FACTORS INFLUENCING CARDIOVASCULAR EXAMINATION

PERFORMANCE BY MEDICAL STUDENTS

A Thesis Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Master of Education

by

Roozbeh Sharif

May 2013

FACTORS INFLUENCING CARDIOVASCULAR EXAMINATION

PERFORMANCE BY MEDICAL STUDENTS

A Thesis for the Degree

Master of Education

by

Roozbeh Sharif

Approved by Thesis Committee:

_____

Dr. Bernard R. Robin, Chairperson

_____

Dr. F. Richard Olenchak, Committee Member

_____

Dr. Sara G. McNeil, Committee Member

_____

Dr. Robert H. McPherson, Dean
College of Education

May 2013

Acknowledgement

I am grateful to my parents and teachers who have always been supporting throughout my life without any hesitation. I would like to express my appreciation to Dr. Robin and Dr. McNeil, for inspiring me in April 2010 to become a medical educator and for their efforts thereafter. Also, I would like to thank Dr. Olenchak who kindly agreed to serve on my thesis committee.

Last but not least, I appreciate Dr. Karen Szauter who graciously agreed to share her archival data with me for the sake of promoting higher quality medical education.

I had the luxury of working with some amazing people throughout my life. I have been inspired by great educators since my elementary school. One important lesson that I learnt is: "*Studying Medicine taught me how to save one's life, but by studying Education I learnt how I can change lives.*"

Sharif, Roozbeh. "Factors Influencing Cardiovascular Examination Performance by
      Medical Students." Unpublished Master of Education Thesis, University of Houston,
      May 2013.

Abstract

There has been a recent renewed interest in physical examination (PE) skills
among medical trainees. While many studies focus on the ability of trainees to interpret
findings, few have actually addressed PE techniques and factors that influence PE
performance. The purpose of this study was to explore potential factors influencing the
technique of the cardiovascular PE by medical students. Fourth year medical students
(n=184) were observed during a clinical skills assessment exercise with standardized
patients (n=368). Using logistic regression, the researcher investigated the association
between two variables and the completeness of the cardiac exam: the patient's position
(supine or sitting) and patient gender. Complete heart examination was conducted in
52.5% of encounters, which was less often performed on female patients ($p=0.005$);
female students more frequently conducted a complete examination ($p<0.05$). The
analysis also demonstrated that patient position (supine or mixed supine and sitting
compared to sitting only) influenced completeness of exam ($p<0.001$). The current study
showed that nearly half of the patients did not have a complete heart examination. The
gender of both the patient and the student and the position of the examiner during the
exam appeared to have an impact on PE technique. Findings support the need for closer
attention to PE techniques during medical training. The utilization of tools and techniques
such as Web 2.0 tools could improve the standard cardiovascular examination.
Keywords: physical examination skills, medical students, heart examination

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Cardiovascular disease (CVD) is now the most common cause of death in the world (World Health Organization, 2013). Before 1900, infectious diseases and malnutrition were the most common causes, and CVD was responsible for less than 10% of all deaths. Currently, CVD causes approximately 17.3 million (30%) deaths worldwide, including 49% of the premature deaths in high-income countries and about 42% of the premature deaths in low-income countries. Deaths from CVD are declining in high-income countries but increasing at a fast rate in low and middle-income countries (World Health Organization, 2011).

The practice of medicine has significantly changed over the last 40 years. The advent of molecular genetics, molecular biology, and molecular pathophysiology, sophisticated new imaging techniques, and advances in bioinformatics and information technology have contributed to an explosion of scientific information that has fundamentally changed the way physicians define, diagnose, treat, and prevent disease. This growth of scientific knowledge is ongoing and accelerating. In addition, the widespread use of electronic medical records and the Internet have altered the way doctors practice medicine and exchange information.

Statement of the Problem

As today's physicians struggle to integrate copious amounts of scientific knowledge into everyday practice, it is important to remember that the ultimate goal of medicine is to prevent disease and treat sick patients. When a patient poses challenging

clinical problems, an effective physician must be able to identify the crucial elements in a complex history and physical examination; order the appropriate laboratory, imaging, and diagnostic tests; and extract the key results from the crowded computer printouts of data to determine what to treat (Drazner, Rame, Stevenson, & Dries, 2001).

Accurate diagnosis constitutes the basic fundamental step in appropriate treatment. The purpose of the physical examination is to identify the physical signs of disease. The significance of these objective indications of disease is enhanced when they confirm a functional or structural change already suggested by the patient's history. At times, however, the physical signs may be the only evidence of disease. The physical examination should be performed methodically and thoroughly, with consideration for the patient's comfort and modesty (Markel, 2006).

Although attention is often directed by the history to the diseased organ or part of the body, the examination of a new patient must extend from head to toe in an objective search for abnormalities. Unless the physical examination is systematic and performed in a consistent manner from patient to patient, important segments may be omitted inadvertently. The results of the examination, like the details of the history, should be recorded at the time they are elicited, not hours later, when they are subject to the distortions of memory. Skills in physical diagnosis are acquired with experience, but it is not merely technique that determines success in eliciting signs of disease.

The approach to a patient with known or suspected cardiovascular disease begins with the time-honored traditions of a directed history and a targeted physical examination. The evidence base that links the findings from the history and physical examination to the presence, severity, and prognosis of cardiovascular disease has been

established most rigorously for coronary artery disease, heart failure, and valvular heart disease (Roy, Minor, Brookhart, & Choudhry, 2007).

It is noteworthy that despite all advances in the medical technology, the role of correct physical examination is increasingly the center of attention. Particularly, considering the rising costs of the medical services, medical educators have become more focused on avoiding unnecessary diagnostic interventions. In recent years, there has been a renewed interest in developing better physical examination skills among medical trainees, including students, residents, and even cardiovascular medicine fellows.

Despite the emphasis on the physical examination (PE), using different physical examination techniques have decreased among medical professionals, and there have been several reports of overusing the technology and not relying on the PE findings. While many studies focus on the ability of trainees to interpret findings, few have actually addressed physical examination techniques and factors impacting PE performance. Particularly, there are few published studies that specifically investigate the factors that influence the performance of the cardiovascular examination by trainees.

Purpose of the Study

In this study, the researcher evaluated the quality of the cardiovascular examination among fourth-year medical students at the University of Texas Medical Branch (UTMB). The study also focused on assessing whether the patient's gender was associated with the quality of cardiovascular physical examination. The researcher also examined the impact of the medical student's gender on the completion of the cardiovascular examination. Finally, the researcher investigated whether patient's position correlated with the quality of the cardiovascular examination.

Research Questions

The study focused on the following questions regarding the cardiovascular examination by the fourth-year medical students at the University of Texas Medical Branch in Galveston, Texas:

1. What percentage of the medical students conducts heart auscultation on each individual points of interest in cardiovascular examination?

2. What percentage of the medical students conducts a comprehensive cardiovascular physical examination in their clinical encounters?

3. Is patient's gender associated with conducting a heart physical examination on all points of interest?

4. Does the medical student's gender correlate with conducting cardiovascular physical examination?

5. Is a patient's position associated with the quality of cardiovascular examinations among the medical students?

The Significance of the Problem

Heart examination is a pivotal part of the physical examination. Many diseases could be diagnosed just based on the physical examinations. For each individual patient with presumed cardiovascular condition, the cost of medical diagnostic interventions adds up somewhere between hundreds to thousands of dollars. Accurate physical examination can result in faster and more accurate diagnosis. In addition, it can help us to use the healthcare resources more efficiently and become more cost-effective. Like many other things, good education is the fundamental step in this process. The current research study investigated the status of quality of the cardiovascular physical examination among

the medical students at UTMB. The study was conducted as a double blind experiment, meaning that neither students nor the simulated patients knew anything about the purpose of the study.

Additionally, cardiovascular examinations are conducted by many different specialists, from surgeons to anesthesiologist to cardiologists. Therefore, addressing the quality of physical examination of the cardiovascular system may improve the overall quality of care amongst several specialties. The researcher believes that implementation of high quality skills in heart physical examination can prevent unnecessary tests and procedures. If medical students learn these techniques appropriately at early stages in their education, they could possibly become more effective diagnosticians for the rest of their professional careers.

Educational Value of the Study

Doing a focused, time-efficient cardiovascular examination, which addresses the most important clinically relevant issues, is a skill that improves over time. However, medical students need to learn the fundamental knowledge of how one should perform a cardiovascular examination as soon as possible. In this study, the researcher was interested in understanding the frequency of standardized cardiovascular examination among young medical students and to understand which factors affects the exam. In other words, this study addressed specific questions about the quality of cardiovascular examination, the patient-physician gender interaction as well as the patient's position. Such studies are usually hard to conduct, as the patients and situations are different. However, the researcher was able to create similar conditions for all students. All of the simulated patients used a similar manual and had similar presentations for all of the

medical students who examined them.

Another educational value of this project was in assessing how well the instructors for this procedure were performing the training. The current project was the first one that specifically focuses on the quality of heart physical examination. For the next stage in the project, appropriate training could be developed to mitigate any influences caused by gender or position. The results of this project can highlight some of the areas that need improvement in this field.

Summary

State of the art physical examination is a crucial step in high quality patient care. In the diagnosis of cardiovascular disease, which is the most common cause of death worldwide, a thorough physical examination has a pivotal role. Utilizing different physical examination techniques has decreased among medical professionals, and overuse of expensive and sophisticated medical tests has surged over the last two decades. While many studies have focused on the ability of trainees to interpret findings, few have actually addressed physical examination techniques and factors impacting PE performance. Particularly, there have not been any published studies that specifically investigate the factors that impact the cardiovascular examination performance by medical students. In the current study, the researcher reviewed the frequency of standard PE among fourth-year medical students at the University of Texas Medical Branch and also investigated whether factors such as patients' and medical students' gender as well as patients' positions could affect the quality of PE among patients in a similar setting.

Definitions and Abbreviations

- **Subject, medical student, or examiner**: the study participant who conducted the cardiovascular examination on a simulated patient

- **Simulated patient (SP)**: a trained actor who acted as a patient

- **Complete cardiovascular examination (CCE)**: consisted of auscultation of four areas and palpation of the point of maximal impulse

- **Comprehensive cardiovascular examination (CoCE)**: conducting a complete cardiovascular examination by the subject on the simulated patient

- **Encounter**: each time that a subject examines one single SP

- **Point of interest**: each of four points of auscultation (aortic, pulmonary, mitral, and tricuspid) or point of maximal impulse

- **CVD**: cardiovascular disease

- **OSCE**: An Objectively Structured Clinical Examination is comprised of a circuit of short examination stations, in which each candidate is examined on a one-to-one basis with one or two impartial examiner(s) and either real or simulated patients played by actors.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of the physical examination is to identify the physical signs of disease. The significance of these objective indications of disease is enhanced when they confirm a functional or structural change already suggested by the patient's history. At times, however, the physical signs may be the only evidence of disease. Several researchers have reviewed the issue of the physical examination and how it can be affected by different factors. This chapter will review some of the prominent studies in this regards.

Interaction between Patients' and Examiners' Gender in Overall Physical Examinations

In a recent study (Carson, Peets, Grant, & McLaughlin, 2010), researchers studied 138 second-year medical students at the University of Calgary who underwent a seven station Objectively Structured Clinical Examination (OSCE). Two stations (precordial and respiratory exams) were considered gender-sensitive. Multiple linear regressions were used to explore the effect of students', standardized patients' (SP), and raters' genders on the students' scores. All 138 students (69 female) completed the OSCE and were included in the analyses. The mean scores [SD] for the two stations involving examination of the chest were higher for female students than for male students (83.2% [15.5] versus 78.3% [15.8], respectively, d = 0.3, P = .009). There was a significant interaction between student and SP gender (P = .02). In the stratified analysis, female students were rated significantly higher than male students at stations with female SPs

(85.4% [15.5] versus 76.6% [16.5], d = 0.6, P = .004) but not at stations with male SPs

(80.2% [15.0] versus 80.0% [15.0], P = 1.0). Based on these findings they concluded that

student and SP genders interact to affect OSCE scores at stations that require examination

of the chest. Further investigations are warranted to ensure that the OSCE is an equal

experience for all students.

Patient-Centered Behavior and Gender Bias

In another study by Blanch-Hartigan, Hall, Roter, & Frankel (2010), investigators

examined whether patient perceptions were equivalently associated with patient-centered

behavior in male and female medical students and tested the impact of a message

emphasizing the importance of patient-centeredness on analogue patients' perceptions of

male and female medical students' performance. Sixty-one medical students interacting

with standardized patients were viewed by 384 analogue patients (AP). APs were

randomly assigned to receive a message emphasizing the value of patient-centeredness or

of technical competence, or a neutral message, and then evaluated the medical students'

competence in the interactions. Students' patient-centeredness was measured using the

Four Habits Coding Scheme (Krupat, Frankel, Stein, & Irish, 2006) and Roter Interaction

Analysis System (Inui, Carter, Kukull, & Haigh, 1982). APs in the neutral and technical

competence conditions gave higher competence ratings to more patient-centered male

students, but not to more patient-centered female students. However, APs who received

the patient-centeredness message gave higher competence ratings to both male and

female students who were higher in patient-centeredness. Authors of this study concluded

that patient-centeredness is a determinant of physician competence that can eliminate a

gender bias in evaluating performance. This indicated that although male students had

more competence in providing patient-centered message, both in cases that patient-centered message was given, both male and female students had higher competence ratings by the APs. They added that because patient perceptions are often used in evaluations, gender biases must be understood and reduced so both male and female medical students receive appropriate credit for their patient-centered behaviors.

Influence of Standardized Patient's Gender on Student's Performance

Humphrey et al. (2009) assessed whether a variation in SP gender on the same case resulted in a systematic difference in student scores. One hundred and forty Year 3 medical students participated in a 10-station OSCE. Two physical examination stations were selected for the study because they were perceived to be 'gender-neutral'. One station involved the physical examination of the back, and the other station involved an examination of the lymphatic system. On each of the study stations, male and female SPs were randomly assigned. There was no difference in mean scores on the back examination station for students with female (6.96/10.00) versus male (7.04/10.00) SPs ($P = 0.713$). However, scores on the lymphatic system examination station showed a significant difference, favoring students with female (8.30/10.00) versus male (7.41/10.00) SPs ($P < 0.001$). Results were not dependent on student gender. Authors concluded that the gender of the SP may significantly affect student performance in an undergraduate OSCE in a manner that appears to be unrelated to student gender. It may be prudent to use the same SP gender for the same case, even on seemingly gender-neutral stations.

Gender Differences

A study by Blanch, Hall, Roter, and Frankel (2008) aimed to review the literature

on gender differences and issues of self-confidence in medical students and to present original research on observers' perceptions of medical student confidence. One hundred and forty-one third-year medical students at Indiana University School of Medicine were videotaped during their OSCE. Trained coders rated how confident the student appeared and coded a variety of nonverbal behaviors at the beginning, middle, and end of the interaction. Analysis focused on gender differences in coders' ratings of perceived confidence. Female medical students were viewed as significantly less confident than male medical students were (F [1,133] =4.45, p<0.05), especially at the beginning of the interaction. They concluded that despite the existing evidence on female students performing equally to their male peers, they consistently report decreased self-confidence and increased anxiety, particularly over issues related to their competence. In a standardized patient interaction examination situation, female medical students also appeared significantly less confident than male medical students to independent observers. This raises a concern especially for certain specialty areas, such as dermatology, where more females are represented. Medical educators should focus on issues of female students' confidence, increasing faculty sensitivity, and publicly recognizing and discussing perceptions of confidence.

Ethnicity and Quality of Physical Examination

In another study, the effects of ethnicity and gender on performance were investigated. Researchers tracked 1,216 third-year medical student (528 male and 688 female, 737 white European and 479 Asian). White females performed best in all OSCEs and in 3 out of 4 written examinations. Mean scores for each OSCE and 2 out of 4 written examinations were higher for white students than for Asian students. The overall size of

the effect is relatively small, being around 1-2%. They concluded students of Asian origin, of both genders, educated in the UK, using English as their first language; continue to perform less well in OSCEs and written assessments than their white European peers do.

Gender Bias and Physical Examination

In another study (Wiskin, Allan, & Skelton, 2004), authors investigated possible bias due to gender combination of students, role players and examiners in a high-stakes assessment. The study examined the Valid Oral Interactive Contextualized Examination (VOICE), a long-station OSCE-style exam in general practice (GP). At the time of writing it consisted of 65% of the student's final GP mark. In the VOICE, students undertook six tasks-four vitals and two role-plays. "Patient" roles were filled by professional role players who worked regularly on the undergraduate curriculum. During the role-play, the student's clinical competence was assessed by an observing GP examiner. The communication skills marks were awarded by the role player and the examiner together, by negotiation. Data had been recorded detailing the role player's initial marks, the examiner's initial marks and their final (awarded) agreed marks for 1024 consultations. Overall, 512 fourth-year medical students, 28 role players and 48 examiners were involved in the study. There were no inclusion or exclusion criteria. All those present on exam day became part of the data. There was a significant relationship between gender and performance for some, but not all, stations. Correlations for multiple comparisons removed the significance. Female students performed better across the board than male students. While not always significant, this did affect grading. There was no significant association between the genders of role players and examiners with the

question choices. The results from male students were lower than previous reports from 1999.

Standardized Patients

Standardized patients are an increasingly prevalent resource in medical education and evaluation. In another study (Abe, Suzuki, Fujisaki, & Ban, 2009), the standardized patients' impact on medical students' education was examined. There was a variety of clinical skills training programs including courses designed to teach and assess communication skills as well as physical examination (PE) skills to the medical students. This subject was examined in detail in the study that was conducted among 532 standardized patients (SPs) in Japan (Abe et al., 2009). In Japan, SPs have contributed enormously to help medical students improve their communication skills. However, there were few SPs who participate in physical examination training, and the use of SPs for physical examination is rarely considered as a useful educational resource. The purpose of this study was to explore SPs' perceptions about participating in PE training. A 27-item questionnaire was used to survey 532 SPs in Japan. The response rate was 62% (n = 332). The ratio of females to males was 4:1. SPs perceived PE training using SPs was effective in teaching students physical examination. Eighty percent of SPs were willing to have PE of head, arms, and legs. Twenty-five percent were willing to have PE on their chest, back, and abdomen. Willingness varied by gender and age. SPs perceived that including SPs in physical examination was valuable. Males or people over 50 years old were more willing to participate than females or people under age of 50. Reluctance to participate in PE may decrease through experience or improved knowledge of PE training and by beginning with examination of head, neck, and legs, then gradually moving to chest, back, and

abdomen.

Differences in Examiner and Examinee Gender on Examination Quality

The potential mechanism which could be responsible for impact of gender on the quality of physical examination has been evaluated in several studies. The medical student's non-verbal sensitivity was hypothesized as the potential effect of gender on the completion of physical examination. In an study by Hall et al. (2009), it was concluded that medical students' nonverbal sensitivity was related to clinically relevant attitudes and behavioral style in a clinical simulation. Authors examined the relation of medical students' nonverbal sensitivity to their gender and personal traits, as well as to their communication and impressions made during a standardized patient (SP) visit. They utilized psychometric testing, questionnaire, and observation in a United State medical school. Two-hundred seventy-five third-year medical students were enrolled. Nonverbal sensitivity and attitudes were measured using standard instruments. Communication during the SP visit was measured using trained coders and analogue patients who viewed the videotapes and rated the favorability of their impressions of the student.

Nonverbal sensitivity was shown to be higher among female than male students ($P < 0.001$) and was positively correlated with self-reported patient-centered attitudes ($P < 0.01$) and ability to name one's own emotions ($P < 0.05$). It was also associated with less distressed ($P < 0.05$), more dominant ($P < 0.001$), and more engaged ($P < 0.01$) behavior by the SP, and with more liking of the medical student ($P < 0.05$) and higher ratings of compassion ($P < 0.05$) by the analogue patients. Correlations between non-verbal sensitivity and other variables were generally stronger and different for male than female students, but nonverbal sensitivity predicted analogue patients' impressions

similarly for male and female students.

In another study (Bertakis, Franks, & Epstein, 2009), it was contemplated that physicians' use of patient-centered communication (PCC) affects important outcomes of care. Although there is evidence that both patient and physician gender affect the process of care, there is limited information about their impact on PCC. Our objective was to investigate the influence of patient and physician gender, as well as gender concordance between patient and physician, on the patient centeredness of primary care visits. Participating primary care physicians (100 family physicians and internists) with clinical practices in the Rochester, New York area, who had two unannounced covertly audio recorded standardized patients' visits. Encounters were analyzed using the Measure of Patient-Centered Communication (MPCC), which measures three aspects of physician communication: Component 1 (Exploring both the disease and illness experience), Component 2 (Understanding the whole person), and Component 3 (Finding common ground). Compared with male patients, females had interactions characterized by greater PCC (total and Component 2 scores). Whereas, female physicians exhibited higher Component 1 scores, male physicians had higher Component 2 scores, and gender-concordant visits also exhibited higher Component 2 scores. However, there were no significant differences in total MPCC scores for encounters of female vs. male physicians or for gender-concordant compared with discordant patient-physician dyads. They concluded that the findings of the study added further evidence that patient gender can affect the interactions between physicians and patients. They also suggested that more research is needed to understand why male patients are less likely to have medical encounters in which their physicians employ a patient-centered practice style.

In another study (Borkhoff et al., 2009), physicians' treatment and referral decisions for total knee arthroplasty (TKA) for standardized patients with matching paper patients were compared. Sixty-seven physicians (38 family physicians and 29 orthopedic surgeons) performed blinded assessments of two standardized patients (one man and one woman) with moderate knee osteoarthritis and otherwise identical clinical scenarios differing only in gender, and consented to including their data. Standardized patients recorded physicians' recommendations (yes/no) to refer for, or perform, TKA. Sixty physicians provided their treatment recommendations to matching paper patients. Recommendation rates for both the male and the female standardized patients (67% and 32%, respectively) were lower compared with the matching paper patients (80% and 67%, respectively). Physicians were more likely to recommend TKA to a man than to a woman when presented with standardized patients (odds ratio, 4.2; 95% confidence interval [CI]=2.4-7.3; P<0.001). In contrast, patients' gender did not affect the same physicians' recommendations regarding referral for, or performing, TKA for the matching paper patients (odds ratio, 2.0; 95% CI=0.9-4.6; P=0.101). Unlike their treatment recommendations for standardized patients, the same physicians' treatment and referral decisions for paper patients were not influenced by patients' gender, suggesting that paper patients are not a sensitive method of assessing physician bias.

In another study (Christen, Alder, & Bitzer, 2008), it was noted that physician's communication style was an essential factor predicting patient satisfaction and compliance. Furthermore, a good physician-patient relationship and high communication quality seem to be crucial elements fostering the activation of patients' self-healing powers. Due to their intimate nature, gynecological health issues require specific adapted

communicative skills. Several studies in primary care reveal gender differences in physicians' communication style. However, controversial findings had been reported in the field of obstetrics and gynecology. The aim of this study was to determine whether the expected gender differences in gynecologists' communicative skills affect patient satisfaction and compliance. We analyzed 196 videotapes of 30 real-life and 166 simulated (standardized) patient consultations in four different gynecological outpatient settings with 13 male and 36 female gynecologists from the University Hospital of Basel, Switzerland. Communicative skills were analyzed by independent raters with the Revised Maastricht History-Taking and Advice Checklist (MAAS-R)(van, Kraan, & Van Der Vleuten, 1991). All patients assessed their satisfaction after the consultation using the patient satisfaction questionnaire. Patients were more satisfied with female gynecologists regarding the relationship and the consultation process, whereas the expected compliance was not related to physician gender. However, regression analyses demonstrated that it is not the gender of the physician but gender-related specific communicative skills - mainly patient-centered communication - that seem to be the crucial factor influencing patient satisfaction and likewise compliance. Authors concluded their work with suggestion of further research should be carried out on how these skills could be improved through specific training.

Impact of the gender bias on the diagnosis of psychiatric disease was also noted in a study by Lewis, Lamdan, Wald, & Curtis (2006). They hypothesized that gender bias had been reported in the diagnosis and treatment of patients with a variety of illnesses. In the context of a 10-station fourth year Objective Structured Clinical Evaluation, the authors queried whether this could influence diagnosis in a geriatric case. In addition, the

writers hypothesized that, due to this bias, the female standardized patient may be diagnosed with depression more often than the male. A male or female geriatric standardized patient portrayed a dysphoric widow with mild cognitive impairment. Students examined the patient and documented the clinical encounter and their differential diagnosis. Major depression was diagnosed in 93/107 female standardized patient encounters compared with 58/78 male exams, with the female students contributing most to this difference. Authors concluded that the potential for gender bias in medical care and in education remains a concern. They suggested that medical educators need to be mindful of this when designing clinical skills assessments.

Despite these studies, in a report published in 2007 by Nicolai & Demmel, the effect of physicians' gender on the perception and assessment of empathic communication in medical encounters was tested. Eighty-eight volunteers were asked to assess six transcribed interactions between physicians and a standardized patient. The effects of physicians' gender were tested by the experimental manipulation of physicians' gender labels in transcripts. Participants were randomly assigned to one of two testing conditions: (1) perceived gender corresponds to the physician's true gender; (2) perceived gender differs from the physician's true gender. Empathic communication was assessed using the Rating Scales for the Assessment of Empathic Communication in Medical Interviews. A 2 (physician's true gender: female vs. male) x 2 (physician's perceived gender: female vs. male) x 2 (rater's gender: female vs. male) mixed multivariate analysis of variance (MANOVA) yielded a main effect for physician's true gender. Female physicians were rated higher on empathic communication than male physicians irrespective of any gender labels. The study findings suggested that gender differences in

the perception of physician's empathy are not merely a function of the gender label. These findings provided evidence for differences in male and female physicians' empathic communication that cannot be attributed to stereotype bias. Future efforts to evaluate communication skills training for general practitioners may consider gender differences.

Impact of Gender Differences on Performance

In terms of impact of the physician gender on their clinical/testing performance, in a study done almost a decade ago (Haist, Witzke, Quinlivan, Murphy-Spencer, & Wilson, 2003), researchers aimed to determine whether gender predicted student performance on a Clinical Performance Examination (CPX) when controlling for pre-matriculation and medical school performance. In this study, a sixteen-station CPX, utilizing standardized patients, was administered to the fourth-year students in three successive years at one United States medical school. Scores for each student by discipline and skills across stations were generated. Bivariate correlation and multiple regression analyses were performed to determine relationships between students' scores and pre-matriculation information (age, gender, MCAT, and undergraduate GPA) and medical school performance (first-, second- and third-year GPA, and USMLE Step 1). The CPX mean score for all students was 65.1% (SD 6.2). The mean total score for men (n = 182) and women (n = 93) was 64.0% and 67.0%, respectively. Being a woman, positively affected a student's score in two models controlling for pre-matriculation and medical school performance by 2.8% or 0.47 standard deviations (SD) and 2.3% or 0.39 SD, respectively. Women scored numerically higher than men in all seven disciplines

(internal medicine, obstetrics/gynecology, pediatrics and psychiatry, $p < 0.05$) and for

nine skills across all stations (introduction, history, physical examination, counseling and

interpersonal, $p < 0.05$). The results of the study indicated that women performed better

than men on the University of Kentucky CPX. Being a woman was a positive and

independent predictor of performance.

Despite all these, in a very large study by Chambers, Boulet, & Furman (2001),

possible performance differences in interpersonal skills (IPS) ratings as a function of

candidate and standardized patient (SP) gender were examined. The IPS scores and SP

characteristics for 79,999 patient encounters were studied. This included 18,325 (20.36%)

female candidate to female SP, 26,872 (29.86%) male candidate to female SP, 18,281

(20.31%) female candidate to male SP, and 16,521 (29.47%) male candidate to male SP

interactions. The analysis did not reveal a significant candidate gender by SP gender

effect. There were no meaningful differences in IPS scores as a function of SP or

candidate gender. The non-significant interaction between SP gender and candidate

gender provides some evidence that male and female candidates are being assessed

equivalently by male and female SPs. This result, combined with the extremely weak

relationship between gender (candidate or SP) and IPS ratings, provides additional

support for the fairness and defensibility of the IPS measures.

Summary

The physical examination should be performed methodically and thoroughly, with

consideration for the patient's comfort and modesty. Unless the physical examination is

systematic and is performed in a consistent manner from patient to patient, important

segments may be omitted inadvertently. Several studies have investigated the potential

effect of gender on the quality of physical examination, although no study has addressed this issues regarding a cardiovascular physical examination.

CHAPTER 3

METHODS

Research Questions

This study addressed the following questions regarding the cardiovascular examination by fourth-year medical students at the University of Texas Medical Branch in Galveston, TX:

1. What percentage of the medical students conducts heart auscultation on each individual points of interest in cardiovascular examination?

2. What percentage of the medical students conducts a comprehensive cardiovascular physical examination in their clinical encounters?

3. Is patient's gender associated with conducting a heart physical examination on all points of interest?

4. Does the medical student's gender correlate with conducting cardiovascular physical examination?

5. Is a patient's position associated with the quality of cardiovascular examinations among the medical students?

Research Design

For this study, the researcher used archival data, obtained from the medical students at the University of Texas Medical Branch. All participants had similar encounters with similar set of simulated patients. Then the researcher reviewed the data gathered on the quality of cardiovascular physical examination from each encounter. All encounters were recorded, and data were reviewed by the principal investigator. The

details of the study protocol, chart review, and analytic methods were reviewed and approved by the institutional review board of the University of Texas Medical Branch, Galveston, Texas, as well as the institutional review board of the University of Houston, Houston, Texas. Furthermore, the educational committee at the University of Texas Medical Branch, Galveston, Texas reviewed and approved the study protocol.

Study Population

Participants were fourth-year medical students from the University of Texas Medical Branch. This study was conducted as part of a mock exam to assess the students' clinical skills as well as to prepare them for clinical skills testing by the National Board of Medical Examiners.

Encounters and Standardized Patient Scenarios

In this study, each participant attended eight different stations and conducted an interview and physical examination of the patient at each one. Participants had to conclude each encounter with an appropriate assessment and treatment plan. Two of these encounters required cardiac examination. The first standardized patient was a female presenting with the chief complaint of intermittent tachycardia, and the second standardized patient was a male who presented for a general physical examination. Both were core cases in the examination, and their complaints prompted a cardiac examination. Encounter time allotment was fifteen minutes, which provided enough time for a cardiac examination. All encounters were video recorded for evaluation by a panel of reviewers.

Examination and Scales

For the cardiac examination, each student should have conducted the following maneuvers: auscultate four main foci; (1) the aortic area in the second right interspace

adjacent to the sternum, (2) the pulmonary area in the second left interspace, (3) the tricuspid area in the fourth and fifth interspaces adjacent to the left sternal border, and (4) the mitral area at the cardiac apex, as well as palpate the point of maximum impulse (PMI). The examination rooms were well lit and comfortably heated, and the simulated patients were properly gowned. The examining tables were large enough so that the patient could easily lie flat, sit up, or roll to one side. For each of the auscultation areas and PMI palpitation, three scales were considered: "student position," "patient position," and the "gown position."

To be counted as an appropriate position, the student could stand on the right, left, or in the front of the patient (student's position), and patients were asked to sit or lay down (patient's position). Other positions were considered as inappropriate given their possible impact on the quality of examination. The "correct" positioning for physical examination of the heart is still controversial. However, for each of the five areas of interest in this study, we defined the "*preferred*" position as following: patients should be positioned in the laying-down or sitting position and the gown should be either pulled down or up to neck so that the stethoscope was in direct contact with patient's skin. If the student placed the stethoscope on the gown or put it on the skin while the gown was in place (dropped the stethoscope while the gown is on, etc.), the examination of that area and the overall encounter would have been considered as "examined in not preferred position."

Assessment of the Encounters

Two reviewers evaluated each encounter; at least one of whom was a medical doctor. To minimize the inter-observer differences, a training session was held for all

reviewers. Reviewers watched sample videos of similar clinical scenarios and discussed the scaling system. The encounters were randomly distributed among reviewers. In cases where there was a disagreement between any individual score, the case was reviewed by a third reviewer. The final score was based on the consensus between all three reviewers.

Variables

The primary outcome (*dependent*) variables were whether examination was conducted on each of the five points of interest ,and if so, whether it was done based on the preferred position. The secondary outcome (*dependent*) variables were whether cardiac examination was done on all of the five points of interest, and if so, whether it was done on the preferred gown position, meaning that stethoscope was directly attached to the skin. These cases were categorized as a comprehensive examination. Therefore, if a student examined the patients on all five areas, but did not do it on the preferred position in Mitral and Tricuspid areas, s/he was counted as "*complete exam* and *not-preferred gown setting; or not comprehensive.*" The predictive outcomes were patient position, student gender, and patient gender.

Statistical Analysis

Descriptive analyses were completed. Frequency of the quality of physical examination in each five foci of interest was calculated. Then, the frequency of completeness of cardiovascular examination and quality of physical examination was examined. Afterwards, the encounters were categorized into two groups: (1) having a complete cardiovascular examination and (2) not having a complete cardiovascular examination. At the next step, the effect of patient's and student's gender, as well as patient's position were assessed. The researcher also utilized logistic regression to

compare these frequencies between the two groups. Then, the quality of physical examination at each individual was examined based on the criteria mentioned above. At each focus, e.g. aortic or mitral area, the encounters were categorized into comprehensive cardiovascular examination (on the preferred position) and not comprehensive examination. Then, the researcher compared whether this was different between female and male patients. Similarly, the researcher examined whether the student's gender was associated or not. Lastly, the researcher evaluated whether the patient's position (sitting or lying down) made any difference in the quality of heart physical examination. Using logistic regression, the association between patient's position (sitting, lying down, or other) and conducting cardiac examination at each point as well as conducting in the preferred position was examined. Furthermore, using chi-square (χ^2), the frequency of complete cardiac examination and performing examination in the preferred gown setting between female and male patients and students was examined. All the statistical analyses were performed with STATA 11 (StataCorp, College Station, TX). The hypothesis testing was 2-sided with a p-value significance level of equal or less than 0.05.

Summary

Using archival data obtained at the University of Texas Medical Branch, fourth-year medical students were observed during a clinical skills assessment exercise with standardized patients. The video-recorded encounters were evaluated by a panel of experts. A cardiac examination was considered complete if five maneuvers: auscultation of the aortic, pulmonary, tricuspid, and mitral areas, and palpation at the point of maximum impulse (PMI) were conducted, while the patient was in a laying-down or sitting position and the stethoscope was directly attached to the skin (gown up or gown

down). Using logistic regression, the reseracher investigated the association between two variables and completeness of the cardiac exam: the patient's position (supine or sitting) and patient gender.

CHAPTER 4

**FINDINGS**

Cardiac Examination

Overall, 184 fourth-year medical students at UTMB, 91 (49.5%) female and 93 (50.5%) male, were enrolled in the study. Each student had one encounter with a male patient and one encounter with a female patient, totaling 368 encounters (Figure 1). The details of all encounters at each point and overall are shown in table 1. In six encounters, data were available on examination of one or more areas (Table 1 and Figure 1); in these cases the encounter was excluded from cumulative analysis. In a majority of encounters (>89%), the heart auscultation was conducted in aortic, pulmonary, tricuspid, and mitral areas, with aortic and pulmonary being the most commonly examined areas in all encounters, 95.7% and 98.3%, respectively. However, PMI was palpated just in 58.1% of the encounters, which made it the most commonly missed area of the cardiac examination. In total, all *five* points of interests were examined in 52.5% of patients.

The same pattern was observed in the frequency of conducting cardiac examination in the *preferred* patient position (either sitting or lying down) and gown setting (pulled up to neck or down). In more than two-thirds of encounters, cardiac auscultation was done in the preferred position, yet just 52.4% of the cases of PMI examination. It is noteworthy that if the student examined the PMI, in more than 90% of the cases, the assessment was done in the preferred position. Furthermore, if the examiner conducted heart auscultation and palpation on all five areas (*n=190*), in almost 85.7% of the cases (*n=163*), the assessment was done in the preferred position (Table 1).

Table 1

Assessment of encounters at each individual area and overall cardiac examination

Variable	Cardiac examination was conducted		Cardiac examination was *NOT* done (%)	Total
	Preferred positioning (%)	Not-preferred positioning (%)		
Aortic area	255 (69.3)	97 (26.4)	16 (4.3)	368
Pulmonary area	261 (70.9)	101 (27.4)	6 (1.7)	368
Tricuspid area	246 (66.8)	92 (25.0)	30 (8.2)	368
Mitral area	253 (68.8)	74 (20.1)	41 (11.1)	368
PMI	193 (52.4)	21 (5.7)	154 (41.9)	368
All five points of interests were examined in the encounter[*]	163 (45.0)	27 (7.5)	172 (47.5)	362
[*]*In 14 encounters, data were not available on one or more areas; therefore, the researcher could not include them in the cumulative analyses.*				
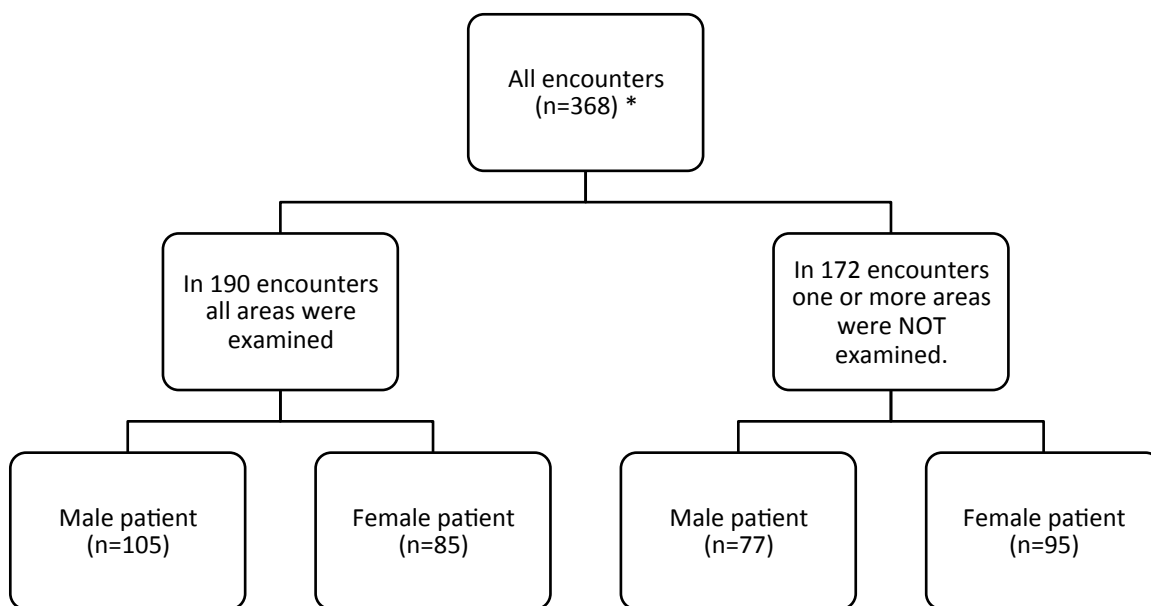
Figure 1. Complete cardiac examination in 368 encounters among 183 4th year medical students at UTMB. [*]6 cases were excluded from the analysis because in one or more areas data were incomplete.

Association of Patient's Position and Cardiac Examination

The researcher also investigated whether the patient's position correlated with the

examining of each of the five points of interest, in the preferred gown setting. In regards

to heart auscultation, when the patient was placed in the lying down position, the

probability of conducting the auscultation in the preferred gown setting was 96% and

92% higher than sitting positions in the aortic and pulmonary areas, respectively

(*p<0.001*). This difference was even more significant in tricuspid and mitral areas. If the

patient was in the lying down position, in 87.9% and 91.5% of cases the examiner

conducted the tricuspid and mitral areas when the stethoscope was directly placed on the

skin, compared to 40.2% and 41.3% of sitting position, respectively. However, the same

pattern was not observed in palpating the point of maximal impulse. As shown in Table

2, the results of the current study indicated that the frequency of assessing PMI while

patient was in laying-down position was slightly higher compared to sitting position. The

difference was not statistically significant (*p= 0.315*).

Table 2
*Frequency of cardiac examination in the preferred gown setting based on the patient's
position*

Variable	Frequency of performing examination in the preferred position		Risk ratio (95% CI[*])	p-value
	Lying down	Sitting		
Aortic area	86.1%	43.9%	1.96 (1.59, 2.43)	< 0.001
Pulmonary area	85.6%	44.5%	1.92 (1.56, 2.36)	< 0.001
Tricuspid area	87.9%	40.2%	2.19 (1.73, 2.77)	< 0.001
Mitral area	91.5%	41.3%	2.22 (1.73, 2.83)	< 0.001
PMI	90.8%	83.3%	1.09 (0.88, 1.35)	0.315
[*]CI: confidence interval				
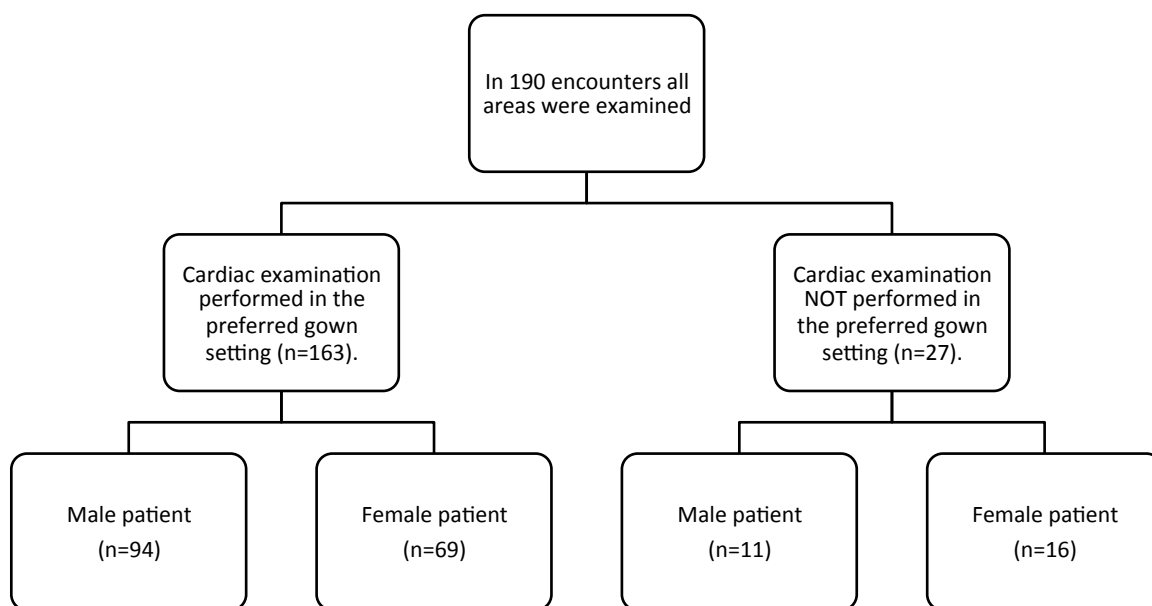
Figure 2. Complete cardiac examination in 368 encounters among 183 fourth-year medical students at UTMB

Female Patients

Female patients had a lower chance of complete cardiac examination compared to male patients. Half of the encounters (*n=184*) were with female patients. As shown in Table 1, the frequency of conducting cardiac examination in all five areas of interest was lower compared to male patients. The most prominent significant difference was in auscultation to the mitral area, where female patients had 10% less chance of being examined compared to male patients (*p=0.005*). The same trend was observed in the tricuspid area, yet the difference was not statistically significant. Despite these differences, conducting cardiac examination in the preferred gown setting was not statistically significant in each area; although the overall trend was toward less frequency among female patients compared to the male patients (Table 3).

Table 3.
Correlation of patient's gender with cardiac examination among UTMB 4th year medical students

	Cardiac examination				Cardiac examination in *preferred gown setting*			
	Female n (%)	Male n (%)	RR (95% CI[*])	p-value	Female n (%)	Male n (%)	RR (95% CI[*])	p-value
Aortic	181 (98.3)	171 (92.9)	1.06 (1.01, 1.11)	0.010	127 (70.2)	128 (74.9)	0.94 (0.82, 1.07)	0.033
Pulmonary	182 (98.9)	180 (97.8)	1.01 (0.98, 1.04)	0.410	128 (70.3)	133 (73.9)	0.95 (0.84, 1.09)	0.450
Tricuspid	163 (88.6)	175 (95.1)	0.93 (0.89, 1.05)	0.450	116 (71.2)	130 (74.3)	0.96 (0.84, 1.09)	0.519
Mitral	155 (84.2)	172 (93.5)	0.90 (0.84, 0.97)	0.005	121 (78.1)	132 (76.7)	1.02 (0.90, 1.14)	0.776
PMI	101 (54.9)	113 (61.4)	0.89 (0.75, 1.02)	0.205	89 (88.1)	104 (92.0)	0.96 (0.88, 1.05)	0.336
All[**]	85 (47.2)	105 (57.7)	0.82 (0.67, 0.99)	0.046	69 (81.2)	94 (89.5)	0.91 (0.80, 1.02)	0.101

[*] *CI: 95% confidence interval.* [**] *In 6 encounters, data were not available on one or more areas therefore the overall score could not be assessed.*

Overall, female patients had an 18% (95% CI: 1%-33%) less chance of having complete cardiac examination (*p=0.046*). If they underwent complete cardiac examination, in 81.2% of the cases, the examination was done in preferred gown setting, compared to 89.5% of male patients (*p=0.101*).

Female Students

Female students more frequently conducted aortic, pulmonary, mitral, and PMI examinations compared to male students. Ninety-one (*n=91*) female and 93 male students

participated in the study, and had total of 182 and 186 encounters, respectively. Although there was no statistical difference between female and male students in conducting the cardiac examination, student's gender was associated with performing the examination in preferred gown setting. If the aortic and pulmonary auscultation were conducted by the student, female students had 16% and 14% higher chance of performing the exam in the preferred gown setting, compared to the male students (*p=0.023 and p=0.036, respectively*). As shown in Table 4, a similar pattern was observed in auscultation of Tricuspid and Mitral where female students had 8% and 11% higher chance of performing the cardiac examination in the preferred gown setting. However these differences did not reach the statistical significance level, but the trend was consistent with other findings. Furthermore, if the point of maximal impulse was examined, the female students performed it in the preferred gown setting more frequently compared to male students.

Overall, although student gender was not associated with performing complete cardiac examination (examining all areas), these data indicated that if the cardiac examination was done in an encounter, the female student had a 7% higher chance of performing it in the preferred gown setting. It is noteworthy that the later finding was not statistically significant, but the trend was consistent with other findings (Table 4).

Table 4.

Association between student's gender and cardiac examination among UTMB 4th year medical students

	Cardiac examination				Cardiac examination in *preferred gown setting*			
	Female n (%)	Male n (%)	RR (95% CI*)	p-value	Female n (%)	Male n (%)	RR (95% CI*)	p-value
Aortic	176 (96.7)	176 (94.6)	1.02 (0.98, 1.06)	0.328	137 (77.8)	118 (67.1)	1.16 (1.02, 1.32)	0.023
Pulmonary	179 (98.4)	183 (98.4)	0.99 (0.97, 1.03)	0.979	138 (77.1)	123 (67.2)	1.14 (1.01, 1.30)	0.036
Tricuspid	171 (93.9)	167 (89.8)	1.05 (0.98, 1.11)	0.144	129 (75.4)	117 (70.1)	1.08 (0.94, 1.23)	0.267
Mitral	162 (89.0)	165 (88.7)	1.00 (0.93, 1.08)	0.927	132 (81.5)	121 (73.3)	1.11 (0.99, 1.25)	0.078
PMI	108 (59.3)	106 (56.9)	1.94 (0.88, 1.24)	0.648	103 (95.6)	90 (84.9)	1.12 (1.02, 1.23)	0.010
All**	97 (54.2)	93 (50.8)	1.07 (0.88, 1.29)	0.521	86 (88.7)	77 (82.8)	1.07 (0.96, 1.20)	0.247

*CI: 95% confidence interval. ** In 6 encounters, data were not available on one or more areas therefore the overall score could not be assessed.

CHAPTER 5

DISCUSSION AND CONCLUSION

Cardiovascular disease (CVD) is now the most common cause of death worldwide. Physical examination is a crucial part of the assessment for CVD. The practice of medicine has significantly changed over the last 40 years. The advent of molecular genetics, molecular biology, and molecular pathophysiology, sophisticated new imaging techniques, and advances in bioinformatics and information technology have contributed to an explosion of scientific information that has fundamentally changed the way physicians define, diagnose, treat, and prevent disease. However, this comes at a cost. Most of these tools and techniques are expensive, time consuming, and not always available, for instance in rural and underserved areas. A thorough physical examination limits the differential diagnosis to the point that a fewer number of tests may be necessary. This can potentially decrease the cost of health care. As described in the study conducted by Drazner et al. (2001), when a patient poses challenging clinical problems, an effective physician must be able to identify the crucial elements in a complex history and physical examination; order the appropriate laboratory, imaging, and diagnostic tests; and extract the key results from the crowded computer printouts of data to determine what to treat. The purpose of the physical examination is to identify the physical signs of disease (Markel, 2006). Skill in physical diagnosis is acquired with experience, but it is not merely technique that determines success in eliciting signs of disease.

In the current study, the researcher evaluated the quality of cardiovascular examination among medical students at the University of Texas Medical Branch. In addition, the researcher hypothesized that factors such as patient's and student's gender

as well as patient's position were associated with the quality of cardiovascular physical examination.

The current study shows that female simulated patients had less likelihood of having comprehensive cardiovascular examinations compared to the male simulated patients. Although no study in the past specifically focused on the cardiovascular examination, the results of the current research was in concordance with some of the previous studies. In a study by Hall et al. (2009), medical students' non-verbal sensitivity was hypothesized as the potential effect of gender on the completion of physical examination. Nonverbal sensitivity was shown to be higher among female than male students and was positively correlated with self-reported patient-centered attitudes and the ability to name one's own emotions. It was also associated with less distressed, more dominant, and more engaged behavior by the patient, and with more liking of the medical student and higher ratings of compassion by the analogue patients (Hall et al., 2009). This was also supported by the study by Bertakis et al. Analyzing the more than a thousand primary care setting encounters, the authors concluded that patient gender can affect the interactions between physicians and patients. This difference could vary across different specialties or organ involved. In the study published by Borkhoff et al.(2009), it was shown that the same physicians' treatment and referral decisions for paper patients were not influenced by patients' gender. In another study by Lewis et al.(2006), it was shown that female medical students were more likely to diagnose depression in their encounters.

Despite these findings, some studies contradict the differences between male and female students. In a study by Van Thiel et al.(1991), it is not the gender of the physician but gender-related specific communicative skills - mainly patient-centered

communication -that seem to be the crucial factor influencing patient satisfaction and likewise compliance. The idea of gender difference was also challenged by another study by Nicolai & Demmel authors concluded that gender differences in the perception of physician's empathy are not merely a function of the gender label. These findings provided evidence for differences in male and female physicians' empathic communication that cannot be attributed to stereotype bias (Nicolai & Demmel, 2007). Blanch et al.(2008) suggested that however female students were performing equally to their male peers, they consistently report decreased self-confidence and increased anxiety, particularly over issues related to their competence. In addition, Wiskin et al. (2004) found no significant association between the genders of role players and examiners with the question choices.

Cardiovascular Examination and Effect of Patient's/Examiner's Gender and Position

In the current study, for the first time, the researcher focused on the physical examination on just one system (cardiovascular system). The researcher aimed to examine whether the patient's and examiner's gender affect the quality of cardiovascular examinations. Interestingly, it was noted that almost half of the subjects did not have a complete cardiovascular examination and more than half did have a comprehensive cardiovascular examination, in the preferred position, with the stethoscope directly attached to the skin. The caveat was that the placement of the stethoscope affects the quality of auscultation, and in many cases of mild disease or initial stages of diseases, problems can be easily overlooked if the stethoscope is not attached to the skin. This underscores the importance of the complete cardiovascular examination. The Institute of

Healthcare Improvement (http://www.ihi.org) has launched several educational programs to further promote the quality of care among the healthcare providers across the nation, one of which is the physical examination.

The results of the current study indicated that patients who had complete and comprehensive cardiovascular physical examinations were more likely to be male patients and in the laying-down position. Furthermore, female students conducted more complete and comprehensive medical management of their patients compared to male subjects. That could be attributable to anatomic difficulties of cardiovascular examination among female patients, as both points of maximal impulse and mitral areas require placing the stethoscope on the patient's breast, which in cases such as overweight or young patients could be challenging, particularly for male examiners.

Future Perspective

In the current study, we observed the high frequency of incomplete cardiovascular examination among medical students. At this phase, we showed the problem and the need for an intervention. Web-based media are crucial for today's communications. Among the new modalities that have been used in similar cases is the growing number of Web 2.0 tools in medical education. Web 2.0 tools such as blogs, Twitter, podcasting, and even social media have been used widely in the education world. However, their use in medical education has remained less widespread, compared to other fields. The physical examination techniques are sometimes very hard to teach and learn. Many videos have been posted on YouTube and they have been widely used by the students, instructors, and simulated patients. Since these measures have mostly occurred at the local and single institution level, evidence on efficacy of these approaches is lacking. In addition, there

has not been a comprehensive approach for the organized use of various Web 2.0 tools for teaching the same subjects. We suggest the development and integration of a multi-dimensional model of posting YouTube videos, online blogs (for students, simulated patient, and instructor), and also utilizing social media for regular follow up and post-tests regarding the cardiovascular examination. The researcher also suggests further studies be conducted that examine the efficacy of these interventions on improving the quality of the cardiovascular examination.

REFERENCES

Abe, K., Suzuki, T., Fujisaki, K., & Ban, N. (2009). A national survey to explore the willingness of Japanese standardized patients to participate in teaching physical examination skills to undergraduate medical students. *Teaching and Learning Medicine, 21,* 240-247.

Bertakis, K. D., Franks, P., & Epstein, R. M. (2009). Patient-centered communication in primary care: Physician and patient gender and gender concordance. *Journal of Womens Health, 18,* 539-545.

Blanch, D. C., Hall, J. A., Roter, D. L., & Frankel, R. M. (2008). Medical student gender and issues of confidence. *Patient Education and Counseling, 72,* 374-381.

Blanch-Hartigan, D., Hall, J. A., Roter, D. L., & Frankel, R. M. (2010). Gender bias in patients' perceptions of patient-centered behaviors. *Patient Education and Counseling, 80,* 315-320.

Borkhoff, C. M., Hawker, G. A., Kreder, H. J., Glazier, R. H., Mahomed, N. N., & Wright, J. G. (2009). Patients' gender affected physicians' clinical decisions when presented with standardized patients but not for matching paper patients. *Journal of Clinical Epidemiology, 62,* 527-541.

Carson, J. A., Peets, A., Grant, V., & McLaughlin, K. (2010). The effect of gender interactions on students' physical examination ratings in objective structured clinical examination stations. *Acadic Medicine, 85,* 1772-1776.

Chambers, K. A., Boulet, J. R., & Furman, G. E. (2001). Are interpersonal skills ratings influenced by gender in a clinical skills assessment using standardized patients? *Advanced Health Science Education Theory and Practice, 6,* 231-241.

Christen, R. N., Alder, J., & Bitzer, J. (2008). Gender differences in physicians' communicative skills and their influence on patient satisfaction in gynaecological outpatient consultations. *Social Science and Medicine, 66,* 1474-1483.

Drazner, M. H., Rame, J. E., Stevenson, L. W., & Dries, D. L. (2001). Prognostic importance of elevated jugular venous pressure and a third heart sound in patients with heart failure. *New England Journal of Medicine, 345,* 574-581.

Haist, S. A., Witzke, D. B., Quinlivan, S., Murphy-Spencer, A., & Wilson, J. F. (2003). Clinical skills as demonstrated by a comprehensive clinical performance examination: who performs better - men or women? *Advanced Health Science Education Theory and Practice, 8,* 189-199.

Hall, J. A., Roter, D. L., Blanch, D. C., & Frankel, R. M. (2009). Nonverbal sensitivity in medical students: Implications for clinical interactions. *Journal of General Internal Medicine, 24,* 1217-1222.

Humphrey-Murto, S., Touchie, C., Wood, T. J., & Smee, S. (2009). Does the gender of the standardised patient influence candidate performance in an objective structured clinical examination? *Journal of Medical Education, 43,* 521-525.

Inui, T. S., Carter, W. B., Kukull, W. A., & Haigh, V. H. (1982). Outcome-based doctor-patient interaction anaylsis: Comparison of techniques. *Journal of Medical Care, 20,* 535-549.

Krupat, E., Frankel, R., Stein, T., & Irish, J. (2006). The Four Habits Coding Scheme: Validation of an instrument to assess clinicians' communication behavior. *Patient Education and Counseling, 62,* 38-45.

Lewis, R., Lamdan, R. M., Wald, D., & Curtis, M. (2006). Gender bias in the diagnosis of a geriatric standardized patient: A potential confounding variable. *Journal of Academic Psychiatry, 30,* 392-396.

Markel, H. (2006). The stethoscope and the art of listening. *New England Journal of Medicine, 354,* 551-553.

Nicolai, J., & Demmel, R. (2007). The impact of gender stereotypes on the evaluation of general practitioners' communication skills: An experimental study using transcripts of physician-patient encounters. *Patient Education and Counseling, 69,* 200-205.

Roy, C. L., Minor, M. A., Brookhart, M. A., & Choudhry, N. K. (2007). Does this patient with a pericardial effusion have cardiac tamponade? *Journal of American Medical Association, 297,* 1810-1818.

van, T. J., Kraan, H. F., & Van Der Vleuten, C. P. (1991). Reliability and feasibility of measuring medical interviewing skills: The revised Maastricht History-Taking and Advice Checklist. *Journal of Medical Education, 25,* 224-229.

Wiskin, C. M., Allan, T. F., & Skelton, J. R. (2004). Gender as a variable in the assessment of final year degree-level communication skills. *Journal of Medical Education, 38,* 129-137.

World Heath Organziation. (2013). Cardiovascular disease. Retrieved from:
http://www.who.int/mediacentre/factsheets/fs317/en/

World Health Organization. (2011). Global atlas on cardiovascular disease prevention and control. Shanthi Mendis, P. Puska, & Bo Norrving, Eds. Retrieved from:
http://whqlibdoc.who.int/publications/2011/9789241564373_eng.pdf