVA to see which clinical experiences were most associated with

success or failure of the dependent variables. Finally, we subjected the MOSCE and OSCE to linear regression, as both exams have continuous data sets. We also performed t-tests comparing the scores of students taking the MOSCE and those who did not.

To evaluate for volunteer/selection bias, we used the CDI Score. We performed a chi-square test comparing the CDI scores of students who took the MOSCE to students not taking the MOSCE to see if "high-achievers" were more or less likely to participate in this optional clinical activity. We also compared the CDI score to the OSCE scores using linear regression to see if there was an association between scoring well on CDI and OSCE.

We performed all data analyses with SAS 9.4 for Windows (SAS Institute Inc., Cary, NC, USA).

Ethical Considerations

In compliance with FERPA, all student data was de-identified, and each student was given a unique identifier known only to a third-party data broker not involved with the research team. As this study is a Quality Improvement study, Institutional Research Board Review was waived by the UTSW IRB.

Results

The box plots did not reveal a significant difference in OSCE score medians or variance for LOOC or SRFCs. CDI scores were shown to have no correlation with either the ICE or CIS component of the OSCE. SEP had no significant effect on CIS or ICE Scores. There was a decrease in the variance of OSCE scores for students who took the MOSCE which was most pronounced on the CIS score. The score range decreased by about 10 percentage points and the inter-quartile range decreased from 8 to 5 percentage points. Q1 for those taking the MOSCE (90.9 percentage points) was also above the median score for those not taking the MOSCE (89.9 % percentage points).

In searching for an effect of multiple interventions on scores, we created box plots as seen in figure 4. Median scores for students participating in no interventions were the lowest (CIS: 88.40%, IQR:7.90%; ICE: 53.84%, IQR: 8.00%). There was a small increase in median score for students only involved in an SRFC (CIS: 91.05%, IQR:8.10%; ICE: 55.05%, IQR: 7.53), but the largest increase in median score was seen for students involved in both MOSCE and SRFCs (CIS: 93.85%, IQR:7.9%; ICE 57.95, IQR: 9.53%). However, this increase was not significantly higher than that seen for students taking the MOSCE only (CIS: 93.40%, IQR:6.60%; ICE: 58.70%, IQR: 6.30%).

In our chi-square of the MOSCE we found that students taking the MOSCE were more likely to get a High pass on the OSCE than those who did not ($p<.0001$) for the CIS portion. A chi-square of the ICE revealed that students were more likely to get a high pass than those who did not ($p=.0068$) as well.

We began testing the strength of association between participation in the interventions and improvement in OSCE score using linear regression and analysis of variance. A high CDI score was again found to have no correlation with a high CIS Score (R^2:0.0026, F: 0.59, p: 0.4428) or ICE score (R^2: 0.0119, F: 2.75, p: 0.0988). SEP score was again found to have no relationship with either CIS or ICE score. There was no association found in a linear regression for the number of hours spent volunteering at an SRFC and scores on the OSCE exam. A higher MOSCE subcomponent score also yielded no association with its corresponding OSCE subcomponents, as can be seen in Figures 2 and 3.

We performed two-sample t-tests on two populations: those who took the MOSCE and those who did not. For both CIS and ICE, the t-test returned as significant (P<.0001 and P=.0003) indicating a significant difference in the population means.

Discussion

The aim of the project was initially to improve OSCE scores by 5 percentage points per student. As the project evolved, our aim was modified to seeking a reduction in the failure rate of the OSCE exam to zero. At this time, it is apparent that taking the MOSCE is associated with higher OSCE scores, as predicted by previous studies [10,11]. There is no obvious linear relationship between the other interventions and OSCE performance. Due to the extremely small number of students participating in LOOC, we were unable to accurately judge its effects on OSCE scores. Further bivariate analyses did not reveal any association not already confirmed by the Chi-square test: That participation in the MOSCE was associated with an increase in OSCE score. All other interventions failed to demonstrate any effect on a student's OSCE score. As shown in figures 2 and 3, an increase in MOSCE subcomponent score is not associated with an increase in the corresponding OSCE subcomponent. However, figures 2 and 3 also show that the vast majority of students scored better on their OSCE than on their MOSCE, as demonstrated by most points falling beneath the Y=X dotted line where the x -axis is OSCE score and the y-axis is the same student's score on the MOSCE.

Students who participated in multiple interventions did show a decrease in the range of scores they received and an increase in median score on the CIS component of the exam. However, these changes were just as strong for students taking the MOSCE only. For the ICE, student scores show the most significant decrease in variability in the MOSCE only condition, which also held the highest median score. Further indicating that the MOSCE is the most effective intervention in place.

Interpretation

While figures 2 and 3 show no obvious association of between OSCE and MOSCE subcomponent scores, this is due to the significant distortion caused by students who do extremely poorly greatly increasing their scores on the OSCE. For the CIS subcomponent Students consistently scored higher on their subsequent OSCE until they reached a MOSCE score of above 90%. For the cohort of students scoring above 90% the decreases in subsequent OSCE score were not as pronounced as the increases seen in students who scored poorly on the MOSCE. This may be due to students receiving a high score being overconfident in their ability to perform well on the OSCE. The is also a pass/fail exam, so a score of 90% on the MOSCE would greatly reduce a student's fear of failing the OSCE exam.

As demonstrated in figure 4, partaking in multiple interventions was not found to be significantly better than taking the MOSCE alone, indicating that taking the MOSCE plays the largest role in students performing well on the OSCE.

Based on these results, no intervention outside of the MOSCE made a significant impact in student scores. While other studies [3,7,12] pointed to the potential for improvement in OSCE scores with increased exposure to clinical settings this effect was not demonstrated. The effect of the MOSCE was notably more pronounced on the CIS subcomponent than on the ICE subcomponent with the ICE subcomponent in general showing much less variability as various conditions were applied to scores.

This is analogous to many of the findings Dong et. al had in regard to OSCE performance being predictive of CS performance. OSCEs are simulations of the patient environment much as CS is.

In turn, the MOSCE is a simulation of the OSCE. This finding can be colloquially summarized as "practice makes perfect", and giving students more practice in an CS-structured environment can be expected to be associated with better performance on the CS.

Limitations

1. Outcome measure validity: Since the MOSCE has been the only thing that has been shown to help with OSCE scores, this calls to question whether the OSCE actually measures "clinical skill". It is possible that it simply measures the ability of students to take the OSCE.

2. We do not have time-stamped data for when a student took the OSCE, so it was not possible to measure the effect of taking the OSCE after other students had already taken it.

3. Limited number of students participating in LOOC (n = 34 out of 468 students) prevented any meaningful analysis from being made.

4. MOSCE participation is limited by number of spots but it is also a program that students have to volunteer for. SRFCs are also programs students must volunteer for introducing the potential for selection bias for high-achieving students. This was controlled for using CDI a test, but this test may not accurately capture "high-achievers".

5. Data on MOSCE and SRFC participation only goes back 2 years with a total of 468 students. There were no scores for the class of 2019, meaning that only 232 students had a complete data set.

6. After taking the OSCE exam students later take the Clerkship OSCE (COSCE) exam which is set up during spring of their third year after approximately a year of rotations. The relationship between the OSCE and COSCE have yet to be studied.

As participation in the MOSCE has shown through various statistical analyses to improve a student's OSCE score, this is the intervention we will be investing in. To this end, for the class of 2021 we plan to make the MOSCE available to the entire class. After students take the OSCE, we will repeat our analyses to see if the pattern holds. We will also use the data obtained to see if we can more accurately predict which students are in danger of performing poorly on the OSCE exam based on MOSCE scores. There has not been any statistically significant impact of any other intervention on OSCE score outcomes. One conclusion that can be drawn from this is that the MOSCE acts as a simulation of the OSCE and that the OSCE only tests how well a student will perform on in a simulated patient interaction. This means that most UTSW medical students enter into the exam possessing the necessary skills to succeed on the OSCE but lack the procedural knowledge of how to navigate the OSCE exam. As the taking the MOSCE has been associated in improvement on the OSCE, it is possible that taking the OSCE leads to improvement on the CS exam concluded. It is also worth exploring whether taking more OSCE type exams closer to a student's appointed CS exam time would lead to lower failure rates on the CS for the study population.

It is a somewhat discouraging finding that increased participation in other optional interventions that place students in front of actual patients had no associated increase in OSCE performance.

The final and most cynical conclusion that we can draw from these results is that the OSCE exam (and by extension, CS) does not actually measure how well a student would perform in a real-life clinical environment. There was no association found between number of hours spent volunteering at an SRFC, participation in LOOC, or participating in multiple interventions and greater success on the OSCE. If we broadly define these interventions as "hands-on" experience, then having more of this hands-on experience does not translate to improved student performance.

It is worth mentioning however that these skills are likely better measured by an CS-formatted exam than they are by a multiple-choice exam as shown by [reference]. This also points to the importance of keeping CS-type examinations pass/fail rather than using the incremental grading scale as seen in the Clinical Knowledge (CK) Step 2 exam. A student needs to be able to function at a basic level of clinical competence to successfully interact with patients. If we can ensure through simulated exams of the CS (MOSCE, OSCE, and later COSCE) that students understand the format of the exam we would be able to reduce the confounding effect this causes. If we remove this confounder we can begin to better assess whether a student is clinically competent, as is the stated intention of the exam.

As the class of 2021 and future classes take the OSCE exam it would be of interest to see if any new conclusions can be drawn from their data. Our inability to analyze LOOC was based on its relatively small sample size, and with more students we will gain more power to analyze their data. It would also be of interests to see how OSCE performance correlates with Clerkship

performance, and if OSCE scores correlate to the Clerkship OSCE which is taken after students have completed the majority of their clerkships.

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Table 1: Table of Acronyms

Name	Acronym	Description
Student-Run Free Clinic	SRFC	Clinical Volunteering opportunity run by students
Objective Structured Clinical Exam	OSCE	Exam taken by second year medical students to measure their clinical skill
Mock OSCE	MOSCE	Mock Exam of above
Communication and Interpersonal Skills	CIS	Sub-component of the OSCE exam that measures a student's ability to effectively communicate with patients
Integrated Clinical Encounter	ICE	Sub-component of the OSCE exam that measures a student's ability to use apply their clinical knowledge to the patient encounter
Spoken English-language Proficiency	SEP	Sub-component of the OSCE exam that measures a student's skill with the English language
Step 2 Clinical Skills Exam	CS	USMLE standardized test geared at measuring a student's clinical skills
Clinical Data Interpretation Exam	CDI Exam	Electronic examination administered by UT Southwestern after the OSCE to measure a student's skill at applying clinical knowledge to patient cases

TABLE 2: STRENGTH OF ASSOCIATION OF INTERVENTION PARTICIPATION WITH OSCE CIS AND ICE HIGH PASS SCORES

	CIS		ICE	
Intervention	**OR of High Pass**	**p-value**	**OR of High Pass**	**p-value**
MOSCE	4.55	*p=0.0002*	2.38	*P=0.011*
SRFC	1.82	P=0.07	1.73	P=0.09
LOOC	3.04	P=0.12	3.04	P=0.11
Table 2 compares the odds ratios of students scoring better than a low pass based off of the intervention they participated in. All interventions show a positive OR if a student participated, but only the MOSCE had a significant result.				

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Figure 1

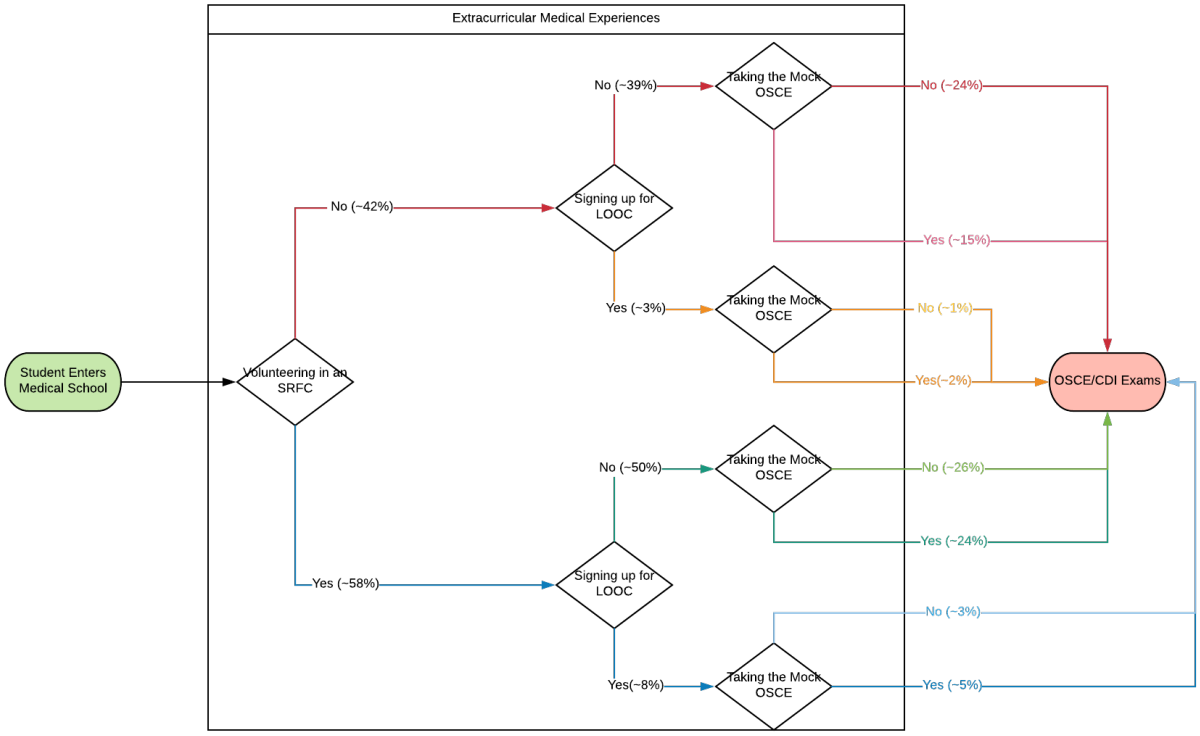


Figure 1 is a process map of the interventions in chronological order from left to right as they are offered by UT Southwestern. Next to each pathway is the approximate percentage of students out of the total class of 2020 that followed that path. As the OSCE and CDI exams are measures of clinical ability, partaking in an extracurricular clinical experience should theoretically enhance that student's clinical ability. As a student navigates medical school at UT Southwestern, their first chance to engage in an extracurricular clinical experience comes in the form of volunteering at an SRFC. They are later given the option to sign up to participate in the LOOC program, and their final opportunity comes with the release of the MOSCE sign-up sheet.

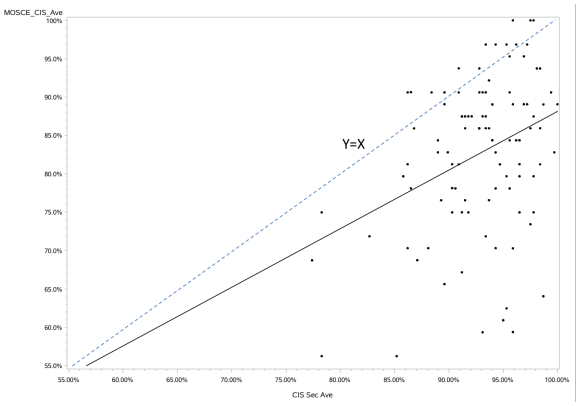
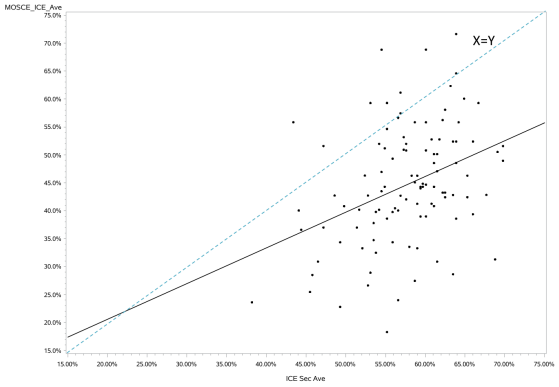
Figure 2: Linear Regression, OSCE vs MOSCE CIS	Figure 3: Linear Regression, OSCE vs MOSCE CIS
	
The Solid line represents the best fit line, for this graph R^2= .34; The dotted line is to show Y=X. The X axis is the OSCE score, and the Y-axis is the MOSCE score. Due to the number of students who performed poorly on the MOSCE going on to perform well on the OSCE, no significant relationship could be drawn. If a student falls below the Y=X line, they have scored better on the OSCE than the MOSCE. No student crosses above this line until scoring at least 90% on the MOSCE CIS	The Solid line represents the best fit line, for this graph R^2= .37; The dotted line is to show Y=X. As stated in figure 2, due to the number of students who performed poorly on the MOSCE going on to perform well on the OSCE, no significant relationship could be drawn. If a student falls below the Y=X line, they have scored better on the OSCE than the MOSCE. No student crosses above this line until scoring at least 50% on the MOSCE ICE

Figure 4: The effect of multiple interventions on distribution of OSCE scores.

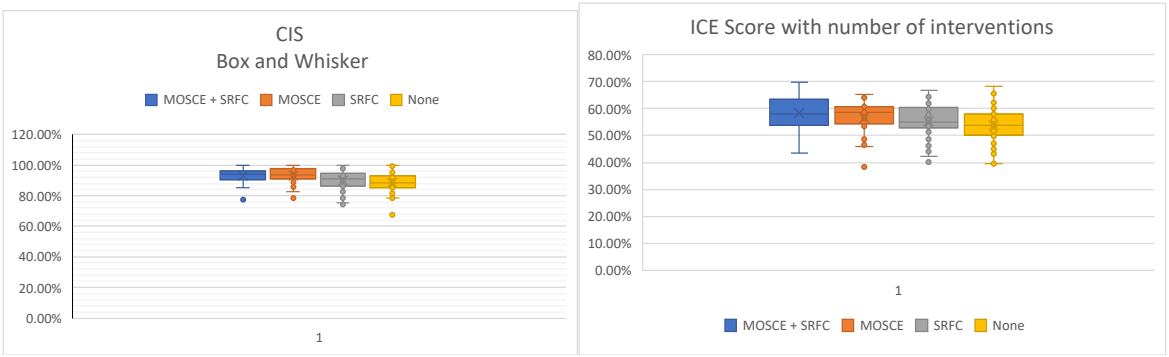


Figure 4 analyzed the effect on the distribution of OSCE scores when students undertook multiple interventions. As demonstrated in the figure students undertaking the MOSCE had the smallest range of scores with the highest median scores for both the CIS and ICE.

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Vitae

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EDUCATION

2015-2019 University of Texas Southwestern University

Medical Doctor, Distinction in Quality Improvement

2014-2015 University of North Texas Health Science Center (UNTHSC)

Masters of Medical Science

2007-2011 Washington University in Saint Louis

Bachelor of Arts, Psychology

Minors: Mathematics and Public Health

AWARDS & HONORS

Date	Title/Description
Spring 2011	Washington University in Saint Louis Dance-off Competition Champion
Summer 2016	Summer Research Grant for Emergency Medicine Quality Improvement Flow Project
Spring 2017	Southwestern Academy of Teachers Grant
Fall 2017	NAPCRG Annual Meeting Oral and Poster Presentation - Student-Run Free Clinics: Enhancing the Ability to Educate Medical Students and Collaborate with Our Communities
Spring 2018	Induction into the Gold Humanism Honor Society

LEADERSHIP

Dates	Activity and Description

2018-2019	**Gold Humanism and Honor Society Curriculum Chair:** Committee planned various educational experiences for students to help them deliver patient-centered humanistic care. • Ran the Humanism in Medicine elective offered to students in the fall semester. • Currently developing Journal Club training activity for medical students with patient-centered medicine focus
2015-2016	**Free Clinic Committee (Clinic Coordinator):** The Free Clinic Committee serves as the advisory board for UT Southwestern's Student-Run Free Clinic (SRFC). The Clinic Coordinator is one of two elected positions of the free clinic committee (whose representatives are first elected by their respective clinic's managers). • Created the current volunteering system in place that allows for fair and equitable distribution of volunteering opportunities for student learners. This system also tracks student volunteering hours. • Co-authored a grant for the Southwestern Academy of Teachers which provided direct funding for the first time to the Free Clinics of UT Southwestern • Developed and held 3 medical student clinical skills training workshops to teach students basic skills for volunteering in the free clinics • Organized vaccination drives
2015-2016	**Institute for Health Improvement (Vice-President, inter-professional engagement):** As one of the IHI vice-presidents I was in charge of engaging the other UTSW schools outside of the medical class in Quality Improvement. • Established a PA class representative for IHI to further enhance inter-professional engagement.
2015-2016	**UTSW Multicultural Show (Choreographer):** • Choreographed the Latin dance routine for UTSW's Latin Medical Student Association. Students performed this dance at the Annual Multicultural show for recently accepted medical students.
2014 – 2015	**UNTHSC Curriculum Representative:** • Elected to position after interviewing with program administration. • Co-authored standardized E-form for students to submit feedback for course faculty • Met with administrators twice monthly to address student concerns about the curriculum. • Addressed professionalism concerns faculty held with student body and streamlined the feedback process
2013-2014	**Leonard Middle School (Head Boys Track Coach):** Track and field head coach for Leonard Middle School were I also taught math. • Supervised training of middle school athletes as well as disciplined students when there were teaching concerns in a constructive manner. • Held study hall for struggling athletes

	• Supervised the distance competitors while serving as leader of the 3 other coaches. • Supported Girls Track Team after Head Girls coach stepped down
2012-2013	**Leonard Middle School (Distance Events Track Coach; Head 7th Grade Boys football coach, Wide Receiver trainer):** Track as described above. • Was 7th grade boys head football coach for games and trained all wide receivers for 7th and 8th grade at Leonard Middle School. • Held weekly study hall for athletes and assisted students with difficult topics. • Assisted teachers with difficult students.

COMMUNITY SERVICE

2016-Present	**UTSW Bryan MD Williams Student Center (Salsa Instructor)**: Provide free lessons weekly to medical students to encourage student wellness.
2015 - 2017	**Union Gospel Missions Free Clinic (Clinic Manager):** While also serving as the Clinic Coordinator for the SRFCs, I was a clinic manager for the UGM clinics. UGM's patient population is homeless men, women and children. I assisted in teaching first year medical students clinical techniques and how to be appropriate during patient interviews. I also helped maintain the clinic during operating hours and assisted the supervising physician with documentation and medication dispensation.
2015 - 2016	**UTSW Student-Run Free Clinic (Volunteer):** Served as a volunteer in both the Monday and UGM clinics. Dispensed free healthcare to the medically underserved and disadvantaged
2014-2015	**Texas Academy of Biomedical Sciences (TABS) After School Program (student volunteer):** Volunteered at TABS after school to tutor high school students in advanced mathematics and science topics including: Biology, Chemistry, Calculus, and Physics.
2011 – 2014	**Fort Worth ISD After School Program** (Mathematics Teacher): After school would assist students with mathematics and homework help in select topics. Worked in an unofficial capacity due to limited funding.

TEACHING & WORK EXPERIENCE

2012-2016	**University of Texas at Dallas (SPYCD Salsa Instructor):** Gave weekly salsa lessons to UTD students
Summer 2015	**Duke Talent Identification Program (Neuropsychology Professor)**: Taught a college level intro course in Neuropsychology to Advanced High School Students. Designed a syllabus as well as all lectures, created a project-based course culminating in an end of the year clinical exam that had students creatively diagnose various neurological and psychological conditions with mock patients.

2011 - 2014	**Fort Worth ISD (Mathematics Teacher)**: Taught high school and middle school math for Fort Worth ISD to underprivileged urban youth.

Hobbies & Interests: Professional salsa dancer and instructor, amateur pianist, half-marathon runner