AN ANALYSIS OF MEDICAL STUDENT ATTITUDES TOWARD THE INCLUSION OF HEALTH SYSTEMS SCIENCE IN MEDICAL EDUCATION

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ABSTRACT

Despite changing demographics, policy, technology, and economics; medical education curriculum has changed very little from its inception over 100 years ago. The United States medical system has been under scrutiny for delivery of affordable, quality and accessible care for years. In order to address these challenges, we need to train physicians to consider these criteria when treating patients. A way to do this is through a curriculum that includes Health Systems Science (HSS). The challenge of HSS is that it adds additional topics and competencies to an already full medical education curriculum. In order to move forward in medical school, students are tested on their knowledge of basic science. Because HSS topics are not included in the required testing, students who have not been exposed to an HSS curriculum perceive HSS topics as less valuable than traditional medical school topics. This research sought to understand if students changed their perception of the value of HSS after exposure to an HSS curriculum.

First-year medical students from a large, urban medical school were surveyed using a pre-test and post-test survey before and after exposure to an HSS curriculum. This study was conducted with two cohorts over two years to see if there was a change in student perceptions of HSS. An Institutional Cycle design was applied to compare the post-test from the students in cycle 1 to the pre-test of students in cycle 2. This approach was deployed for two reasons. The first because of restrictions placed on the data collection; the pre-test for each person could not be directly linked to the post-test. The second, because there was no way to create a control group. These cohorts could not be

randomly assigned to another curriculum. Comparing the post-test of Cohort 1 to the pre-test of Cohort 2 allows for the analysis of change between the two cohorts.

Student perceptions did not change significantly between the pre-test in cycle 2 and the post-test in cycle 1. More research is needed to provide guidance for the development of an HSS curriculum that aligns with traditional medical education components.

DEDICATION

This final project is dedicated to first generation students like me who never imagined they could go this far. Believe in yourself, work hard, find some great mentors, and never give in to that little voice. Even when life seems too much, you can do it. You are not "too" anything. You are exactly where you need to be. Just keep moving.

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Anything is possible when you have great people supporting you. I am very fortunate that I am surrounded by an amazing and supportive group of mentors, advisors, friends and family.

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CHAPTER 1

INTRODUCTION

Health System Science

Health Systems Science refers to the critical competencies that are necessary to deliver the highest quality value-based health care in a manner that is both patient and population centered. Health Systems Science is the scaffolding which medical education can utilize to ensure future physicians have the knowledge and skills to address some of the shortcomings in the U.S. healthcare system, which spends a higher percentage of its gross domestic product on health care than other nations, yet lags others when it comes to life expectancy and prevention of chronic diseases (Mann, 2019; Tikkanen & Abrams, 2020).

The U.S. healthcare system is a multi-billion-dollar industry that has captured the attention of the government and the public as they struggle to manage the costs associated with the provision of health care services. It is important to remember, however, that health is largely impacted by non-medical factors outside of this complex system. That is, health is impacted by where we live, work, learn and play, and the realities of life that influence health behaviors and interactions between patients, providers, and the healthcare system (World Health Organization, 2008). These factors are commonly referred to as the Social Determinants of Health (SDoH) and these conditions are shaped by the distribution of money, power, and resources at global, national, and local levels (Healthy People 2020; Heiman& Artiga, 2015).

Healthcare systems and programs that consider the SDoH within their approach to care offer the potential to reduce costs, improve patient outcomes and reduce health disparities (Anderman & CLEAR, 2016). Health disparity is defined by the Centers for Disease Control and Prevention (CDC) as "the difference in health outcomes and their causes among groups of people" (CDC, 2013). These differences are closely linked to educational, social, economic, and health status. Health status is dependent on the degree to which we practice *healthy behaviors*, *environmental determinants* and *educational and economic status and opportunities*. All these factors and determinants play a role in positively supporting health (Braverman & Gottlieb, 2014).

Healthcare is delivered by many types of providers and services. However, the most prominent driver of care is the medical doctor.[1] Doctors are the center of the healthcare delivery system and are therefore the central players in healthcare transformation. If healthcare systems want to change the way they operate they will need to change the way they educate doctors and produce doctors who are trained to look at patient care differently. The traditional model of medical education focuses on a strong foundation in basic science. Most accredited US medical schools operate on a four-year model and require at least 130 weeks of training (Liaison Committee on Medical Education, 2016). The first two years of training are largely didactic while the latter two years focus on providing students clinical training in the field, in hospital and clinic settings. Students are trained to focus on diseases and cures; and little, if any, attention is paid to consider or understand the patient in context in conventional medical training.

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[1] For the purpose of this research, I will use the term "medical doctor", "doctor" , "clinician", and "physician" interchangeably.

Medical doctors are rarely trained to see the underlying social realities and challenges that might drive a patient's health issues. In order to prepare doctors to meet the challenges facing the healthcare system, and to better serve their patients, we must start upstream and change the way medical education is delivered (Song, Poythress, Bocchini & Kass, 2018).

This research investigated the addition of a Health Systems Science (HSS) curriculum in medical education designed to help train physicians to identify and address social challenges of their patients. HSS is defined by the American Medical Association (AMA) as how healthcare is delivered, how healthcare professionals work together to deliver that care, and how the health systems can improve patient care and healthcare delivery. HSS refers to the competencies that are needed for healthcare delivery systems to deliver high quality and value-based care (improved care with lower cost) that is both patient and population centered (Mann, 2019). These competencies include population health (social determinants of health and healthcare equity) healthcare policy and economics, value-based care, informatics, interprofessional skills, and health system improvements (Daniel, Bornstein & Kane, 2018).

The governing bodies within medical education have recognized the need for emphasis on social factors. In 2015, the Medical College Admission Test (MCAT) added a social and behavioral science component to the biological and physical sciences portions of the exam. This was done with the belief that students with a greater understanding of social and behavioral issues will result in greater advances in medical science and greater proficiency in medical practice, including improved success in preventing, diagnosing, and treating disease and injury (Frazer & Twohig, 2012). An HSS

curriculum is designed to include education addressing the social, economic, and political

forces that have become an integral part of health delivery. In order to address the health

of the population, HSS trains medical students to address these forces when caring for

patients. An HSS curriculum provides students with the context of how the SDoH

impacts health and exposes students to a variety of learning modules. These modules

provide practical application of SDoH topics and provide students with an immersive

experience that allows them to work in interprofessional care teams. These care teams

immerse them in roles that are not traditionally physician-centric like assisting patients

with social services (Skochelak & Hawkins, 2017). The Liaison Committee on Medical

Education (LCME) and graduate medical education standards recognized the importance

of understanding how the social determinants of health impact care, and in 2016,

mandated education in cultural competency and understanding underserved populations

within the context of health disparities in order for medical students to become clinically

proficient physicians (LCME, 2016).

Statement of the Problem

The United States spends almost twice what other high-income nations do on

healthcare but has a lower life expectancy and a higher infant mortality rate than other

peer nations (Papanicolas, Woskie & Jha, 2018). In addition, the United States falls far

behind other comparable countries on measures of quality of healthcare, and access to

care and health equity (Trujillo, 2016). Across disciplines and roles, healthcare leaders

are being asked to improve quality of care and reduce healthcare costs but are unprepared

to address the non-clinical issues that are at the core of the problem. As the main steward

of health delivery, doctors find themselves in a quandary. They struggle to care for

patients who need to be seen for chronic illness like diabetes, but they lack the time to effectively deliver counseling to address health behavior changes that could decrease demand for care (Kahn & Eshbach, 2019).

Medical education has not traditionally included training involving the SDoH, leaving the physician workforce ill prepared to address non-clinical drivers of poor health outcomes. Failure to identify social challenges can lead to misdiagnosis, inappropriate testing, flawed treatment plans, lack of adherence to medication, readmission, and overall poor health. For example, counseling a patient to exercise without recognizing that they live in an unsafe neighborhood or counseling a patient with high blood pressure to reduce the intake of salt but failing to identify a lack of access to food can affect short-term and long-term health.

These social challenges and inequities can contribute to health disparities. Health disparities defined by the Department of Health and Human Services, are "a particular type of health difference that is closely tied with social, economic and/or environmental disadvantage" (Healthy People 2020). One goal of HSS is to eliminate these disparities through system level approaches and universal access to quality of care that is immune to bias. In 2013, the AMA solicited grant proposals for their Accelerating Change in Medical Education initiative with the goal of "providing innovative curriculum that embeds students in real-world experiences, provides cutting edge technology, and system-based thinking through the development of an HSS based curricula." (Accelerating Change, 2017). The AMA defines HSS as how healthcare is delivered, how healthcare professionals work together to deliver that care, and how the health systems can improve patient care and healthcare delivery. This project funded 11 schools

in 2013 and 21 more were awarded in 2015. According to the AMA an estimated 19,000 medical students—18% of all U.S. allopathic – MD granting medical schools, and osteopathic – DO granting medical schools, medical students—study at medical schools that are consortium members (Accelerating Change, 2017; Gonzalo, Skochelak, & Wolpaw, 2017).

The goal of HSS training is to create physicians who are better prepared to address the non-clinical issues that impact their patients' health, and have a more holistic view of patient care (Accelerating Change, 2017; Gonzalo, Skochelak, & Wolpaw, 2017). The introduction of these topics into the traditional medical education curriculum formally adds training to consider social determinants of health (SDoH), health disparities, prevention, and health promotion. The impact of this curricular change is difficult to measure as the outcomes are far downstream and often may not be realized until a first-year medical student becomes a practicing physician.

Purpose of the Study

The goal of this research is to evaluate medical student perceptions of the importance of HSS before and after exposure to a new curriculum that includes HSS.

In 2017 the AMA, through their Accelerating Change program, developed a comprehensive framework to support the integration of HSS into medical school curricula. Prior to the integration of HSS medical school training did not routinely embed education for training doctors core constructs of HSS like health communication, identifying and addressing SDoH (Gonzalo et al., 2017). HSS framework is designed to provide medical students with the tools and the lens to look beyond the medical event and

consider the social issues surrounding the problem. The goal of this framework is to train clinicians to make a difference at the patient's side and in the community.

After the development of the framework for HSS, Gonzalo et al. (2017) conducted a qualitative study at Penn State University with 50 medical students across all years of medical school, but not participating in a HSS curriculum. Focus groups were used to explore student perceptions of barriers, benefits, and recommendations for integrating HSS into medical school education. Gonzalo et al. found that while students felt that adding training focused on the HSS was important, they were concerned that adding this to their training might decrease the time they have to focus on the basic science information needed to pass the board examinations required to secure a residency (required postgraduate clinical training) and practice medicine. Lawley, Saxton, and Johns (2005) identified similar concerns among a group of faculty from a diverse mix of medical schools across the United States. These faculty expressed concern for the alignment of curricular change and the impact on benchmarks, board exams and residency placements. Gonzalo, Haidet, Blatt and Wolpaw (2016) found that HSS is viewed by medical students as peripheral and non-essential which could limit commitment to mastering the content. Student feedback is required to address these challenges and create new perspectives on the importance of the SDoH and how they impact medical care. To successfully implement the new curriculum, medical schools need to help medical students see that HSS information as just as important to their medical education as the traditional basic science components of medical education (Fink, 2003).

Research Questions

The implementation of HSS in the curriculum of medical education is an educational initiative that was designed to increase knowledge of HSS topics. The goal of this research was to investigate the perception of the importance of HSS topics by medical students before and after receiving exposure to the curriculum. The following research questions guided this study:

1. *What are medical student perceptions of the value of HSS training pre-exposure to a curriculum that addresses HSS?*

2. *What are medical student perceptions of an HSS curriculum post-exposure?*

3. *Does exposure to an integrated HSS curriculum affect the perception of importance of these topics among medical students?*

4. *Do these perceptions vary based on age, race, gender, ethnicity, previous training or whether medical students grew up in a rural, urban or suburban environment?*

Summary

HSS is important to medical education. It addresses the significance of how the SDoH influence health and health delivery and how the addition of information about the SDoH to the curriculum prepares physicians to consider these factors when practicing medicine. This study will be the first step in identifying student perceptions of curriculum changes that include HSS. The goal is to help educators understand how students perceive the importance of HSS and how to address these perceptions.

Definition of Terms

1. **American Medical Association (AMA)** - founded in 1847, is the professional organization for physicians in the United States. The AMA disseminates information on issues important to physicians, patients, and the nation's health.

2. **Cultural Competence** - Cultural competence is the ability to understand, communicate with and effectively interact with people across cultures. Cultural competence encompasses. being aware of one's own world view. developing positive attitudes towards cultural differences. gaining knowledge of different cultural practices and world views

3. **Health Disparity** - Health disparities are preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are experienced by socially disadvantaged populations.

4. **Health Status** - Health status is dependent on the degree to which we practice healthy behaviors, environmental determinants and educational and economic status and opportunities.

5. **Health System Science (HSS**) – Health System Science is the study of how healthcare is delivered, how healthcare professionals work together to deliver that care, and how the health systems can improve patient care and healthcare delivery for patients and populations.

6. **Liaison Committee on Medical Education (LCME) -** The Liaison Committee on Medical Education is an accrediting body for educational programs at schools of medicine in the United States and Canada. The LCME is sponsored by the Association of American Medical Colleges and the American Medical Association.

7. **Medical College Admission Test (MCAT) –** The Medical College Admission Test is a multiple -choice, computer-based, standardized exam that is required for admission to medical schools in the United States and Canada.

8. **Public Health -** is the science of protecting and improving the health of people and their communities. This work is achieved by promoting healthy lifestyles, researching disease and injury prevention, and detecting, preventing, and responding to infectious diseases.

9. **Population Health** - the health outcomes of a group of individuals, including the distribution of such outcomes within the group (Kindig & Stoddart, 2003).

10. **Social Determinants of Health (SDoH) -** Conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.

CHAPTER 2

LITERATURE REVIEW

Introduction

The Flexner Report outlined a model of medical education that focused on a strong foundation of didactic basic science in the first two years followed by two years of clinical training in the field. While this model has served the medical community for over 100 years, there is question if this is still the best model to produce physicians that are prepared to provide care that reflects the changes in the healthcare delivery model and provides adequate attention to patient populations (Billet, Cooke, Irby & Obrien, 2010).

Traditionally, medical school training has not consistently included training that included the social determinants of health (SDoH), how social factors impact health and how health systems function (American Medical Association, 2017). This training is interwoven in the curriculum in many ways. Some students gain some or all this information from electives or over the course of their clinical experience with no standard of operation or assessment of competency (Gonzalo et al., 2017).

A Call for Change

In 2001 the Institute of Medicine issued a report identifying major changes needed in medical education (Institute of Medicine, 2001). The report reviews the quality of healthcare systems and recommends the need for centralization of information. At the time of publication this would have been a huge undertaking for many medical systems

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and the report lacked details of how these changes could be operationalized. Medical schools have taken this on in a variety of ways by embedding HSS curriculum.

In 2002 the AAMC established the Institute for Improvement in Medical Education "to better align the knowledge, skill and professionalism of medical students, resident and practicing physicians…" across training programs. The mission of this Institute was to better align knowledge and skills to meet the needs and expectations of the public. This report outlines strategies and needs but does not address barriers to implementation (Gould et.al., 2002). Barriers included cost and most important, the change in attitudes and beliefs of physicians and medical schools. It has been a transition for current physicians to change the way medical education is delivered. HSS competencies require formal education and role modeling in both the clinical setting and the classroom. This is challenging because few faculty have had formal training in how to practice or teach these concepts (Gonzalo, Chang & Wolpaw, 2018). Students are overwhelmed by their traditional course load which makes it hard to prioritize HSS topics without an inclusive curriculum.

In 2005 Lawley, Saxton and Johns (2005) surveyed 50 medical school faculty from across the United States and the results showed that while the faculty felt that they did a good job educating medical students, there was significant room for improvement. They found that programs have changed to include more time for clinical training and more focus on sub-specialties but lack focus on health education. One important piece of information was the link between change and meeting regulatory standards and benchmarks. United States Medical Licensing Examination (USMLE) requirements affect or limit the alteration of curriculum. After medical school, graduates who plan to practice

clinically are required to do an internship and a residency. These training positions are competitive, for example, pediatrics, surgery, and radiology. The higher students score on their USMLE the more competitive they become. One measure of a successful medical education program is their residency placement success, also known as "matching". Matching is a uniform system where medical students who have completed their four-year training and residency programs simultaneously "match" to fill post-graduate training positions (AAFP, 2013) Changing curriculum could impact benchmarks. This could affect the willingness of institutions to implement change for fear that change could limit a student's ability to secure a training spot (match) in their desired residency program (Lawley, Saxton & Johns, 2005).

HSS focuses on improving quality, outcomes and the cost of healthcare and complements the traditional basic and clinical science components of medical education. HSS provides focus on the health care delivery system and prepares students to work within all aspects of the health delivery system (Sajid, 2016).

In 2006 Cooke, Irby, Sullivan and Ludmerer (2006) revisited the Flexner Report and suggested that changes to medical education were needed due to the transformation of medicine and new delivery systems. Relying just on biologic knowledge is limiting, they argued, and future clinicians need skills in critical thinking, empathy, inter-professional teamwork, population health and health policy. While these authors point to the need for change, and the potential obstacles, they do not offer any framework or path forward.

In 2009 as a response to accreditation concerns and professional development of physicians, Moskowitz and Nash put together a review of medical education teaching and

assessment methods to evaluate competencies in problem-based learning and improvement and systems-based practices. This review outlines the lack of and need for quality and safety training for healthcare professionals (Moskowitz & Nash, 2009). While the data cited support the authors' findings, they too, offer no suggestions on how to operationalize these changes.

In 2010 The Carnegie Foundation for Advancement of Teaching published *Educating Physicians: A Call for Reform of Medical School and Residency*. This report calls for major reforms of how physicians are educated. Irby, Cooke and O'Brien (2010) did not find great disparities in the quality of education among the medical schools visited but they did cite that medical education is too focused on the inpatient experience and change to the overall delivery of medical education is needed. In 2010 a review of the report studied these recommendations and stated that "a new model is needed based on a rigorous platform of competency-based instruction and assessment" (Irby, Cooke & O'Brien, 2010). This model emphasized standardization, individualism, and inquiry. While they do not specifically address SDoH or HSS they do call for a revision in medical education

The Case for HSS

HSS provides a framework for the delivery of knowledge and hands-on experience to students so they can consider non-clinical factors when caring for patients. An HSS informed curricula seeks to provide students with the context of how social status and influences impact health and provides students with a lexicon that allows them to work in interprofessional care teams in roles that are not traditionally physician centric.

An example of this non-traditional role is assisting patients with non-clinical needs like access to food or public utilities (Skochelak & Hawkins, 2017).

In 2009, Baum, Begin, Howeling and Taylor suggested that reorienting health delivery and increasing a focus on the social determinants of health could help to close the gap of health equity issues. They argued that healthcare systems themselves are a key resource in improving health and health equity. Many healthcare systems do not focus on the social determinants of health which impedes a system's ability to make healthcare available and accessible to all social groups. While the human lifespan has doubled over the past 200 years, major inequalities of health persist (Baum, Begin, Howeling & Taylor, 2009). The gap between the health of the rich, middle class and poor is dramatic despite major advances in medicine. A focus on population health is one way to address these inequalities (National Academies of Sciences, 2017). Changing risk factors by addressing social issues is required to reorient health delivery systems (Baum, Begin, Howeling & Taylor, 2009). The authors present several tiers of how this can be achieved: policy changes, a focus on health promotion and prevention, comprehensive health care, adequate information systems, and an appropriately skilled workforce. In order to make the suggested changes to health delivery, future physicians need to strengthen their knowledge of the impact of the social determinants of health on health delivery and population health approaches to care. They support the need for creating a central training curriculum that focuses on the understanding and improvement of HSS (Baum, Begin, Howeling, & Taylor, 2009).

In 2013, research began to surface regarding the benefits of HSS training in medical education. In their research, Mabry and Kaplan (2013) review the current state of

the field and funding of HSS applications in health promotion and public health. While there is an increase in funding research grants and training programs, they suggest that much more funding is needed to promote these programs. The authors acknowledge that funding for medical education and all the components of medical training has included a steady stream of public dollars from a federal level. They do not address how or where more funding should come from and if it were to come from a federal budget which other programs would be cut or see a decrease in funding in order to support HSS.

Mabry, Milstein, Abraido-Lanza, Livingood and Allegrante (2013) reviewed HSS as part of the development of health promotion and public health research. They reviewed HSS through the lens of how we understand and act effectively within complex systems. They suggest that HSS offers a practical approach to a complex system and health challenges that include social, physical, and organizational settings. They offer strong support that HSS is important to the training of future physicians.

In 2013 the AMA solicited grant proposals for their Accelerating Change in Medical Education (ACE) initiative with the goal of "providing innovative curriculum that embeds students in real-world experiences, provides cutting edge technology, and system-based thinking through the development of an HSS based curricula". The AMA defines HSS as how healthcare is delivered, how healthcare professionals work together to deliver that care, and how the health systems can improve patient care and healthcare delivery. This project funded 11 medical schools in 2013 and 21 more were awarded in 2015 to implement an HSS curriculum. According to the AMA an estimated 19,000 medical students—18% of all U.S. allopathic – MD granting medical schools, and

osteopathic – DO granting medical schools, medical students—study at medical schools that are consortium members (Gonzalo, Skochelak, & Wolpaw, 2017).

While there is support for the benefit of HSS in medical education, there has been limited research that addresses the student's reaction to this new curriculum. Gonzalo, Haidet, Blatt and Wolpaw (2016) surveyed a group of medical students who had not been exposed to the curriculum. They found that HSS is viewed by medical students as peripheral and non-essential which could limit student engagement. Students reported recognizing the importance of systems knowledge and skills, but many students viewed basic and clinical skills as more essential given the time pressures of medical school. Students felt that HSS skills could potentially come later in their careers without consequence to patients or healthcare systems. Student feedback is required to address these challenges and create new perspectives. To successfully implement the new curriculum, medical schools need to help students see that HSS is just as important to their medical education as anatomy and physiology (Fink, 2003). The Gonzalo et al. (2016) study focused on the perceived barriers, challenges, and benefits of an HSS curriculum. They conducted a series of focus groups and qualitatively explored students' perceptions of a proposed HSS curriculum. There is a need to explore these perceptions with students who have been exposed to an HSS curriculum.

Theoretical Model and Conceptual Framework

This study is an investigation of baseline perceptions and post exposure perceptions of HSS integration into a medical school curriculum. This study was informed by the Transtheoretical Model (TTM) also known as the Stages of Change

Model. Constructs embedded in TTM were used to explore student perceptions of HSS pre- and post-exposure to related curriculum.   This work is focused on measuring the perceived impact of consciousness raising to ascertain how students feel about the curriculum pre- and post-exposure (Whitelaw, 2000). The Transtheoretical Model (Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992) is an integrative, biopsychosocial model to conceptualize the process of intentional behavior change.

fig 1. Stages of Change Model (adapted from Prochaska, DiClemente & Norcross, 1992)
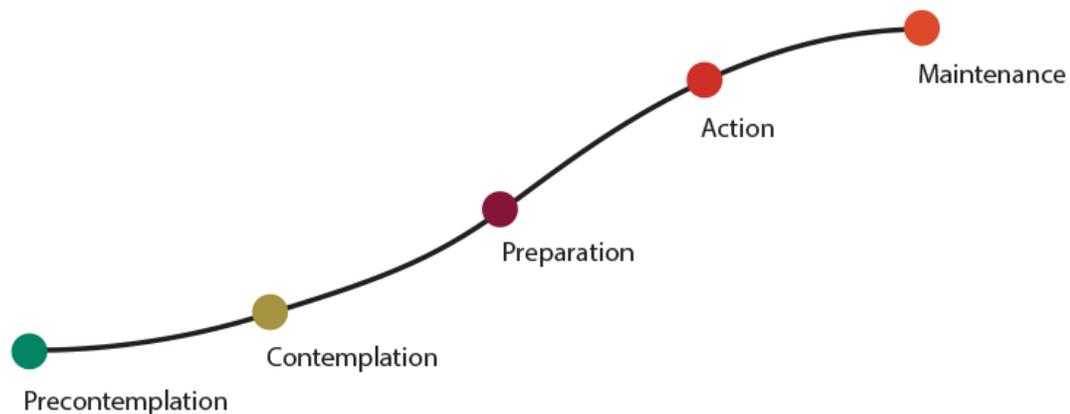
The TTM asserts that when modifying behavior, individuals move through a series of stages (Prochaska, DiClemente, & Norcross, 1992). The TTM identifies these as stages of change. Within these stages are processes of change or steps to facilitate change. For the purposes of this study, the research focuses on the first process, Consciousness Raising. Consciousness raising is an increased awareness of an issue and an appreciation of the benefits associated with a change related to that issue. That is, once

an individual is aware of the benefits, they begin to recognize the need for change (Glanz, Rimer & Viswanath, 2015). This awareness helps an individual to progress. The processes include decisional balance (the pros and cons of accepting change) and self-efficacy (the ability to implement the change). TTM recognizes change as a process that happens over time, and is influenced by exposure (Glanz, Rimer & Viswanath, 2015).

There are 10 processes of change in the TTM model. This evaluation focused on the consciousness raising process of change. Consciousness raising is embedded in the precontemplation stage and refers to finding and learning new facts, ideas and tips that support behavior change (Glanz, Rimer & Viswanath, 2015). In reference to this study, the consciousness raising process assumes that the student has no perception or has a negative perception of the value of HSS. Students are tested in the precontemplation stage, exposed to the consciousness raising process of change (new curriculum) and tested to see if exposure changes perceptions. The goal was to learn if students have moved to contemplation where they show a positive perception of the value of HSS topics.

This model was applied with the intent to focus on consciousness raising around the topics of HSS and their role in healthcare delivery. This intervention was intended to provide data that will allow for the assessment of difference in perception of HSS by medical students exposed to an HSS curriculum. This information can then be used to inform future curricular development.

CHAPTER 3

METHODS

The purpose of this research was to evaluate the perception of the importance of HSS topics specific to population health by medical students before and after receiving exposure to the curriculum during their first year of medical school. This chapter describes the setting and participants, research methodology, research design, instrument development and testing, and data analysis.

Restatement of the Research Question

1. *What are medical student perceptions of the value of HSS training pre-exposure to a curriculum that addresses HSS?*

2. *What are medical student perceptions of an HSS curriculum post-exposure?*

3. *Does exposure to an integrated HSS curriculum affect the perception of importance of these topics among medical students?*

4. *Do these perceptions vary based on age, race, gender, ethnicity, previous training or whether medical students grew up in a rural, urban or suburban environment?*

Setting and Participants

Larger context and local setting

This research took place in a large, urban, private, allopathic medical school located in a large east coast, US city. Each year approximately 270 students are admitted from an applicant pool of 11,000. Data were collected over two years (2017

and 2018), and surveyed two independent, first-year cohorts. Each year, 250 first -year medical students were invited to complete a voluntary, baseline assessment that explores their perception of the importance of HSS topics and the importance of these same topics in medical education.

In 2019 the AAMC reported that the national average of the enrolled medical student population as 48% male and 52% female. In addition, the national average of the enrolled medical student is 50% white (AAMC, 2019). Study participants reflected AAMC data, and self-reported a gender mix of 51% males and 49% females. The institution where the research took place reports that 66% of students are white which is 16% higher than the national average. Thirteen percent of students reported that they are from non-white ethnic groups which are underrepresented in medicine. *Underrepresented in medicine* is defined by the AAMC as those racial and ethnic populations that are *underrepresented* in the medical profession relative to their numbers in the general population (e.g.., Blacks, Mexican Americans, Native Americans, etc.).

The demographics of study respondents are representative of the overall student population with the exception of gender. More females than males or persons who identified as other genders, participated in all four phases of the study. The largest group of respondents report their race as White (64%) the second largest group is Asian (22%) the remaining 13% is shared between Black/African American (1%), Hispanic (5%) and other (7%).

Research Methodology

This pre-test and post-test survey-based study aligns with a post-positive framework. A quasi-experimental, repeated cross sectional design was employed to facilitate the collection and analysis of the survey data. This approach is often used to evaluate the benefits of specific nonrandomized interventions (Harris, McGregor, Perencevich, Furuno, Zhu, Peterson, & Finkelstein, 2006).

Setting

First year medical students from a large, urban medical school were surveyed for this study before and after exposure to the HSS curriculum. Prior cohorts were not exposed to this curriculum and no control group was established. An Institutional Cycle Design was applied for analysis (Campbell & McCormack, 1957). This design combines the "longitudinal" and "cross-sectional" approaches commonly employed in developmental research when a study lacks the intrinsic symmetry of a true experimental design. It is best applied in situations in which the study follows a recurrent cyclic schedule continually being presented to a new group of respondents. In this case, a survey of new, incoming medical school classes each year for two years was administered (Campbell & McCormack, 1957; Campbell & Stanley, 1963).

Notation of the study is:

| Cycle 1 | O | X | O | | |
| Cycle 2 | | | O | X | O |

O = test

X = exposure (HSS Curriculum)

Research Design

This quasi-experimental, repeated cross-sectional, Institutional Cycle Design was used to analyze the pre and post-test of group 1, the pre- and post- test of group 2 and the post-test of group 1 compared to the pre-test of group 2. Data were analyzed using a paired t-test to calculate the difference between responses prior to exposure to the educational intervention and after exposure to the intervention. The pre- and post-test spanning groups 1 and 2 was used to ensure triangulation.

This study aimed to examine the changes in perception of medical student attitudes pertaining to the addition of HSS topics and their importance to medical school education through a pre- and post-test survey. Students were tested early in their first year of medical school (September) and re- tested at the end of that academic year (May) using a Qualtrics electronic survey tool using a seven-point Likert scale. The survey was anonymous, and all information de-identified. Students were asked to rate the importance of key first-year medical school curriculum topics including HSS topics and rate how important they thought these topics were in preparing them to become

practicing physicians. The pre-test survey was sent early in September before students were exposed to the HSS curriculum. The post-survey was sent in May after students spent one academic year exposed to the curriculum. Other data that were gathered were the respondents' age, prior degree(s), race, gender and if the student considers themselves to have grown up primarily in an urban, suburban, or rural setting.

A post-test was sent in May, at the end of the first year of training after students had completed the 1st year curriculum. These assessments were in the form of a short, Qualtrics electronic survey sent out via an email communication from the Office of Student Affairs connected to the medical school.

 In the pre-exposure survey, students were asked their personal perception of importance of HSS topics and their perception of importance of the topics in medical school education prior to exposure to the new curriculum. These topics included population health related terms and traditional medical curriculum topics. Population health topics were SDoH, Public Health, Healthcare Quality & Safety, Population Health, Wellness and Prevention and Interprofessional Practice. Traditional medical education topics were Immunology, Anatomy and Physiology, Infection Control, and Clinical Skills. In addition to these topics, demographic data were also collected.

Data Collection

A survey link with a request for participation was sent to all 1st year medical students from the Office of Student Affairs at the medical college. The first survey was sent in late August prior to the introduction of the HSS curriculum. The post-survey was sent in May after completion of the HSS curriculum. This survey was anonymous and

included no identifiable information. The responses were held in a protected Qualtrics account that only the researcher (JR) had access to. Any data that were downloaded were downloaded on a password protected laptop. The laptop was not accessible from any other open drives or remote access.   This study was not research involving human subjects as defined by the Department of Health and Human Services and it was not designed or developed to contribute generalizable knowledge. Consequently, Temple IRB and the IRB at the university where the data were gathered deemed that a review and approval were not applicable.

Role of the Researcher

The researcher was in no way connected to the medical school, the medical students, or the medical school curriculum committee. The research was being conducted at a different college at the institution where I was once employed. Recruitment was limited to email messages with no recruitment taking place in formal or informal interactions with students. Thus, my position at the institution was not affiliated with the study. I am trained as a public health professional and feel that the implementation of the topics of HSS in medical school education have great value to help address health disparities.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 25 was used to conduct all statistical analyses. Data were analyzed using separate samples t-test to

calculate the difference between responses prior to exposure to the educational intervention and after exposure to the intervention. An explanation of why this choice was made is presented below. The pre- and post-test spanning groups 1 and 2 was implemented to ensure triangulation. A Cronbach's Alpha was applied to assess the internal consistency of the test and a factor analysis was conducted as an exploratory analysis for future research.

Validity

There are several threats to the validity for this type of evaluation. Without the ability to control for exposure to the curriculum (all incoming students were exposed to the same curriculum) it is difficult to evaluate the effect of the exposure. Students who were part of the previous curriculum were not available for participation as they were active in the clinical portion of their program and at various sites off campus. In addition, because these students would be 3rd and 4th year students, they may have a different appreciation for population health due to a greater exposure to patient experiences. In addition, the student affairs officer at the medical school would not allow any identifiers to be used in the survey to protect the medical student's identity. This requirement made it impossible to link pre- and post- responses to a single respondent. Without that, it is impossible to directly measure change. It is possible that differences observed could be due to exposure to the curriculum or to differences in recruitment from year to year. This limitation also impacted the choice of the statistical analysis. In the more typical pre-test/post-test design the appropriate analysis is a paired samples t-test. Since the pre-test data could not be linked to the post-test data, the only possible analysis was to treat these

as if they were separate groups. One of the effects of this is that the statistical analysis has less power.

The most likely threats to validity for this study are listed below (Campbell and Stanley, 1963):

- **History**--between pre-test and post-test many events may have occurred apart from the curriculum exposure to produce the differences in outcomes. For example, students may be exposed to people experiencing homelessness or people who have health access issues and that could impact their measure of importance of HSS.
- **Test-Retest**--the effect of giving the pretest itself may affect the outcomes of the second test. There is also the possibility of a reactive effect and students change their perception because they are being asked about it and they may perceive they need to answer differently than they really feel.
- **Maturation**—students may gain different perspectives as they age in the program.

The pre-test/post-test cross-sectional comparison of O_1 and O_2 provides differences which could not be explained by history or a test-retest effect (Campbell & Stanley, 1963).

Limitations

      The critical limitations of this study include four key issues. The first is that there is no baseline data from previous 1st year medical students who followed the traditional medical education route to compare with the data of these students who are new to the HSS curriculum. The second is that there is no control group to measure the outcomes of the pre-test/-post-test against and therefore I am unable to make any direct inferences about the effects of the curriculum. Because the medical school would not allow any identifying information attached to respondents, there is no way to follow individual pre- and post- responses and therefore change cannot be directly measured. The analysis that was conducted was based on the assumption that if the mean at the pre-test for the group of students is significantly different than at the post-test, there is some basis to conclude that a change has occurred. It is important to note that all students who come in as 1st year medical students are required to follow the same curriculum. The third limitation is that the study assumes that all respondents start at the same stage of change – precontemplation. There is no tool to determine if any respondents are further along the stage of change spectrum. Finally, this research was conducted at a single-site and may not be able to be applied to other medical schools, thereby limiting the transferability of these findings.

<div align="center">

CHAPTER 4
RESULTS

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As described in Chapter 3, the survey was administered to all first-year medical

students at XX university at the beginning and end of the 2017 – 2018 academic year,

and then again at the beginning and end of the 2018- 2019 academic years. There were

129 students in the first cohort and 168 in the second.

Descriptive Data on the Sample

Descriptive data on the students are presented in Tables 4.1 through 4.5.

Tale 4.1:   Gender

	2017 – 2018		2018 – 2019	
	N	Percent of sample	N	Percent of Sample
Males	53	41.1	67	39.9
Females	63	48.8	93	55.4
Missing	13	10.1	8	4.8

Table 4.2:   Age

	2017 – 2018		2018 – 2019	
	N	Percent of sample	N	Percent of Sample
19 – 21	6	4.7	11	6.5
22 – 24	80	62.0	109	64.9
25 – 27	26	20.2	29	17.3
28 – 30	3	2.3	11	6.5
31+	2	1.6	4	2.4
Missing	12	9.3	4	2.4

Table 4.3:   Environment

	2017 – 2018		2018 – 2019	
	N	Percent of sample	N	Percent of Sample
Rural	13	10.1	14	8.3
Suburban	90	69.8	115	68.5
Urban	14	10.9	32	19.0
Missing	12	9.3	7	4.2

Table 4.4:   Previous Degree

	2017 – 2018		2018 – 2019	
	N	Percent of sample	N	Percent of Sample
No Previous Degree	101	78.3	131	78.0
One or more Previous Degrees	18	14.0	32	19.0
Missing	10	7.8	5	3.0

Table 4.5:   Race

	2017 – 2018		2018 – 2019	
	N	Percent of sample	N	Percent of Sample
White	79	61.2	119	70.8
Black	1	.8	2	1.2
Hispanic	5	3.9	4	2.4
Asian	18	14.0	34	20.2
Other	13	10.1	3	1.8
Missing	13	10.1	6	3.6

As shown in the above tables, the in-coming freshman class is predominately white, in

the 22 – 24 age range, has come from a suburban environment, and does not have any

previous degrees. There are slightly more females than males in both cohorts.

Internal Consistency of the Scale

The survey that was administered to the students consisted of 10 questions asking

the students' perception of the importance of various components of Health Science

Curriculum. The first set of questions asked: How important are the following medical

school curricular topics to you?   The second set of questions asked: How important do

you feel it is for medical schools to include these topics in order to prepare students to become clinicians? Cronbach's Alpha for Question set # 1 was .892; for Question set # 2 it was .901. Both of these are well beyond the standard metric of .8 considered adequate for internal consistency. Although both scales have adequate internal consistency, the analyses presented below will focus more on the individual questions to provide nuance.

Analysis of the Data to Answer the Research Questions

The analyses for each of the research questions are presented below. As mentioned above, there were two cohorts of students from two consecutive freshman classes. Although there were some differences between these cohorts, it was decided to combine them to answer the major research questions.

Research Question # 1:

What are medical student perceptions of the value of HSS training pre-exposure to a curriculum that addresses HSS?

Research Question # 2:

What are medical student perceptions of an HSS curriculum post-exposure?

The pre-exposure and post-exposure mean for each of the questions on the survey are presented in Table 4.6.and 4.7. These means are derived from a 7-point Likert scale where "1" means "Not at all important" and "7" means "Extremely Important". The complete distribution of the answers is contained in Appendix B.

Table 4.6: **Means for the 10 Questions for: How important are the following medical school curricular topics to you?**

	Pre-Exposure Mean	Post-Exposure Mean
Social determinants of health	5.13	5.23
Immunology	6.12	6.10
Public Health	5.24	5.31
Anatomy & Physiology	6.46	6.45
Healthcare Quality and Safety	5.28	5.19
Infection Control	5.62	5.63
Population Health	5.01	5.22
Clinical Skills	6.61	6.47
Wellness and Prevention	6.36	5.28
Inter-professional Practice	5.00	4.86

Table 4.7: **Means for the 10 Questions for: How important do you feel it is for medical schools to include these topics in order to prepare students to become clinicians?**

	Pre-Exposure Mean	Post-Exposure Mean
Social determinants of health	5.46	5.49
Immunology	6.40	6.35
Public Health	5.41	5.40
Anatomy & Physiology	6.60	6.57
Healthcare Quality and Safety	5.65	5.43
Infection Control	5.99	5.85
Population Health	5.39	5.40
Clinical Skills	6.77	6.53
Wellness and Prevention	5.63	5.44
Inter-professional Practice	5.49	5.25

As shown in Tables 4.6 and 4.7, most of the means range between 5.5 and 6.5 indicating that the students feel these topics are "Moderately" to "Very Important". While there are some differences between the responses for the two questions, the answers are

basically consistent. In both cases the three areas with the strongest support at both pre-exposure and post-exposure are "Clinical Skills", "Anatomy and Physiology" and "Immunology". For Question set # 1 the second strongest support is for "Wellness and Prevention" at pre-exposure, although this drops considerably post-exposure. The least supported area for both questions is "Inter-professional Practice"

Research Question # 3:

Does exposure to an integrated HSS curriculum affect the perception of importance of these topics among medical students?

To answer this question, separate samples t-tests were computed comparing the pre-exposure and post-exposure means. As mentioned in Chapter 3, the most typical analysis for a pre-test/post-test analysis is a paired samples t-test. However, since the subjects were not required to identify themselves in completing the survey, this analysis was not possible. This results in a loss of power which should be considered in interpreting the results. The homogeneity of variance assumption was checked for each analysis through the Levene Test. Where the assumption was not met, the corrected t-test was used. Tables 4.8 and 4.9 present the t value, the two-tailed probability and Cohen's d where significance was found.

Table 4.8: **Separate Samples t-tests Comparing Pre-Exposure to Post-Exposure Means:**

Question Set # 1

	t	Two-Tailed Probability	Cohen's d
Social determinants of health	.767	.444	-
Immunology	-.262	.793	-
Public Health	.600	.549	-
Anatomy & Physiology	-.094	.925	-
Healthcare Quality and Safety	-.786	.432	-
Infection Control	-.082	.935	-
Population Health	1.645	.101	-
Clinical Skills	-1.862	.063	-
Wellness and Prevention	-.578	.077	-
Inter-professional Practice	-.999	.318	-

Table 4.9: **Separate Samples t-tests Comparing Pre-Exposure to Post-Exposure Means:**

Question Set # 2

	t	Two-Tailed Probability	Cohen's d
Social determinants of health	.243	.808	-
Immunology	-.727	.467	-
Public Health	-.029	.977	-
Anatomy & Physiology	-.479	.632	-
Healthcare Quality and Safety	-1.85	.065	-
Infection Control	-.1.30	.193	-
Population Health	.094	.925	-
Clinical Skills	-3.33	.001	.24
Wellness and Prevention	-1.41	.158	-
Inter-professional Practice	-1.72	.085	-

Note: In the above tables a positive t value indicates that the means increased between pre-exposure and post-exposure. A negative t value indicates that the means decreased.

As shown in Tables 4.8 and 4.9, there is only one significant change between the pre-exposure and post-exposure means-- "Clinical Skills" for Question Set # 2. As shown

in the table, the mean significantly decreased with a small effect size. Of the 20 analyses presented in these tables, seven indicated a positive change between the pre-exposure and post-exposure; 13 were negative.

Research Question # 4:

Do these perceptions vary based on age, race, gender, previous training or whether medical students grew up in a rural, urban or suburban environment?

Two sets of analyses were conducted to answer this question. The first set used the means at pre-exposure to ascertain if any of the demographic variables listed in Research Question # 4 affected the students' responses. This set of analyses attempts to ascertain if the students entered the program with varying perceptions based on their demographic characteristics. The second set of analyses used the post-exposure means. All of the analyses used either separate samples t-tests (gender, race, and previous training) or a one-way ANOVA (environment). The analysis for age used the Pearson correlation. To make the presentation easier to interpret, only significant findings are reported.

Age

There was only one significant correlation with age: Pre-Exposure Immunology. The correlation was .167, $p < .01$. This indicates that older students believe Immunology is more important to them. Considering that 20 correlations were computed, the most reasonable interpretation of these results is that age has almost no effect on student perceptions. Considering that almost all of the students are in the 22- 24 age range, this restriction of range is the most likely explanation for these results.

Race

Because the sample is so overwhelmingly white, race was dichotomized into white and other. There were nine significant results. These are presented in Table 4.10

Table 4.10:   Results for Race

Question	Mean for Whites	Mean for Other	t-test	Two-Tailed Probability	Cohen's d
Pre-Social Determinants	5.33	4.69	3.32	.001	.45
Pre-Public Health	5.36	4.98	2.13	.034	.32
Pre-Population Health	5.17	4.64	2.82	.004	.37
Pre-Inter-Professional Practice	5.15	4.70	2.23	.027	.30
Post Social Determinants	5.68	4.98	3.83	.000	.52
Post Public Health	5.60	4.99	3.36	.001	.48
Post Population Health	5.53	5.08	2.58	.019	.43
Post Wellness and Prevention	5.78	5.33	2.55	.011	.31
Post Inter-Professional Practice	5.64	5.18	2.45	.015	.34

As shown in Table 4.10, in all cases where there is a significant difference, whites have higher means than all other races. The effect sizes are in the small to medium range.

Gender

There were several significant comparisons between males and females. The means, and t-test results are presented in Table 4.11.

Table 4.11   Results for Gender

Question	Mean for Males	Mean for Female	t-test	Two-Tailed Probability	Cohen's d
Pre-Social Determinants	4.81	5.49	3.87	.000	.67
Pre-Population Health	4.99	5.53	3.32	.001	.54
Pre-Infection Control	5.50	5.78	2.09	.038	.24
Pre-Population Health	4.75	5.35	3.58	.000	.58
Pre-Wellness and Prevention	5.10	5.57	2.67	.008	.48
Pre-Inter-Professional Practice	4.75	5.27	2.70	.007	.45
Post Social Determinants	5.18	5.77	3.44	.001	.42
Post Public Health	5.20	5.66	2.69	.007	.44
Post Population Health	6.73	6.84	2.89	.004	.47
Post Clinical Skills	6.73	6.84	2.12	.035	.26
Post Wellness and Prevention	5.39	5.85	2.77	.006	.31
Post Inter-Professional Practice	5.31	5.70	2.19	.032	.25

As shown in Table 4.11, females have higher means than males in all cases were significant differences were found. The effect sizes range from small to medium with a majority being medium.

Environment

A one-way ANOVA was computed on the questions at the pre-exposure and post-exposure administration. There was only one significant result: Pre-exposure for Anatomy and Physiology.

The means and standard deviations are presented in Table 4.12.

Table 4.12:   Means for Environment (Anatomy and Physiology)

Environment	Mean	Standard Deviation
Rural	6.00	1.23
Suburban	6.56	.68
Urban	6.58	.61

$F = 3.45$, $p = .034$

As shown in Table 4.12, rural students rate this lower than either suburban or urban students.

Previous Degrees

There were no significant differences as a function of having a previous degree.

Comparing Year 1 Post-Test to Year 2 Pre-Test

One of the methodological issues with the research is that it involves a pre-experimental, one-group pretest/posttest design with replication. As Campbell and Stanley (1964) indicate, this design has serious threats to internal validity. One suggestion to overcome these threats is to use a quasi-experimental design where the post-test of year 1 is compared to the pre-test of year 2. Although this design is also considered weak, this analysis was conducted. These results are presented below. To

make the presentation shortened only the means and significance levels below .05 are

presented. Where there is a significant effect, Cohen's d is also reported.

Table 4.13:   Post-Test Year 1 Compared to Pre-Test Year 2.

How important are the following medical school curricular topics to you?

	Year 1 – Post	Year 2 – Pre	Significance	Cohen's
Social determinants of health	5.23	5.46	.108	-
Immunology	6.17	6.03	,194	-
Public Health	5.27	5.45	..264	-
Anatomy & Physiology	6.51	6.40	.183	-
Healthcare Quality and Safety	5.24	5.38	.382	-
Infection Control	5.70	5.69	.919	-
Population Health	5.16	5.23	.639	-
Clinical Skills	5.52	6.58	.552	-
Wellness and Prevention	5.30	5.61	.058	-
Inter-professional Practice	4.82	5.40	.001	..372

How important do you feel it is for medical schools to include these topics in order to prepare students to become clinicians?

	Year 1 – Post	Year 2 – Pre	Significance	Partial Eta Squared
Social determinants of health	5.35	5.81	.009	.433
Immunology	6.44	6.34	.272	-
Public Health	5.29	5.73	.008	.305
Anatomy & Physiology	6.61	6.54	.418	-
Healthcare Quality and Safety	5.38	5.82	.004	.327
Infection Control	5.86	6.08	.109	-
Population Health	5.25	5.65	.013	.284
Clinical Skills	6.51	6.77	.007	.318
Wellness and Prevention	5.40	5.98	.000	.403
Inter-professional Practice	5.08	5.95	.000	.398

As demonstrated in Table 4.13, there are several significant results, especially for the second set of questions. With the one exception of the rating of Inter-Professional Practice for Question Set # 1, all of the significant results are the opposite direction of what would be desired to show that the program worked. That is, the mean for the pre-test of year 2 is higher than the post-test for year 1.

CHAPTER 5

DISCUSSION

This chapter includes a discussion of major findings as related to the literature about the need for changes to medical education and how Health Systems Science (HSS) can support those changes. Also included is a discussion on connections to this study and change theory and what implications may be valuable for use by medical educators. This chapter concludes with a discussion of the limitation of the study, areas for future research, lessons learned, and a brief summary.

This study examined the impact of a curriculum change in medical education designed to deliver HSS subject matter to medical students. Research supports the need for changes to medical education (Billett, Cooke, Irby, & O'Brien, 2010; Gonzalo, Dekhtyar, Starr, Borkan, Brunett, Fancher, & Skochelak, 2017). HSS is the framework upon which the changes needed to medical education can occur. An HSS curriculum is designed to provide the knowledge and skills focused on the Social Determinants of Health (SDoH) and population health care delivery to medical students to prepare them to address some of the shortcomings of the US healthcare system (Daniel, Bornstein, & Kane, 2018). This research was focused on changes in perception of medical students regarding the importance of HSS topics specific to population health before and after receiving exposure to the curriculum during their first year of medical school.

This study also considered variables that may impact perceptions. These Perceptions and variables were explored using the following research questions:

1. *What are medical student perceptions of the value of HSS training pre-exposure to a curriculum that addresses HSS?*

2. *What are medical student perceptions of an HSS curriculum post-exposure?*

3. *Does exposure to an integrated HSS curriculum affect the perception of importance of these topics among medical students?*

4. *Do these perceptions vary based on age, race, gender, ethnicity, previous training or whether medical students grew up in a rural, urban or suburban environment?*

Summary of Findings

The primary objective of this study was to assess medical student's perception of the value of the addition of HSS into the traditional medical school curriculum. The findings of this study indicated that, in general, students did not change their perceptions of the value of an HSS curriculum.

The strongest support at both pre-exposure and post-exposure was for "Clinical Skills", "Anatomy and Physiology" and "Immunology". For Question set # 1 the second strongest support was for "Wellness and Prevention" at pre-exposure, although this drops considerably post-exposure. When the research took a deeper dive to see if other variables impacted the perception of value, it was discovered that age, environment, previous degrees, and ethnicity did not make an impact. The research showed that females had higher means than males for pre-population health data and post SDoH. The

effect size ranged from small to medium with a majority being medium. In addition to the findings that more females felt that population health was important prior to and post-exposure, a higher number of females felt that the social determinants of health are an important part of medical training.

Data were collected to explore the impact of race, environment, and previous degree(s) on the perception of importance by participants. Because the sample was overwhelmingly white, race was dichotomized into white and other. In all cases where there was a significant difference, whites have higher means than all other races. The effect sizes were in the small to medium range. In reference to Environment – whether a student grew up in an urban, suburban, or rural environment, there was little impact although rural students had a lower mean overall. There were no significant differences as a function of having a previous degree.

Discussion of the Findings

The results unexpectedly indicated that there were little to no changes in perception regarding the importance of HSS topics. Differences were found among male and female participants as well as white participants versus non-white participants. Females had a higher mean across all areas. This is not surprising as females tend to rank higher on empathy tests in medical school than do their male counterparts (Hojat & Gonnella, 2015). When empathy scores are analyzed by race and ethnicity in similar studies utilizing the same scale, African-American and Hispanic students rank higher than white students (Hojat, DeSantis, Shannon, Speicher, Bragan & Calabrese, 2020) This contradicts the findings. White students had a higher mean across all areas.

Because the sample is so overwhelmingly white, race was dichotomized into White and Other. Asian students were included in the "Other" and represented the second largest subset of respondents. Asians tend to score the lowest empathy scores (Berg, Majdan, Berg, Veloski & Hojat, 2011; Hojat, DeSantis, Shannon, Speicher, Bragan & Calabrese, 2020). Because Asian students represented 14% of the sample this may have skewed the data. However, empirical research on empathy and race and ethnicity in medical students is scarce and more research is needed in this area (Hojat, DeSantis, Shannon, Speicher, Bragan & Calabrese, 2020).

As previously mentioned, there were two cohorts of students from two consecutive freshman classes. Although there were some differences between these cohorts, it was decided to combine them to answer the major research questions. Questions number 1 and 3 were combined. These questions both focused on the perception of importance of HSS and can be restated as one question of: *What are medical student perceptions of the value of HSS training pre- and post-exposure to a curriculum that addresses HSS?*

While there are some differences between the responses for the two questions, the answers are basically consistent. As mentioned previously, in both cases the three areas with the strongest support at both pre-exposure and post-exposure are "Clinical Skills", "Anatomy and Physiology" and "Immunology". The second strongest support is for "Wellness and Prevention".   It is not hard to understand why these topics garnered the strongest support. Afterall, clinical skills and basic sciences are the backbone of medical education and medical care. While Wellness and Prevention ranked high among pre-exposed students, it dropped after students made their way through the curriculum. This

could be due to students realizing the impact of gaining the needed knowledge to successfully pass the United States Medical Licensing Exam (USMLE). Before you can apply for a medical license, students must pass a three-step test called the USMLE, also known as the board exam. The Step 1 exam comes after a student's second year of medical school. The Step 1 exam emphasizes basic science principles, specifically anatomy, behavioral science, biochemistry, microbiology, pathology, pharmacology, and physiology. The stakes are high; students have up to three tries to pass their Step 1 exam and they are required to wait six months to retake their exam for a third time. Once students understand that the USMLE does not test for HSS topics, and that in order to pass their board exams they need to retain basic science knowledge, they may opt to focus more on those topics that will help them to successfully pass their board exams.

The least supported area for both questions is "Interprofessional Practice". This result is concerning as improved health care collaboration has been cited as a key strategy for health care reform (Hardin, Kilian & Spykerman, 2017). Interprofessional collaboration has been shown to improve patient outcomes and decrease medical errors, reduce morbidity and mortality, and decrease cost (Bosch & Mansell, 2015). Because the participants are first year medical students, it is likely that many have not yet been exposed to the concepts and competencies of interprofessional practice due to the curriculum and/or commonly cited barriers of time constraints, and scheduling conflicts (Zecharia, Ansa, Johnson, Gate & DeLeo, 2019).

When looking at the TTM model in relation to this study, the survey was designed to consider that all participants entered the study at the same stage of change; Precontemplation. Stages of change are the foundation of the TTM. Individuals move

through a series of stages when modifying behavior or in the case of this study, changing perceptions. The principles and processes of change include decisional balance (why HSS is important to clinical practice) and self-efficacy (how confident the student feels HSS will prepare them for addressing social issues when they enter clinical practice).

Traditionally, the TTM model is used to measure intentional behavior change. In this study it was applied to measure changes in perception. When the TTM model was applied within the context of this study, there was no tool in place to explore if students had exposure to HSS topics either through academics or personal experiences. For instance, a student who has experienced food insecurity or who completed a social science or public health degree prior to medical school will have a greater understanding of HSS topics and the impact of the social determinants of health on health outcomes. These types of exposures may have moved some students beyond Precontemplation to Contemplation or Preparation. Therefore, their survey responses may not be in parity with those students who have not had exposure.

One of the barriers to the implementation of an HSS curriculum is changing the attitudes and beliefs of physicians and medical school faculty (Gould et. al., 2002). While this study did not include any research on the attitudes and beliefs of the teaching faculty, an anecdotal discussion with a senior administrator revealed that many of the teaching faculty had the same fears about the USMLE as the medical students. In addition, in the first year of implementation of HSS, speakers were recruited from different schools and departments outside of the medical school and were offered stipends for their time. In the subsequent year, stipends were no longer available. This

limited the variety of speakers and sent a message that could have been internalized as HSS topics are not as important as clinical skills.

Directions for Future Research

A crucial part of medical education and healthcare reform must include the knowledge of and skills in Health Systems Science (HSS). Traditionally, medical education focuses primarily on basic science and clinical skills and while these are important, research suggests that social factors are powerful determinants of health and drive as much as 80 percent of health outcomes (Manatt, Phelps & Phillips, 2019). In order to provide equitable healthcare, medical students must understand and be trained to address the social determinants of health (SDoH). This study attempted to explore the perceptions of the importance of HSS and the barriers to the implementation of an HSS curriculum. More research is needed to explore assessment of the new curriculum and the barriers of changing perceptions of the importance of HSS topics.

In relation to the study, being able to add a unique identifier for each respondent would have allowed for a more in-depth data analysis. Without that tool, it was impossible to directly measure change. Moving forward, adding this information will be critical to learn if the curriculum was effective in changing the perception of the importance of HSS. In addition to unique identifiers, this study would have benefitted from a qualitative component. Having a conversation with the student would give the researcher a greater depth of understanding of the barriers to changing perceptions, the perceived shortcomings of the curriculum, and ideas for changes to the curriculum to support student learning. Why is/isn't HSS important to you? Why do/don't you think

HSS is important for training future physicians? What are the barriers changing your perception towards HSS? Another important tool would be a measure of where a student is on the TTM scale. This would allow for understanding of where each respondent is starting in the process of change and therefore give a more accurate picture of the impact of exposure to the curriculum.

The HSS curriculum was rolled-out in the first year of the study replacing the previous curriculum. The critical components of the HSS curriculum are offered in the first year of medical school prior to clinical exposure. The topics are "front-loaded" in the curriculum with the idea that students will use this knowledge as a foundation moving forward. In the first months of medical school the topics are introduced and continue to be included in weekly sessions throughout the first year. Students are quizzed on all the topics they are exposed to weekly and HSS topics make up approximately 10% of the quiz. A longitudinal study would allow researchers to follow students throughout their four-year program. Would there be changes in perception based on the implementation of HSS tools? Would direct exposure to the impact of the SDoH on patients that these clinicians serve change their perspective about the importance of having this knowledge?

In addition to these questions, more work is needed to study the support of these curriculum changes. It will be important to learn the relationship between the teaching faculty and their perceptions of the value of HSS. In several studies, one of the barriers to change is the attitudes and beliefs of physicians and medical school faculty (Gould et. al., 2002) due in part to a lack of training in HSS (Gonzalo, Change, & Wolpaw, 2019). If more can be understood, it might be possible for medical schools to support faculty development in the field of HSS. Understanding the answers to the questions posed in

this section would allow medical school administrators to develop a curriculum that supports students and faculty and aligns HSS with traditional medical education components. More research on this topic will lead to a more effective and much needed change to medical education.

While the data did not support the hoped outcomes, there were several lessons learned. First and foremost a clear understanding of why developing a research plan and a logic model is needed prior to the gathering of data became clear as I moved through this research process. Trying to fit data around research is much more difficult than developing an assessment plan prior to the implementation of a study. In retrospect, the exercise of setting up a research plan, gathering and analyzing data, and summarizing findings, regardless of the outcomes, are tools that I will carry forward forever. The path of least resistance is rarely the path of wisdom and the tools obtained from this work will be added to my toolbox and carried forward to future research projects.

Conclusion

Despite changing demographics, policy, technology, and economics; medical education curriculum changed very little from its inception over 100 years ago. With the medical system under scrutiny for delivery of affordable, quality, and accessible care, a time for change was finally recognized. In order to create physicians that can meet the challenges of these criteria, a curriculum that includes Health Systems Science was developed and is being implemented across the United States. Change is difficult and students and medical schools feel the pressure of board examination and residency

placements. Because of this, students are unable to align the value of HSS with the more traditional medical school curriculum topics.

One of the goals of training medical students in HSS is to provide future clinicians with the information needed to identify and address SDoH. Healthcare systems and programs that consider the SDoH within their approach to care offer the potential to reduce costs, improve patient outcomes and reduce health disparities (Anderman & CLEAR, 2016). Creating a workforce of physicians that are focused on addressing social challenges and inequities in the health care system will help pave the way for reducing health disparities and addressing systemic racism embedded within the healthcare delivery system (Frasso, Romney, Baker, Ravelli, & Jaramillo, 2019). This research sought to understand if the curriculum was successful in changing the perceptions of the value of HSS. The findings of this study suggest that more, in-depth assessment of the curriculum is needed and additional opportunities for research should include a qualitative component as well as input from the teaching faculty.

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APPENDIX

Survey

Q1 How important are the following medical school curricular topics to you?

	Not at All Important (1)	Low Importance (2)	Slightly Important (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
Social Determinants of Health (1)	◯	◯	◯	◯	◯	◯	◯
Immunology (2)	◯	◯	◯	◯	◯	◯	◯
Public Health (3)	◯	◯	◯	◯	◯	◯	◯
Anatomy & Physiology (4)	◯	◯	◯	◯	◯	◯	◯
Healthcare Quality & Safety (5)	◯	◯	◯	◯	◯	◯	◯
Infection Control (6)	◯	◯	◯	◯	◯	◯	◯
Population Health (7)	◯	◯	◯	◯	◯	◯	◯
Clinical Skills (8)	◯	◯	◯	◯	◯	◯	◯
Wellness & Prevention (9)	◯	◯	◯	◯	◯	◯	◯
Interprofessional Practice (10)	◯	◯	◯	◯	◯	◯	◯

Q2 How important do you feel it is for medical schools to include these topics in order to prepare students to become clinicians?

	Not at All Important (1)	Low Importance (2)	Slightly Important (3)	Neutral (4)	Moderately Important (5)	Very Important (6)	Extremely Important (7)
Social Determinants of Health (1)	○	○	○	○	○	○	○
Immunology (2)	○	○	○	○	○	○	○
Public Health (3)	○	○	○	○	○	○	○
Anatomy & Physiology (4)	○	○	○	○	○	○	○
Healthcare Quality & Safety (5)	○	○	○	○	○	○	○
Infection Control (6)	○	○	○	○	○	○	○
Population Health (7)	○	○	○	○	○	○	○
Clinical Skills (8)	○	○	○	○	○	○	○
Wellness & Prevention (9)	○	○	○	○	○	○	○
Interprofessional Practice (10)	○	○	○	○	○	○	○

Q3 Previous degrees (please choose all that apply).

☐ BA/BS   Major: (1) _____

☐ MA/MS   Major: (2) _____

☐ MPH (3) _____

☐ PhD (4) _____

Q4 What is your age:

○ 19-21 (1)

○ 22-24 (2)

○ 25-27 (3)

○ 28-30 (4)

○ 31+ (5)

Q5 Choose one or more races that you consider yourself to be:

☐ White (1)

☐ Black or African American (2)

☐ Hispanic/Latino (3)

☐ Other (4) _____

☐ Native Hawaiian or Pacific Islander (5)

☐ American Indian or Alaska Native (6)

☐ Asian (7)

Q6 What is your gender?

☐ Male (1)

☐ Female (2)

☐ Trans male/Trans man (3)

☐ Trans female/Trans woman (4)

☐ Gender queer/Gender non-conforming (5)

☐ Other (6) _____

Q7 Would you consider yourself to have grown up in a Rural, Suburban or Urban environment?

○ Rural (1)

○ Suburban (2)

○ Urban (3)