EXPLORATION OF A GRADUATE ACADEMIC MEDICAL FELLOWSHIP PROGRAM: AN APPROACH TO EVIDENCE-BASED MEDICAL CURRICULUM DEVELOPMENT

by

Allison Brown Silveus

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Allison Brown Silveus

Dissertation approved:

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Major Professor

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For the College

DEDICATION

This dissertation is dedicated to my children, Hadrian and Emory Silveus, in hopes that it will teach them to never give up on a challenge, even when a curve ball is thrown your way. To my grandmother, Dr. Angela Oñate Fraga, who taught me the courage to stand up for myself, even when the decision changes your life plans.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

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Allison Brown Silveus

Doctor of Education, 2021 and Higher Educational Leadership

Dr. Jo Beth Jimerson, Associate Professor

Leadership within higher education begins with modeling and disseminating sustainable evidence-based decisions that can be incorporated into educational practice using evidence-based curriculum. While the use of the evidence-based decision-making has been significantly studied (Barrett et al., 2018; Farley-Ripple & Cho, 2014), many educators struggle at putting it into practice (Lauderdale-Littin & Brennan, 2018) due to issues related to data literacy and social modeling practices that frame epistemological worldviews. The purpose of this research was to evaluate physician leaders within the academy and their own understanding of evidence-based decision-making in medical curriculum design. A pre-and-post survey was administered to participants (N = 10) in a Graduate Certificate in Academic Medicine (GCAM) Fellowship at a local university in central Texas. Mixed methods were employed by using the quantitative findings from the survey to assess self-declared confidence and its association to the fellow's actual use of evidence-based reflective practices in designing medical curriculum. Interviews and artifacts (e.g., assignments built into the academic medical curriculum course) informed conclusions about the fellows' progression in use of evidence-based practices. Barriers to

evidence-based decision-making illustrate the importance of incorporating leadership feedback mechanisms that can address potential barriers to successful implementation in practice, particularly where educational systems assess quality through a linear lens.

Keywords: *evidence-based decision*, *medical education*, *retrospective reflection*

CHAPTER ONE: INTRODUCTION

Medical educators operate in two domains of practice: one as clinical practitioner and one as educator to future practitioners. As a clinician, one must navigate working with patients, medical students, resident physicians, and clinic stakeholders and as an educator, one must teach and practice evidence-based decision-making. This pressure to be skilled in both domains requires competence in both designing and refining medical curriculum that is put into practice, even though physicians receive little to no coursework on the best educational practices (Graffam, 2007; Lawley et al., 2005; McLeod et al., 2003; Rassie, 2017). While medical education has experienced five curricular reforms since the late 1700s (Joyner, 2004; Ludmerer, 1999; Papa & Harasym, 1999; Thelin, 2011), challenges still exist in appropriately enacting medical curriculum that aligns with the learning sciences (Casiro & Regehr, 2018). Despite a lack of training in course design and pedagogy (McLeod et al., 2003), and regardless of a historical reliance on physicians taking on the dual role of clinician and teacher, educational fellowships which develop medical educators are a relatively recent phenomenon. Thus, this researcher seeks to address how medical educators participating in an academic medical fellowship program define and use evidence in designing medical curriculum when provided instruction.

Medical Education Training

Educational fellowships for medical educators started in the 1980s for emerging departments in medical schools or teaching hospitals which emphasized Family Medicine, to provide additional training needed to medical faculty, residents, dentists, or other health professions faculty interested in providing quality education built around principles of learning theory (Searle et al., 2006). This external training in the form of academic medical fellowships or graduate medical education (GME) serves as one mechanism to support practicing physicians

who also take on duties of teaching in the field of medicine, thus allowing medical educators to acquire educational skills that can support them in navigating both domains. This additional training may be used to teach in medical schools at the undergraduate medical education (UME) level, or at the GME level held at various resident teaching hospital sites. Additional training in the form of continuing medical education (CME) overseen by the Accreditation Council for Continuing Medical Education (ACCME®, n.d.) assists with accreditation of medical education organizations—organizations which also provide educational training to physicians.

Each of the training units—UME, GME, and CME—influence each other relative to training goals, outcome, and interaction between funding streams. For example, medical educators train both medical students (UME) and residents (GME), and the training provided in medical school for UME eventually feeds into the GME programming held at various work sites such as residency hospitals. This interaction can be troubling, where Santen et al. (2019) posit that medical education has failed to self-regulate, thus perpetuating the problem for GME in identifying quality residents. This regulation problem in UME is a result of fears of reporting high attrition rates, which in the United States is about 3%, and due to administrators having fears of dismissing students due to legal implications (Santen et al., 2019). Thus, this regulation problem posited by Santen et al. in UME eventually feeds into the next system of GME. Furthermore, medical education reform is struggling to innovate due to (a) unreceptive education imperatives at academic health centers, (b) training linked to specialties and/or requirements for the service provider, and (c) poor understanding of learning and pedagogy at the GME or CME level (Lawley et al., 2005).

Even with these external training opportunities, the Committee on Quality of Health Care in America (2001) posited that quality problems exist due to interaction effects between (a) growing complexity of science and technology, (b) increase of chronic conditions, (c) poorly

organized delivery within the system, and (d) constraints on misusing information technology. This interaction between these factors, without acknowledgment of their roles and impact on the other, can perpetuate the challenges medical educators face in providing quality curriculum.

Organizational Factors in Medical Education

Medical educators are confronted with numerous challenges when it comes to medical education due to the demand to balance their own practice while also having increased pressure from administration to use evidence-based teaching strategies (Barrett et al., 2018). This demand is explained through understanding of the organizational system, where two communities exist—the community within the group receiving faculty development and the community within the teaching workplace (O'Sullivan & Irby, 2011). Schreurs et al. (2016) noted the second community (the workplace) involves review of the environment, organizational setting and culture, workplace tasks, and available mentoring in their clinical and teaching practice. Therefore, desire for quality evidence-based medical curriculum comes from support from external training provided and within one's own workplace.

Recognition of the complexity of the organization adds an additional layer worth evaluating, in that a medical educator's workplace and fellowship program-embedded organizational policies can support and inhibit growth. For instance, attending an external faculty fellowship program to support development in the medical education field may serve the learner, but further support is needed beyond the fellowship training in the form of time and resources to maximize the chances that the medical educator will embed and sustain proper medical curricular change at their home program.

Lack of recognition of the complexity and the system's failure to detect barriers to growth can lead to programmatic decline, particularly when education is funded through state or federal aid. This complexity is emphasized by Sklar (2014), in that medical curriculum typically

focuses on UME and is disconnected from its GME segment. To reduce the complexity between the systems, physicians need quality training in faculty development programs where they may develop skills towards competency-based medical education (Dath & Lobst, 2010). However, it takes time to develop these skills, and Zeidel et al. (2005) noted a challenge exists in residency training and fellowship training where the demand to teach occurs with little or no direct compensation. Consequently, this researcher seeks to address how a fellowship program supports medical educators in curriculum development using evidence-based decision making and reflective practices, while also addressing factors such as limited time or resources that influence the design of medical curriculum.

Complexity of Medical Education

Medical education is nested within a larger and complex organizational system made up of policies, as well as external and internal stakeholders (e.g., hospitals, universities, accrediting bodies, funding agencies, and state/federal laws and regulations). Furthermore, the medical educators serve both within university settings and various hospital workplace structures (Graffam, 2007). Because of this complexity, change within medical education is no easy task, and examining change efforts requires analysis of each component of the broader system (e.g., hospitals and clinics as well as universities) alongside policies enacted by government to regulate quality, allocate funding, and ensure adherence to accreditation requirements (Casiro & Regehr, 2018). This already-complex system may be further complicated depending on which entity commands attention in the accreditation space, for example, the Accreditation Council of Graduate Medical Education or the Council on Osteopathic Postgraduate Training (Bass & Chen, 2016; Committee on the Governance and Financing of Graduate Medical Education, 2014). Since medical education involves numerous intricacies, proper identification of the impact of various change efforts has become more complex, particularly as it relates to the demand for

quality care in response to the Patient Protection Affordable Care Act (2010) and implementation of a quality assurance and performance improvement program (Balasubramanian & Jones, 2016).

Funding in Medical Education

Continuing education for medical educators within GME is funded through diverse revenue streams such as research grants, Medicare (since 1965), aid from state and local governments, monetary gifts, payments for patient care, and revenue from the patient care facilities (Committee on Implementing a National Graduate Medical Education Trust Fund, 1997). Both medical schools and teaching hospitals that support GME have experienced financial constraints as federal support for GME has declined (Townsend, 1983). This decline in financial support, which began in the 1990s, increased medical educator challenges where physicians were held responsible for providing high quality training and bridging the revenue deficiency gap using billable patient encounters (Committee on Implementing a National Graduate Medical Education Trust Fund, 1997; H.R. 2425–Medicare Preservation Act, 1995; H.R. 2491–Balanced Budget Act, 1995; H.R. 4069–Graduate Medical Education Trust Fund Act, 1996). The diverse revenue streams that have funded medical education challenge alignment of Medicare funding to outcomes related to program recruitment efforts, education materials provided, meetings and events, and training and support (Kelly et al., 2012). Furthermore, there is not enough clinical income to support medical schools and the teaching hospitals due to actions and inactions prior to the 1980s (Ludmerer, 1999).

In 2012, the Institute of Medicine formed a committee to address a variety of concerns related to GME noting concerns over the following: (a) mismatch between patient needs and medical specialization, (b) distribution concerns of physicians, (c) lack of diversity in physician practice, (d) a gap between physicians' knowledge and proficiencies needed in the practice, and

(e) little transparency in how funds were spent (Committee on the Governance and Financing of Graduate Medical Education, 2014). Once the Committee on the Governance and Financing of Graduate Medical Education met, various criteria regarding improvement of GME evolved, noting the need for increased transparency and accountability as a byproduct of accepting Medicare-related funds.

GME funding is subsidized by the federal government with indirect and direct Medicare dollars, which cover resident salaries, teaching, education materials, and other expenses related to association membership that bring notoriety to the hospital (Kelly et al., 2012). Unfortunately, declines in federal aid will stretch medical educators' roles and responsibilities between teaching and clinic time, which will place more emphasis on patient clinic encounters (Rich et al., 2002). To leverage changes in medical education, the Medicare Payment Advisory Commission (2010) recommended establishing performance-based incentives for attainment of educational outcomes and standards. As a result of required changes and demand for accountability, Nasca et al., (2011) evaluated the impact of reduced funding for residency and fellowship programs using a survey, they found that under a 33% reduction, approximately "1,136 programs and 13,662 positions" would be lost and under a 55% reduction, "1,749 programs would close in the responding sponsors, representing 22,411 positions" (p. 586). These declines in GME funding with increased accountability demands (Committee on the Governance and Financing of Graduate Medical Education, 2014) make it challenging for leaders to improve GME teaching and learning when the systems are so complex.

Furthermore, research has not considered how current medical educational practice and organizational demands may inadvertently perpetuate a poorly functioning medical education system (Santen et al., 2019). What is taught and learned through social modeling (e.g., Bandura, 1976) and what is practiced within the medical community (e.g., Wenger et al., 2002) are

byproducts of an interaction between both the existing educational system which defines evidence and the organizational system that emphasizes how the evidence is used to direct such learning. To teach the practice of using evidence as it applies to learning theory, medical educators must be trained on developing curriculum that addresses the requirements of the learner through needs assessments (Frank et al., 2010). Support for developing these skills will require time away from practice and formation of shared governance where curricular decisions align to learner, patient, and community needs (Casiro & Regehr, 2018; Frank et al., 2010).

Problem Statement

Training on best practices in education, particularly training in curricular design, is essential to providing quality evidence-based medical education. To obtain such training, medical educators must seek professional development, which is typically provided in the form of fellowships or CME (Searle et al., 2006). This training assists in addressing gaps in pedagogical practice in medicine (McLeod et al., 2003) and provides opportunities for medical educators to develop additional skills necessary for training future physicians. Thus, modeling quality medical education to future medical educators allows for the development of evidence-based practice as physicians.

The fields of education and medical education stress the use of evidence-based decision-making (Barrett et al., 2018; Datnow & Hubbard, 2016), while Santen et al. (2019) posited medical education has failed to self-regulate, producing ill-equipped students. It is possible that the field of medical education has perpetuated poor pedagogical practices through social modeling (e.g., Bandura, 1976), which have, in turn, inadvertently shaped the curriculum and evidence selection within the curriculum. Furthermore, medical educators who eventually become part of the academy are met with external organizational demands that shape how evidence is defined and used within the curriculum. This demand later perpetuates the failed self-

regulation due to misalignment between learner needs and contextualized program requirements, leading to a cyclical regulation problem (Santen et al., 2019). To address this problem, both educator and leader need to be cognizant of how evidence use is taught within the curriculum, and how external organizational demands can unintentionally hinder the implementation of evidence-based medical education, even when external professional development is provided.

Aims of the Study

Changes in medical education may be understood through evaluation of historical curricular reform in reference to funding and accountability policies enacted over the years (Joyner, 2004; Ludmerer, 1999; Papa & Harasym, 1999; Thelin, 2011). Fellowships, which began in 1980s (Searle et al., 2006), and which are a form of GME, provide medical educators with additional needed training in pedagogy and learning (McLeod et al., 2003). However, alongside the existence of these fellowships and external professional development opportunities, funding continues to decline (Medicare Payment Advisory Commission, 2010; Townsend, 1983), which negatively impacts the availability of development opportunities outside of traditional medical practice.

Given structural and financial constraints, novel approaches to strengthening and scaling academic graduate fellowships are necessary as means for continuous improvement within medical education. This means that fellowship programs must design their training to meet the needs of the medical educators, while being cognizant of financial constraints. Fellowships do this by providing education in scholarly research, teaching, and curriculum design. However, fellowship content variation exists in the United States, and Thompson et al. (2011) noted only 24 (N = 55) in their study were required to produce designed curriculum and only 10 were required to implement curriculum. Since the variation exists (Thompson et al., 2011), review of a fellowship program which emphasizes developing evidence-based curriculum design will assist

in shaping the future of a competency-based curriculum that meets learner needs for future practice (Frank et al, 2010).

Evidence-based practice has been posited to be fundamental to the field of medicine, where the Committee on the Health Professions (2003) stated, "All health professionals should be educated to deliver patient-centered care as members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics" (p. 45). Designing curriculum may serve as one mechanism for teaching such evidence-based practice. For example, Voogt et al. (2016) found the use of curriculum design teams supported teachers' development of pedagogical content knowledge and understanding of addressing stakeholder needs for improved practice. Thus, this researcher will examine how academic medical fellows can and do provide additional training to medical educators in evidence selection, and how these fellowships can impact evidence-based practice through production of a designed curriculum for later implementation. Furthermore, this research could assist in addressing potential organizational structures or other factors that influence evidence selection or confidence in evidence selection (Camacho et al., 2018; Smircich, 1983). The purpose of this study is to evaluate physician leaders within the academy and their own understanding of evidence-based decision-making in medical curriculum design. The study is guided by two questions:

Q1: How and to what degree does instruction in medical curriculum development impact medical educators' confidence in using evidence to inform curriculum?

Q2: What factors influence the ways in which medical educators design and implement curriculum?

Significance of the Study

There are two primary reasons why educators and leaders should focus on addressing the gap between evidence-based practice and the theory of making evidence-based decisions within

medical curriculum design. First, the research can help the field understand how instruction in medical curriculum development can leverage improved confidence in using evidence in curriculum design and implementation. Second, this research can identify factors (facilitators as well as hindrances) to effective design and implementation of curricula in GME.

This researcher attempts to evaluate a GME fellowship program, which educates adult medical professionals in a learning sciences domain. It is important to assess learner development and the learners' own perceived confidence regarding their ability in developing an evidence-based curriculum both prior to and after training. Additional training represents both a monetary and time commitment on behalf of the medical professional's workplace. If training demonstrates improvement in making evidence-based decisions, this evaluation may support the need for more GME funding, which has been a target by various accountability groups (Medicare Payment Advisory Commission, 2010).

Additional training in the form of GME serves as a form of professional faculty development, analogous to the professional development provided to teachers in the K–12 system. Research suggests that elementary teachers report having moderate to low levels of confidence in implementing evidence-based practice in large part due to the gaps in evidence-based research practices (Lauderdale-Litten & Brennan, 2018). This gap exists in large part due to what Bakah et al. (2012) refer to as time spent on *what* is enacted to change education, as opposed to the process of *how* curriculum is put into practice reflective of the teachers' needs. Exemplars of successful modeling in medical education where the what and the how curriculum is put in practice (Bakah et al., 2012) is demonstrated by O'Sullivan and Irby (2011) where the learner is supported at the program level and at the secondary level in their clinical teaching practice. Therefore, if quality changes are necessary for improvement of medical curriculum, it is necessary to support an individual's confidence by providing training that aligns with support

within the faculty development community and within their workplace community, which consists of their own organizational culture and workplace demands (O'Sullivan & Irby, 2011).

Conclusion

In conclusion, medical education has emphasized evidence-based practice (Committee on the Health Professions, 2003) but has as of yet not considered factors or barriers to such practice as they pertain to pedagogical performance. While external training exists to support medical educators in the learning sciences domain (Searle et al., 2006), declines in funding to support such training are diminishing while accountability demands are increasing (Committee on the Governance and Financing of Graduate Medical Education, 2014; Nasca et al., 2011; Townsend, 1983). Therefore, leaders within medical establishments must be cognizant of how their own organizations may hinder the use of evidence within the modeled medical curriculum that is put into practice for future physicians.

CHAPTER TWO: LITERATURE REVIEW

Medical education has been shaped by an educational era, research era, and clinical era (Ludmerer, 1999). Each of these historical eras encompass points of significant curricular change that produced the overall structure of medical education. One of the byproducts was the formation of medical fellowships in the 1980s (Searle et al., 2006). While medical fellowships assist in providing skills and training in the learning sciences, challenges have been put forth regarding their future (Lawley at al., 2005). Therefore, this study has the potential to inform medical education research and practice as it relates to GME fellowships' impact on evidence-based decision-making and pedagogical practice.

To address the research proposed, evaluation of the various areas is necessary: (a) the history of medical education, (b) accountability efforts in medicine, (c) medical education funding, (d) pedagogy in medical education, (e) the birth of evidence-based medicine (EBM) and (f) social learning theory (Bandura, 1976). This background research will provide understanding of the complexity of monitoring change efforts in medical education, noting that evaluation is often non-linear and complex (Byrne & Callaghan, 2014). Furthermore, organizational theory (Buzzelli & Allison, 2017) provides a foundation for understanding patterns of development and behaviors that lead to overall change of the system. Lastly, social learning theory (Bandura, 1976) will provide insight into how learners interact with the environment as part of their practice and learn from coaches or peers to develop evidence-based decision-making as part of curricular design.

Medical education has been shaped through various curricular reforms (Kliebard, 2004; Ludmerer, 1999; Papa & Harasym, 1999). While these reforms provide insight into the evolution of medical education, they culminate with their influence on accountability, medical funding, and demand for evidence-based practice. Rothstein (1987) posited "a fundamental pedagogical

issue concerns how to balance the need to teach students the basic concepts of medical science with the need to train them in the practical skills needed to practice medicine" (p. 5). Both skills are essential to medical education, and both have undergone significant reforms over the last 100 years (Santen et al., 2019).

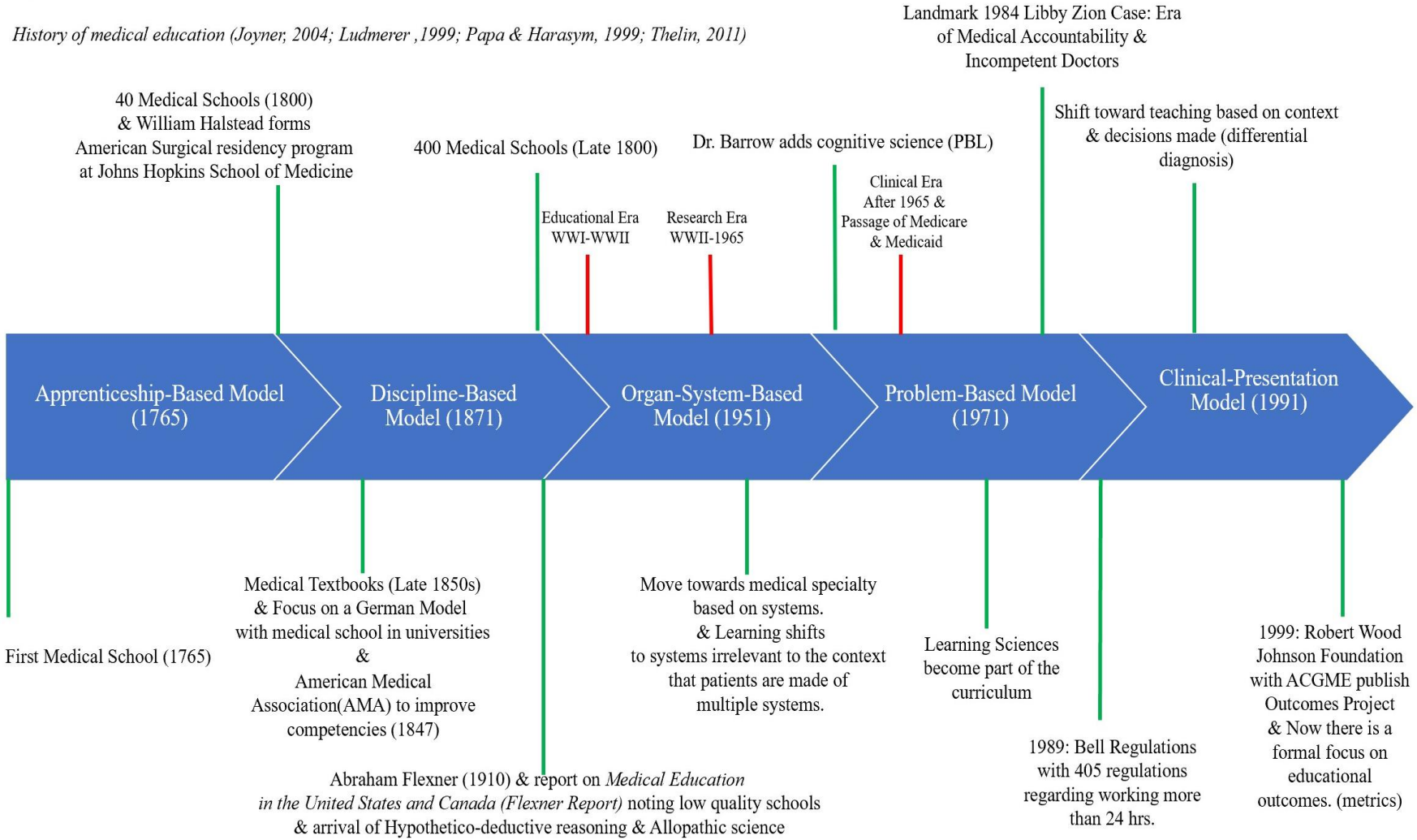
UME provides the 4-year curriculum encompassing biomedical and pre-clinical or clerkships. While curricular variation exists between UME and GME, the CME provided by organizations outside academic health centers (AHCs) adds an additional layer of concern since there are no standards for content (Committee on Quality of Health Care in America, 2001; Lawley et al., 2005). Thus, this synthesis provides insight into the complexity of medical education, noting that it is impossible to understand the field through a linear approach.

History of Medical Education: Curricular Reforms

The history of medical education can be explored through curricular reform efforts and historic events which resulted in medical consumerism and accountability, in an effort to monitor organizational change (Joyner, 2004; Ludmerer, 1999; Papa & Harasym, 1999; Thelin, 2011). See Figure 1 for a timeline of these developments. Five curricular models represent shifts in understanding of cognition and application of knowledge within medical education: (a) apprenticeship-based model—1765, (b) discipline-based curricular model—1871, (c) organ-system based model—1951, (d) problem-based model—1971, and (e) the clinical-presentation model—1991 (Papa & Harasym, 1999). Each of these models provide an understanding of the current structure of medical education and its relationship to accountability and funding reforms.

Figure 1

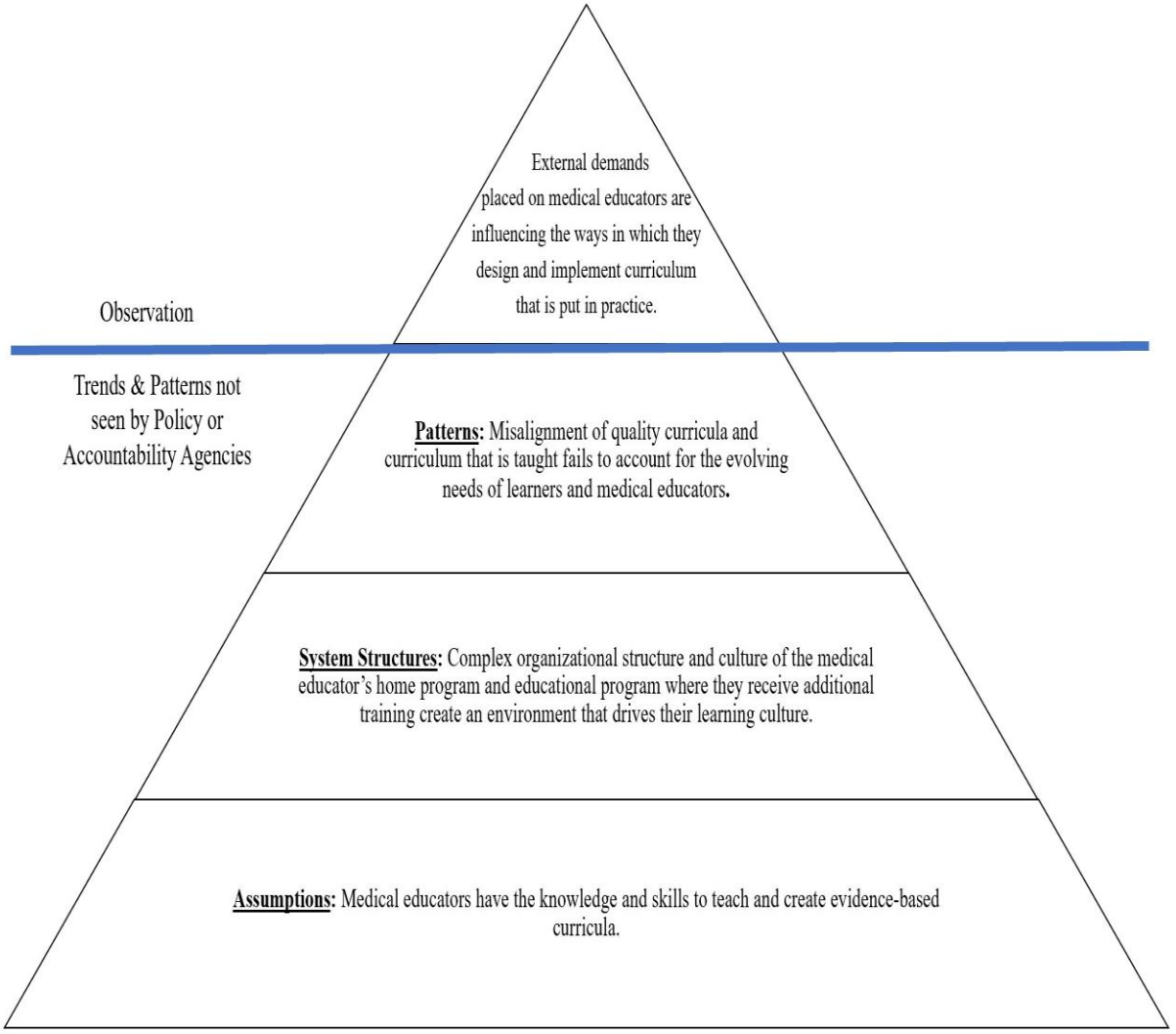
History of Medical Education



Curricular reform refers to changes made regarding the structure and delivery of the content relative to the learner. However, reform is challenging when theory presents the ideal or evidence-based method to curricular design but does not account for the factors that might impair practice (see Figure 2).

Figure 2

Iceberg Model for Medical Education



Note: The iceberg model reflects the discrepancy between what is observed in practice and what is overlooked by policy, accountability or funding agencies that drive future medical education practice.

For example, Hughes (2016) recommends that curriculum developers focus on the needs of the learners and of the culture of the learner's environment, while simultaneously addressing the hidden curriculum which can inhibit translation of the curriculum into clinical practice. This recommendation can be particularly challenging though as hidden curriculum (by definition) consists of unwritten codes or practice of avoidance (Thelin, 2014).

Hidden curriculum is often influenced by the "complex interaction between the high-level leaders who oversee the curriculum, the course directors who coordinate the curriculum, and the teachers who enact the curriculum on a day-to-day basis" (Casiro & Regehr, 2018, p. 179). Therefore, addressing curricular reform must also account for factors associated with the hidden curriculum during the five time periods proposed by Papa and Harasym (1999). This analysis involves addressing the reform from the perspectives of why a curricular approach came to existence, its association with the principles of building knowledge, and the barriers associated with its respective hidden curriculum.

Apprenticeship-Based Model

The apprenticeship-based curricular model existed during the late 1700s and into the 1800s and was largely grounded in providing clinically relevant knowledge through memorization (Papa & Harasym, 1999). This model is distinguished from other models in that it emphasized the learner, a trainee who progresses through their learning, and a supervisor—usually an expert clinician (Rassie, 2017). The progression during this time period incorporated two 4-month semesters of lectures allowing the expert to guide the learner through periods of gradually increasing responsibility and limited oversight (Papa & Harasym, 1999; Rassie, 2017). These lectures incorporated gross anatomy with limited understanding of physiology, thus producing a physician that made diagnosis decisions by what was observable to the naked eye (Rothstein, 1987). Additionally, this model ranged in time of study, had little affiliation to a

college, and was financed through exam fees and nonrefundable paid tickets to each lecture (Thelin, 2011). The physician during this time had a limited formal curriculum, and instead spent most of the time doing self-directed learning by observing patients (Ludmerer, 1999).

While this model was limited in the foundational sciences, it provided the learner with support in the form of direct feedback—something still utilized today in the GME world, where hospital sites incorporate residents as teachers (Rangachari et al., 2016). The elements of deliberate practice in applying one's skill and feedback are still emphasized today in the field of education. However, challenges to this model came under scrutiny when Abraham Flexner arrived (Dornan, 2005). Flexner, appointed by Andrew Carnegie to evaluate standards of medical teaching, noted variations in length of training in medical schools where some doctors graduated without any dissection experience (Dornan, 2005).

Discipline-Based Model

Various events produced a "discipline-based model" by the late 1800s. In the early 1800s schools were still owned by faculty, but as the years progressed formal institutions brought on professors who added scientific coursework to the curriculum (Slawson, 2012). In 1828, the Yale report was released by faculty and noted all education needed discipline and standard pedagogy; thereby, enforcing a more standardized curriculum grounded in the adoption of Latin and Greek literature (Kliebard, 2004; Thelin, 2011). This demand infiltrated medical education since it was seen as derived from Greek philosophy (Wang, 2020). The integration of intense studies with various electives reflected the image of a new type of education proposed by Charles Eliot, then president of Harvard University. By 1840, medical schools had added courses on disease pathology which extended the length of schooling to years as opposed to months (Slawson, 2012).

The desire to add new curriculum in medical education intensified with the establishment of Johns Hopkins University in 1876, which structured the curricula in academic units (Thelin, 2011). This system resisted observation and dissection alone, and instead attempted to integrate the sciences to explain the cause of disease through experimentation (Walker, 1990). This rigor and integration of sciences in the German system was noted by American medical educators, who voiced concern over the lack of standardization in the for-profit medical schools (Dornan, 2005). Prior to the Hopkins policies, such as the college degree requirement implemented in 1893, no medical school made a college degree mandatory for entrance (Derickson, 2005). Due to this leniency, the early 1900s had numerous physicians who charged patients with modest fees (Derickson, 2005). However, the demand for high levels of rigor lengthened the curriculum from a couple of semesters to taking years to complete. While emphasis on the basic sciences had been lacking in the apprenticeship-based model, a shift occurred around 1871 that placed emphasis on discipline-specific departments integrated with science and clinical application (Papa & Harasym, 1999).

The Era of Flexner: Defining Rigor in the Discipline

Two views have historically dominated medical education, one proposed by Osler, who focused on bedside teaching through experience with patients, and the other proposed by Flexner, and grounded in intense applied lab content (Ludmerer, 1999; Norman, 2012). Flexner, who was commissioned by the Carnegie Foundation, saw value in incorporating the strong biological roots necessary for the future of medicine, whereas Osler, father of medical residency, placed value in the experience of working directly with patients (Norman, 2012). Further changes occurred as a result of the Industrial Revolution, which involved capitalists in medical education—Andrew Carnegie, John D. Rockefeller, Sr., Cornelius Vanderbilt, Ezra Cornell—as they attempted to monetize medicine (Joyner, 2004; Thelin, 2011). The changes that followed

the Flexner era shaped medical education, which can collectively be broken into three eras: (a) educational era, (b) research era, and (c) clinical era (Ludmerer, 1999).

Abraham Flexner's 1910 report on medical education in the United States and Canada noted a need for systemic change in medicine, one that modeled the exemplar of Johns Hopkins University (Thelin, 2011). Johns Hopkins was based on a German system, with an emphasis on work and education, yet disparity existed between this rigorous model and other surrounding medical schools that adopted more holistic philosophies (Joyner, 2004). The curriculum at Johns Hopkins was unparalleled to others at the time, where Joyner (2004) noted "Johns Hopkins University School of Medicine had an innovative curriculum, combining outstanding research with the 'Oslerian' bedside teaching that made it the new medical school archetype" (p. 35). The curriculum pulled a few elements from the apprenticeship model related to clinical teaching yet added newer elements that were grounded in the discipline behind scientific research.

Even though the "Hopkins" model served the medical community well, medical education during this time lengthened and increased training, yet failed to innovate (Lawley et al., 2005, p. 312). Specifically, the medical curriculum became standardized to embed a core curriculum of behavioral, social science, humanities, and basic science (Dornan, 2005). The Flexner study and demand for standardization supported by the American Medical Association (Dornan, 2005), resulted in about 30% of medical schools in the United States closing 1 to 2 years later, due to a combination of financial problems and results from the report (Thelin, 2011). These closings were due to the inability of many of the schools who adopted different philosophies as part of their own sect, to conform to new standards supported by the American Medical Association (1847) (Slawson, 2012).

During the Flexner era, the budget for a medical school was about $100,000 (Ludmerer, 1999) and demands for quality medical education spread. The influx of money in medical

education occurred gradually due to war and scientific advances. While the Flexner report illustrated quality deficiencies, Norman (2012) posits that it was these scientific advances post World War II that contributed to a medical curriculum grounded in basic science. Furthermore, the curriculum after WWII, shifted and "There was so much science to be learned that it was not unusual for students to have 40-50 scheduled lectures hours per week" (Norman, 2012, p. 9). By the end of the Flexner era in the 1940s, medical schools' budgets grew to $1,000,000 (Ludmerer, 1999). This unprecedented growth in large part was due to the demand for quality science. After World War II, medical research and the National Institute of Health accelerated along with the demand for pre-clinical curriculum (Norman, 2012). Furthermore, the curriculum during this period was now dominated by the hard sciences with little link between science and practice.

Organ System-Based Model

Challenges to the discipline model occurred in the 1950s, particularly as individuals came to question the value of separating the clinical education from the science education. Specifically, this model embedded courses broken down by their respective organ systems disconnecting the clinical cases from the science education of the system (Papa & Haraysm,1999). Prior to the 1950s, most of the faculty positions in medical education were classified as part-time positions, with a majority of faculty maintaining their own private medical practice (Rothstein, 1987). Federal funding increased for support of the National Institute of Health research leading to increased numbers of full-time faculty positions, with a majority classified clinical faculty as opposed to basic science faculty (Altenderfer & West, 1964; Diehl et al., 1952; Rothstein, 1987). This shift propelled basic science faculty to pioneer their own graduate teaching and research separate from the medical school and increased clinical faculty earnings where a teaching salary coupled with private practice earnings were pocketed (Kendall, 1965; Rothstein, 1987). As a byproduct of National Institute of Health grant support, separation

occurred between science faculty and clinicians, shifting the curriculum towards a stronger clinical model.

Case Western Reserve pioneered the challenge to the discipline-based model in favor of an "organ-system model" that would address (a) reducing basic science content, (b) increasing opportunity for specialization, (c) and decreasing uniformity of the course content reflecting students' interests (Norman, 2012; Townsend, 1983). This model focused on categorizing content relative to organ systems and course content from anatomy and physiology (Papa & Haraysm, 1999). Upon the introduction of the organ-system model, Duke University and other schools began modifying the curriculum so students would have more flexibility with diverse career opportunities (Gifford, 1978; Townsend, 1983). While this integrated approach provided the learner with specialization ability, it also fragmented teaching experts in the curriculum into domain topics, where concepts were linked to a specific organ system (Papa & Haraysm, 1999; Patterson, 1956). This curriculum followed a sequential process whereby objectives were covered, overseen by subject committees, and learners progressed through 4 years, gradually increasing in exposure to patients (Patterson, 1956).

In 1965, the budget for medical school student expenditures hit $20,000,000 (Ludmerer, 1999). The signing of the Social Security Amendments of 1965 by President Lyndon B. Johnson further changed medical education by creating Medicare and Medicaid (Berkowitz, 2005). Upon the introduction to Medicare and Medicaid, medical faculty increasingly switched to focusing on patient care, which funded nearly 50% of a medical faculty member's income (Ludmerer, 1999). The focus on patient care as opposed to teaching future physicians impacted the quality of medical education leading many clinical faculty to de-emphasize educational duties (Ludmerer, 1999).

While medical care support and public assistance date as far back as the New Deal efforts under President Franklin D. Roosevelt, the amendments in 1965 drastically altered medical education (Berkowitz, 2005; Derickson, 2005). In fact, Derickson (2005) argued the funding for medicine, which was an issue since the early 1900s, was largely about addressing the supply-side of medicine on having an adequate number of physicians relative to the social welfare of patients. The key fundamental shift in the 1960s towards Medicare and Medicaid, while well-intentioned, had drastic impacts on how hospitals would fund medical education for medical students and residents. According to the Congressional Research Service (2018), Medicare, which is the largest source for GME funding, began subsidizing education in 1965 using factors such as the teaching hospital's full-time equivalent residents. These funding results during the late 1960s contributed to the following: (a) hiring of full-time medical faculty with little clinical experience outside of residency, (b) declines of university hospitals due to increased numbers of community hospitals, and (3) a decrease in the focus on the biomedical sciences within the curriculum in favor of teaching systems and their relation to clinical presentation (Knowles, 1966; Rothstein, 1987). These changes, in addition to changes between the 1970s and 1980s, pushed medical education towards increased forms of managed care, which financed the care through low payments and created a shift from high quality academic health centers to community health centers (Ludmerer, 1999).

Problem-Based Model

By the 1970s, medical educators desired a curriculum which focused on learners solving clinical problems and this led to the development of a curriculum designed around expertise in diagnosis ability (Norman, 2012; Papa & Harasym; 1999). While the problem-based learning (PBL) model became popular, Wijnia and Servant-Miklos (2019) argued that this model was deficient in how it was presented in the motivation research, noting that the model embeds

several elements like problems, tutors and group work that help with motivation but have largely been overlooked in research. This PBL model, however, did begin to re-shift the curriculum towards self-directed learning and towards the learner themselves. This shift was needed, noting medical education had historically focused on regurgitation of facts. Barrows and Tamblyn (1980) sought to disrupt medical education using PBL by providing the opportunity to connect real clinical problems that were usable in practice. Furthermore, the PBL curricular model placed the teacher as a facilitator to the learning process, whereby the learner became engaged through their own motivation to solve the clinical problem presented (Hmelo-Silver, 2004).

During this learner-centered curricular shift, other systematic changes occurred. During the 1960s and early 1970s medical schools (UME) began to move away from traditional grading to pass/fail evaluation (VanWoerkom et al., 2009), making it challenging for resident directors to distinguish quality medical students; 89% of respondents from one study indicated their preference towards using grades (Dietrick et al., 1991). Additionally, the AMA responded in the 1970s to the shortage of physicians by removing required internships which emphasized general medicine, thereby allowing medical students to instantly enter their specialty residency programs (Lerner, 1974; Rothstein, 1987). This change resulted in specialty boards, who were in favor of removing the internship, overseeing accreditation at residency sites, and increasing the revenue burden for funding residency towards patient-care revenue (Rothstein, 1987; Whitcomb, 1992).

While concerns over the quality of medical education were challenges, proponents of pass/fail (Yarbro, 1982) noted the value of focusing more on knowledge acquisition as opposed to grades, since deemphasizing grades reduced anxiety. This shift towards pass/fail also aligned with shifts in the curriculum, whereby the learner was engaged in their own problem solving. With this grading shift, concerns over accountability mounted; yet the need for physicians in the

1970s took precedence. The pass/fail system continues today in UME, where schools are still able to rank students using medical student performance evaluations (VanWoerkom et al., 2009).

As medical schools moved away from grading in the 1960s to address UME students' anxiety, upcoming accountability issues emerged by the 1980s noting medical errors with a need for more accountability. Quality issues regarding clinical faculty at the medical schools involved clinicians who served "without board certification" and ". . . have never been carefully evaluated as clinicians, because their appointments were based primarily on their research skills" (Rothstein, 1987, p. 264). This lack of accountability in clinical faculty translated to pedagogical practices dependent on lectures with increased clinical electives and gaps in basic science content due to increased faculty specialization (Lewis, 1983; Rothstein, 1987; Visscher, 1973). Even though PBL curriculum and electives emerged to assist students in exploring opportunities for choice, secondary effects impacted the overall learning structure. Increased faculty specialization and de-emphasis of the basic sciences in the curriculum led medical students to select residency training at their prospective residency GME site (Patel, 1999; Rothstein, 1987). These residency sites, which also supported medical students in clerkships, burdened their residents with a dual responsibility of teaching and learning, even though these residents had not yet acquired education in pedagogical practices (Tonesk, 1979).

In the late 1970s and the 1980s, medical fellowships developed to support medical faculty beyond residency training by providing quality educational training that emphasized research and teaching (Rothstein, 1987; Searle et al., 2006). This training assisted in providing faculty members with training since most had "never been private practitioners" and lacked "the skills to teach general medical care to students" (Rothstein, 1987, p. 303). It also added an additional element for clinicians, who may not have been exposed to the learning sciences and pedagogical practices. The training addressed evaluation and teaching gaps in medical education,

which were attributed to increased orders of lab tests due to knowledge gaps, less time in practice, and a shortened curriculum in favor of the elective system (Carroll & Monroe, 1979; Griner & Glaser, 1983; Rothstein, 1987; Wiener & Nathanson, 1976).

While these fellowships aimed at bridging the deficit gap for quality medical educators, studies indicated that remaining in the academy is heavily dependent on publishing during medical school and residency and having an interest in teaching (Brancati et al., 1992; Simpson et al., 2001; Straus et al., 2006). Pololi et al. (2012) found faculty leave academic medicine due to "negative perceptions and distress about the nonrelational and ethical culture of the workplace" and predictors of leaving were "feeling vulnerable and unconnected to colleagues, moral distress, perceptions of the culture being at times unethical, and feelings of being adversely changed by the culture" (p. 865). This finding suggested the emergence of the fellowships, which aimed at increasing the number of clinicians in the academy (Searle et al., 2006; Rothstein, 1987) have been met with organizational culture challenges.

In 1984, Libby Zion died at a New York hospital as a result of the interaction between multiple medications at the hand of an intern who was working her 18th hour on call (Joyner, 2004). Prior to this case, residents worked without duty hour restrictions. The Libby Zion case eventually led to the Bell Regulations, which limit the scheduling of residents for no more than 24 hours straight or 80 hours a week (Asch & Parker, 1988; Whang et al., 2003). The Libby Zion case illustrated a fundamental flaw in the American medical healthcare system. While the system had set out to support a diverse array of patients by instilling payment support efforts, it did not consider impacts related to medical education. Popp (2014) argued the Bell Regulations overlooked the need for more experienced faculty in the educational system for physicians-in training and instead placed emphasis on only reducing work hours. Furthermore, Bell (1993)

posited that duty hour restrictions failed to account for the fact that "residency programs, as graduate education, should be run by educators" (p. 404).

Fundamentally, medical curriculum by the 1980s had evolved into a student-centered, problem-oriented curriculum, which was largely led by clinicians and was disconnected from the fundamental fabric that held the various basic science concepts together (Norman, 2012). Drug interaction involves in depth understanding of the biochemistry of the cells, and the organic chemistry of the molecular compounds. Norman (2012) argued the duty hour restriction only addressed the visible part of the problem, leaving quality concerns (sicker patients, more multi-symptom diseased patients, and decreased patient stay) of the Osler clinical education unresolved. These concerns would eventually be addressed through the evolution of EBM in the 1990s, by integrating evidence with clinical decision making.

Evidence-Based Medicine

Gordon Guyatt, a program director in Canada, is credited with the term EBM (Thoma & Eaves, 2015). The EBM naming occurred during an American College of Physicians Journal Club meeting at McMaster Medical School in Ontario, and this was later presented as a new paradigm for medical practice (Guyatt, 1992; Zimerman, 2013). Guyatt (1992) posited that EBM involves "problem defining, searching, evaluation, and applying original medical literature, it is incumbent on residency programs to teach these skills" (p. 2422). Evidence-based medicine evolved from problem-based learning and cost strains in the Canadian Health System in 1964, officially making its way into the curriculum by 1991, emphasizing clinical problem solving and medical decision making (Zimerman, 2013). The practice of medicine, which had been grounded in clinical decision-making situated around problems, had now transitioned towards integration of the evidence use with the literature. David Sackett, Guyatt's mentor, later became the father of EBM (Thoma & Eaves, 2015; Canadian Task Force on the Periodic Health Examination, 1979).

Sackett also established levels of evidence, which varied based on the following: (a) one randomized control trial, (b) well-designed cohort or case control analytics study, (c) comparison study between time and places with or without intervention, and (d) opinions of respected authorities (based on clinical experience, descriptive studies, or reports). These levels were co-taught as part of the McMaster problem-based learning method and embedded clinical problem solving and analysis of decision making (Zimerman, 2013).

While the practice of EBM appeared relatively new, the roots are common to epidemiology and methods of quantification and statistics, which originated in the 18th and 19th centuries in Europe (Zimerman, 2013). Within this paradigm, value is placed in using evidence for decision-making within medicine, and a review reflects common barriers to EBM are (a) barriers to doing research, (b) few resources, (c) little time, (d) inadequate skills, (e) poor access, (f) lack of knowledge, and (g) fiscal barriers (Sadeghi-Bazargani et al., 2014). Even though these barriers exist, the principles behind using evidence to make decisions has evolved into other health care fields. As this evolution occurred, so too did the phrasing and terminology behind its meaning and use. Such transition also helped to redefine the meaning behind evidence, where Sackett et al. (1996) posited that evidence should not be limited to only randomized trials but should instead focus on finding the best external form of evidence to answer a question. The practice of using evidence-based research practices is defined as the ability to "integrate best research with clinical expertise and patient values for optimum care, and participate in learning and research activities to the extent feasible" (Committee on the Health Professions, 2003, p. 46). The use of evidence-based-medicine in practice emphasized the patient's values and research evidence, which helped to redefine a physician's purpose. This purpose is illustrated by the Institute of Medicine's Committee on the Health Professions Education Summit (2004), where they note that "All health professionals should be educated to deliver patient-centered care as

members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics" (p. 45).

Clinical-Presentation Model

The clinical-presentation model started in the 1990s to replace the prior PBL model. However, the concepts of EBM, such as integration of clinical expertise with patient values, are fundamental to the clinical-presentation model because it supports clinical decision-making (Ferwana et al., 2012). Starting at the University of Calgary Faculty of Medicine, approximately 120 clinical presentations were analyzed by various experts in the field resulting in the development of a schemata on how patients presented clinical problems (Mandin et al., 1995). Instead of using generalized problems as exhibited in the PBL model, this model adopted the use of categorization, learner objectives, and connected the student's learning to their scientific understanding (Papa & Haraysm, 1999).

The shift towards this competency-based curriculum recognized that there was no generic problem-solving process and instead needed to integrate the learner's knowledge into schemes that could be categorized (Mandin et al., 1997). Because this curricular model emphasized classification, demonstration, and problem solving of each case (Papa & Haraysm, 1999), it aligned conceptually with the understanding of System 1 (intuition) and System 2 (analytic) thinking (Tay et al., 2016). Within this System 1 and System 2 thinking, individuals can make decisions either quickly (intuition) or slowly (analytically) through careful analysis. However, the challenge with System 2 thinking is that it requires effort, takes years to develop, and "may use 'what-ifs' to generate hypotheses, but still may not test these hypotheses" (Hattie & Yates, 2014, p. 304).

The integration of this categorization based on cognitive-experiential self-theory (Epstein, 1973) is linked to the understanding of System 1 and System 2 thinking utilized in the

clinical presentation curriculum. These two systems focus on "the rational system . . . referred to as *beliefs* and those in the experiential system as *implicit beliefs* or, alternatively, as *schemata*" (Epstein, 1994, p. 715). Evaluation of these two systems has been studied in pre-clinical and clinical medical school by students using cognitive reflection tests, noting roughly half depended on intuitive thinking with no significant differences between clinical and pre-clinical respondents (Tay et al., 2016). This suggested for this curriculum to work, it must be designed in a way that the constructs are scaffolded, building on learner knowledge as opposed to being isolated and taught separately (Epstein, 1994). This is supported by the concept of dual processing theory, where Papa (2016) posited that System 2 thinking heavily depends on prior knowledge and rule weighting leading to the culmination of a decision. However, the challenge with System 2 thinking is that it requires time to develop, uses 'what ifs' to create hypotheses that may lack testing, and is effort intensive (Hattie & Yates, 2014).

For activation of System 2 thinking, it is essential that the necessary feedback experiences are provided so learners can either succeed or fail. To do this, Hattie and Yates (2014) recommended activating prior knowledge and creating spaces for observational modeling (Bandura, 1976). However, Norman (2012) had concern with clinical education, noting there are fewer patients to observe due to increasing numbers of outpatient clinics, with most patients exhibiting multi-symptom diseases. With fewer patients to directly observe, learners will lose out on the ability of acquiring experiences in a safe space where misdiagnosis is less costly. Thammasitboon and Cutrer (2013) echoed this concern, noting roughly 75% of diagnostic errors are associated with poor clinician diagnostic thinking.

In summary, through the five curricular models (see Table 1) one can trace the evolution of present-day medical education and practice. While the pedagogical practices embedded within the curricular models shifted between emphasizing basic science content and clinical experience-

based presentation (Altenderfer & West, 1964; Diehl et al., 1952; Rothstein, 1987), each built upon the prior model producing a highly specialized (Patel, 1999; Rothstein, 1987) disconnected curriculum. The societal demands for higher quality patient care, lower cost of care, and medical education linked to quality standards are reflective of both internal curricular shifts and external organizational practices due to market forces (Committee on Quality of Health Care in America, 2001). Ludmerer (1999) stated:

> medical school and teaching hospital officials, who once measured their success by the physicians they educated and the new knowledge they produced, now increasingly focused on their institution's profitability and market share, with scant discussion of what was happening to education research. (p. xxiv)

However, Norman (2012) proposed simulation learning as part of an integrated curriculum will assist in bridging the education gap by providing opportunities for deliberate practice. While the idea proposed by Norman targets the curriculum directly, Lee (2016) proposed AHCs must re-evaluate their organizational strategies by focusing on the following six concepts in the organization: (a) identifying the goal, (b) identifying the business they are in, (c) identifying the patient conditions they will focus on, (d) identifying what sets them apart, (e) identifying synergies and reducing duplication, and (f) reviewing their delivery system services.

The call to action for AHCs translates to the

> need to work with educators and other resources within their parent universities to develop the evidence base for clinical education so that the approaches used will be based on sound educational principles that improve understanding of the quality of clinical education. (Committee on the Roles of Academic Health Centers in the 21st Century, 2004, p. 46)

Table 1

Summary of the Five Models of Curriculum, Standards, and Funding

Category	Apprenticeship Model	Discipline Model	Organ-System Model	Problem-Based Model	Clinical-Presentation Model
Pedagogy	Emphasis on modeling observable clinical practice. Teacher focused. Heavy emphasis on science and clinical observation, with disconnect at the macro-level understanding of science.	Emphasis on standard lecture and recitation, specifically hard sciences. Teacher focused with separation by departments. Heavy emphasis on basic sciences.	Emphasis on standard lecture with a focus on integrating science to a specific organ system. Teacher focused. Separation of basic science and clinical education.	Emphasis on active learning and small group work centered around a clinical problem (context). Small group and learner centered. Origin of EBM. Heavy emphasis on clinical education.	Emphasis on activation through use of schemata and classification based on *typical* clinical presentations in the field. Student focused with small groups. Emphasis on clinical education.
Standards	Few standards with many options on how one could become a physician.	Standards are introduced in 1847 with American Medical Association.	Increased standards & specialty boards.	Standards shifted in the (1970s) with removal of internships & increased specialization at the GME level.	Focus on terminal learner objectives for competency assessment.
Funding for Medical School (UME) and GME	Paid by individual exam fees	$100,000	$1,000,000	$20,000,000 and GME support from federal government in 1965 with Medicare.	$200,000,000 GME funding support continues from diverse revenue streams (Medicare, VA, DOD, HHS)

Note. (Congressional Research Service, 2018; Joyner, 2004; Ludmerer, 1999; Papa & Harasym, 1999; Rothstein, 1987; Thelin, 2011).

For AHCs to adopt such strategies, leaders must understand organizational theory, social learning theory, and data use as it pertains to its influence in medical education and systematic change efforts.

Organizational Factors in Medical Education

The Institute of Medicine's Committee on Quality of Health Care in America (2001) posited increased levels of complexity in health care, noting focus should be on identifying patients' needs as opposed to the needs within the organizational system. As part of their suggestion, recommendations were made to finance using a health care quality innovation fund for the evaluation of programs that can assist in implementing these organizational changes. However, for change to occur, the structure, culture, and values of the organizational system must be evaluated carefully in order to ensure changes are made with an overall goal in mind (Lee, 2016). Furthermore, the complexity of the structure can complicate analysis, due to the non-linear nature of systems.

Organizational change reflects patterns and behaviors that are embedded in the structure, culture, and values of the system (Camacho et al., 2018; Smircich, 1983; Supovitz, 2002). The term *organization* assumes a level of structure that reflects an underlying mechanism for which disorder is ordered, thereby decreasing the entropy within the system. Viewing an organization as a system provides insight into how change occurs, barriers to respective change, and support structures that exist that can facilitate such change. Adoption of this view allows medical educators to understand that change will not occur through the development of curriculum alone. This is supported by the work of Bloom (1998), who posits that while curricular reforms have occurred, they have not considered "the importance of social organization (the social structure of the medical school) is either lost or deemphasized" (p. 297). It is through this social lens within

the organization proposed by Bloom that educators can attempt to understand medical education change efforts and factors influencing decision-making in curriculum development.

Theoretical Framework

The complexity of decision-making in education leads to administrative challenges in aligning evidence-based decisions towards organizational goals and mission (Corcoran et al., 2001; Farley-Ripple & Cho, 2014; Hendrickson et al., 2013). The rapidity with which technology makes data and data analysis available (largely a technology issue) creates challenges to collaboration around data (largely a human-centered enterprise). Farley-Ripple and Cho (2014) further described challenges when it comes to evidence-based decision-making, noting that questions should be raised about what evidence is used, how it is used within the organizational context, and who is using the evidence to make the decisions. These questions require time for reflective practice; however, a medical educator's time is challenged by internal classroom demands, committee demands, and external systematic accountability strains. These strains represent an external organizational culture (Sallee, 2012), which acts on the internal educational setting in the form of social distrust guided by the age of consumerism in education (Lonsbury & Apple, 2012). To frame this research, this study draws on organizational theory, data-driven decision-making, and social learning theory.

Organizational Theory

Organizational theory as a mechanism for understanding change has not always been viewed through this systems approach. Chance (2013) explained that organizational theory may be broken down into three periods: (a) classic organizational theory, which arose in the early 1900s as a byproduct of the desire for efficiency; (b) the behaviorist view, predominant from the 1920s through the 1950s focusing on behaviors of humans in their organizations; and (c) the systems view, which paved the way for integrating the idea of an organization as a living

organism. Historically, medical educational change reflects these three periods proposed (Chance, 2013), beginning with entrepreneurial university presidents, who possessed power and autonomy at the turn of the century, and shifting to an era of accountability and commercialization (Thelin, 2011). While medical education has evolved and adapted in response to change, so too have leaders and systems that are embedded in medicine-related organizations. Historical events and the five curricular reforms represent a few of these progressive changes, but change is largely due to a dynamic interaction among multiple components. For example, Genn (2009) argued leaders must acknowledge that medical education is a learning organization where the external climate including the curriculum and dynamics of the organization interact.

Understanding organizational theory requires a systems approach, where it is inherently important to understand how each component of the system (the organization) affects, responds to, and related to the other components of the system. For medical education to adopt a systematic approach, the members within the organization will need to become partners to their respective adjoining systems. For example, UME and GME will need to work together to align medical education outcomes. Price (2005) posits that one approach for continuing medical education is use of the Plan-Do-Study-Act cycle where members in an organization identify areas for improvement and then pilot such implementation. This Plan-Do-Study-Act cycle is part of improvement science, which is a cyclical process where small tests are applied with reflective practice, even when some evidence is lacking to address and make quick change to practice (George et al., 2019). To exemplify this complex process, Christie et al. (2017) noted that improvement is not focused on development for small group goals; rather it focusses on addressing policy. Curriculum alignment that is contextual serves as one tool for improving smaller group goals. This collective team effort is exemplified by Byrk et al. (2011) noting the value of networked improvement communities, which are more decentralized in nature and allow

for collective problem-solving. Adoption of this system approach where organizations work together to improve medical education has been proposed by Price (2005), suggesting that leaders use data-driven needs assessments which can identify performance gaps in an organization. This inherent non-linearity of the system demonstrates how an organization's structure, culture, and values all act on one another later influencing various forms of decision-making.

Organizational Structure

While each organization functions in its own unique way, the structure of the organization lays the foundation for how it will operate to achieve its goals and ultimate mission. Blau (1994) described the structure of an educational organizational system as possessing an academic component, composed of faculty and students and a bureaucratic system, made up of a hierarchy of administrators. This hierarchy in medical education is often associated with an "organizational structure" that "reflects the distribution of power within the medical school as much as any other decision" (Rothstein, 1987, p. 9). This structural division occurred in response to the Flexner report of 1910, whereby the social structure became divided among basic science educators, clinical scientists, and clinician educators (Bloom, 1998). Thus, while the report aimed to improve standards in medical education, leaders overlooked the implementation process within a complex organization. However, improvement is likely if leaders become cognizant of the systematic nature of the organization. Price (2005) recommended that teams work together instead of addressing change solely through the content of medical education; thus, overlapping their improvement efforts with all levels of the organization.

This system structure has evolved over the decades leading to more diverse ways of understanding decision-making in response to change. However, while the two-pronged breakdown provided by Blau (1994) assists educators and researchers in understanding why

organizations can respond so differently to change, expanding the definition of organizational structure based on their size assists researchers in valuing their contextual nature. For example, Hrabowski et al. (2019) posited that large institutions run very similarly to major corporations with increasing complexity as opposed to smaller institutions, where there is a higher probability of knowing and communicating with all members. This corporation-like structure is what Bloom (1998) suggested as a form of corporate bureaucracy requiring a continuous flow of resources that fail to support the income required for medical education itself. Thus, size and context impact how an educational organization forms their respective academic and bureaucratic systems (Blau, 1994; Blau & Scott, 1962; Hendrickson et al., 2013). Decisions made within the educational organization for instance, will reflect a combination of academic and bureaucratic ideals where organizational power is either centralized or decentralized. Hendrickson et al. (2013) noted institutions that adopt highly bureaucratic structures will be vertical in nature with a more centralized approach to making organizational decisions, as opposed to flatter approaches where power is evenly distributed. The power within the organizational structure is fundamental to how medical education operates. Specifically:

> educational values become subordinate to the requisites of the organizational structure of the medical school, and therefore to policy that is determined by external groups who provide the means and regulate the activities of the major persons within the institution. (Bloom, 1998, p. 298)

Hence, structures put in place within the organization will involve an interaction between subsystems both internally and externally, have different power distributions, and adopt a variety of communication strategies for decision-making.

Data-Driven Decision-Making

Use of data to drive decisions begins with addressing how it is defined, used, and interpreted within the context of the organizational structure. In data-driven decision-making, observation leads to empirical data that is qualitative and/or quantitative where one can make inferences (Buck et al., 2014). This process is further explained by Jimerson and Wayman (2015), who delineate between *data use* and *effective data use*, noting how one hinders practice and the second aligns with educator practice. Hamilton et al. (2009) defined data-based decision-making in education as referring

> to teachers, principals, and administrators systematically collecting and analyzing various types of data, including demographic, administrative, process, perceptual, and achievement data, to guide a range of decisions to help improve the success of students and schools. (p. 46)

Using data to drive decision-making necessitates fundamental data literacy skills, in which the practitioner or evaluator engages with the data in a way that they understand the meaning of the data (Mandinach & Gummer, 2013). Through their work with the Institute of Education Sciences, Hamilton et al. (2009) established key elements necessary for using data: (a) embed a cyclical model of data use in instruction, (b) provided students with autonomy in making data-driven decisions that align to learning goals, (c) develop a vision, (d) adopt a data-driven culture, and (e) utilize a data system. These key elements serve as hallmarks for data-driven decision-making; however, further exploration on putting data-driven decision-making into practice is needed to affirm associations of data-to-decision models (Mandinach & Gummer, 2015). Therefore, while these guidelines (Hamilton et al., 2009) may assist in understanding the breadth and depth of each hallmark in data-driven decision-making, they should not be seen as concrete in nature since the field is evolving.

Cyclical Model

The first hallmark within data-driven decision-making in an educational setting involves understanding of student learning while engaging in cyclical reflective practice. To accomplish this engagement, the educators must collect data from several sources, while simultaneously building out assessments that provide data to improve and modify practice (Hamilton et al., 2009). Assessment use provides opportunities for teachers to engage in understanding of where students currently are, and how gains are met progressively over time. In medical education this assessment use involves aligning the methods of assessment to the curriculum outcomes in a way that monitored progression may be tracked (Boulet & Durning, 2019). Schuwirth and Van der Vleuten (2011) recommended medical educators design these assessments around four constructs: (a) knowledge, (b) skills, (c) problem-solving skills, and (d) attitudes or professionalism.

Understanding of learning and continual collection of data are fundamental to the first tenet within data-driven decision-making. This continual assessment use is further supported by Blanc et al. (2010), where the data from benchmark assessments, known as interim assessments, assisted in producing feedback necessary for teachers to engage in understanding student needs. This cyclical nature where one assesses, identifies the problem, tests out an intervention. and assesses the intervention are key drivers in how data use can direct successive decisions (Blanc et al., 2010; Datnow & Hubbard, 2016). Continual assessment using cross-curricular domain models, where learning is evaluated multiple ways, provide an exemplar model of cyclical data use (Bennett, 2010).

Autonomy in Decision-Making as an Emerging Practice

The second hallmark addresses the need for teachers to provide more autonomy in the classroom by motivating students with their own achievement data, which aligns back to rubrics

and feedback (Baldwin et al., 2012). If the teachers set expectations ahead of time in a clear concise manner, students are provided the autonomy they need to engage in reflective practice by knowing where they currently are, and where they can be based on goals. These practices involve engaging with curriculum in a way where aspects of data use are observed, and inferences may be made. Providing autonomy in decision-making by medical faculty depends on resident assertiveness in demonstrating their competence in providing a clear rationale for their respective decisions (Baldwin et al., 2012).

Shared Vision

The third hallmark involves communication and alignment of a shared vision between all levels of an organization. In order to facilitate the development of a shared vision, Schildkamp and Poortman (2015) suggested using data teams made up of teachers and leaders in the organization who work with university personnel to understand data use while establishing shared goals. These collaborative efforts exemplified by Schildkamp and Poortman demonstrate how educational models may align data use efforts to accountability standards, thereby improving organizational structure and culture. By addressing the issues related to the organizational structure and culture, data communities contribute to overall improvement (Supovitz, 2002).

Data-Driven Culture

The fourth hallmark involves working in collaboration with diverse team members, where professional development facilitates understanding of data. For example, adoption of models using communities of practice (Wegner et al., 2002), while engaging in use of cognitive-based assessment as learning, provides opportunities for action-oriented assessment strategies that measure and facilitate achievement (Bennett, 2010). Since assessment along with collaborative efforts assists in developing a data-driven vision, alignment between the two assists

in reinforcing the culture. For example, social collaborative networks in a study of 42 educators demonstrated improvement in shifting the data culture, where results established members who fell into categories of providing advice or seeking advice (Farley-Ripple & Buttram, 2015). Thus, to transform data-driven decision-making into an enculturated practice, educators must use a combination of what Jimerson and Wayman (2015) referred to as collective practice and individual practice, where information is shared in a way that aligns across different systems and can improve overall data literacy (Mandinach & Gummer, 2013). This collaborative approach is recommended in medical education curriculum, since it addresses the increased specialization and complexity while teaching organizational teamwork (Lerner, Magrane, & Friedman, 2009).

Data System

The fifth hallmark involves adopting systems that can assist in linking all groups and the data together in order to meet user needs. Various forms of data are utilized both in educational practice and at larger organizational levels. In medical education, the use of curriculum mapping with a database provided data that facilitated in continued development, improvement, and refinement of medical curricula (Al-Eyd et al., 2018). Data-driven decision-making is part of a process in attaining educational goals within a classroom; however, the actual practice of working with data may be limited to tools at a larger organizational level regarding access to data, as opposed to development of true literacy skills (Farley-Ripple & Buttram, 2015). However, Al-Eyd at al. (2018) found use of the curriculum mapping data centralized data collection allowing decisions regarding medical education content, strategies, teaching, and assessment to align in a way that provided organizational transparency.

Social Learning Theory

Social learning theory assists leaders in understanding how educators and other peers develop knowledge and understanding (Bandura, 1976). Educational training that targets medical

educators can assist in serving as a learning community that models evidence-based practice regarding curriculum development. For example, Wenger et al. (2002) aligns with this idea noting that in communities of practice, members have a ". . . set of socially defined ways of doing things in a specific domain: a set of common approaches and shared standards that create a basis for action, communication, problem solving, performance, and accountability" (p. 38). Therefore, as adult learners engage in a domain modeled on a consistent basis, they may begin to refine their own epistemological assumptions. This modeling is important from a medical education perspective, in that the modeling provided in the faculty development domain and in the workplace domain (O'Sullivan & Irby, 2011) act as a form of mentoring and coaching of what evidence-based practice means. Thus, when adult learners engage within their own network and within the educational network, they can serve as exemplar teacher models (Schreurs et al., 2016) in making evidence-based decisions within their practice.

Integration of Theories

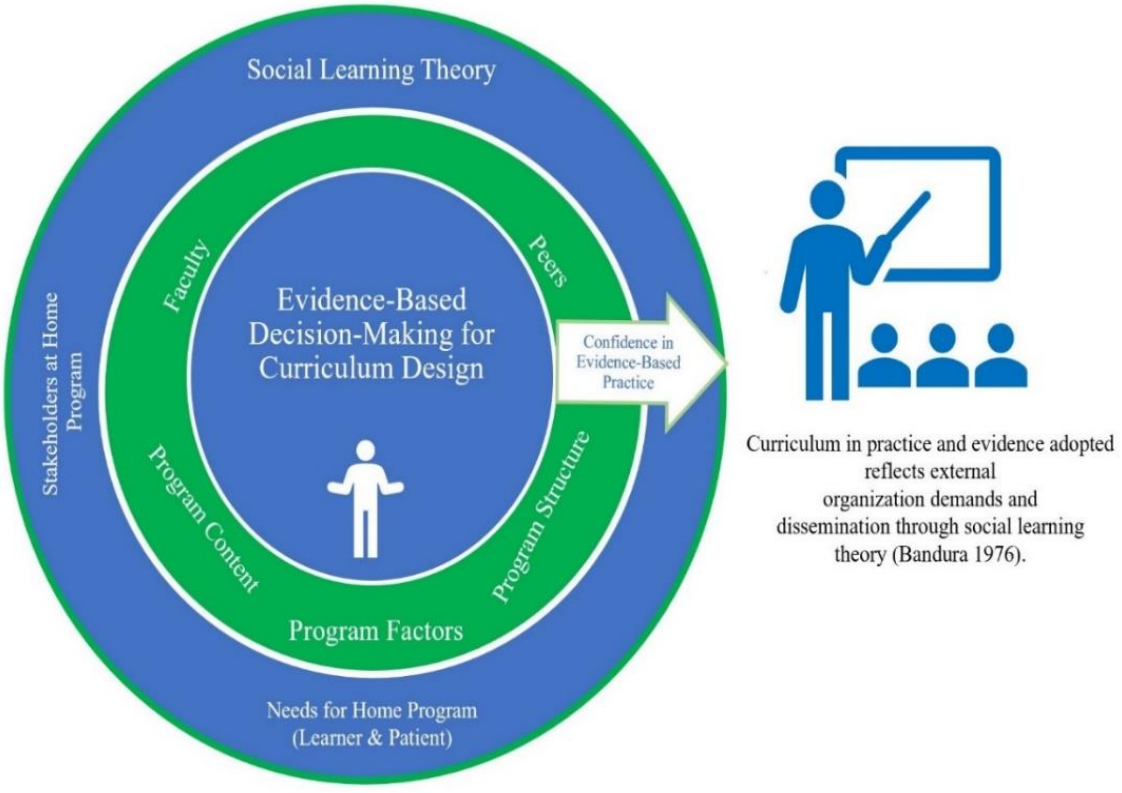
Integration of organizational theory, data-driven decision-making, and social learning theory provides an opportunity to critique medical education fellowship training at two levels (see Figure 3, social learning in medical education and a learner-practitioner framework). The first level is nested within an internal educational environment, which socially models evidence-based decision-making with data to design curriculum. The second exists when a learner/medical educator, who engages in the primary educational environment, moves back to their own organization where the organizational structure, culture, and values may be inherently different from the primary level. Through this layered analysis, one may begin to understand development of confidence related to evidence adoption, and organizational factors associated with the lack of evidence adoption, even when external training is provided to a learner. Thus, the use of

evidence assists in shaping the curriculum and reshaping how one develops as a medical teacher for future practice.

The primary internal organization of the framework represents a medical education fellowship, which models how evidence is used for curriculum design. Specifically, training from exemplars in the domains of research, clinical teaching, professional development, and curriculum development model the use of data, which drives curriculum design.

Figure 3

Social Learning in Medical Education: A Learner-Practitioner Framework



Thus, the peers and faculty that deliver the program content will help to shape how a participant's confidence is molded epistemologically and whether it can change over the course of an intervention that culminates with a developed curriculum. The method of teaching in medicine involves clinical teaching and supervision, both of which encompass aspects of social learning (Bandura, 1976). Social learning helps adult learners conceptualize defining evidence

for organizational problem-solving, particularly as they are exposed to modeled activities within various paradigms. Guyatt (1992) noted, "The role of modeling, practice, and teaching of evidence-based medicine requires skills that are not traditionally part of medical training" (p. 2421). As social learners, individuals come to know and perceive the world through diverse world experiences, which ultimately assist in shaping their own epistemology. Through this process, faculty and peers assist in modeling perceptions of truth and reality. For example, Charlier et al. (2019) found faculty must attempt to acknowledge their own biases or ideologies, noting social science is "socially constructed-there are no 'facts' that are absolute truths" (p. 443). Therefore, if leaders adopt models from social learning, it is possible to engage both educator and learner in understanding how evidence is defined and used to address gaps between theory and practice. Rothstein (1987) distinguished the clinician from the researcher, noting researchers use standardized tools and precise measurements while clinicians use crude methods often based on observer variability. However, the skills that target the use of such tools may be applied within the pedagogical practices of an academic medicine fellowship. Such training can support clinical teachers who often have little training in education (McLeod et al., 2003). Furthermore, many medical educators come into teaching with a focus on passing down massive amounts of information with emphasis placed on passive versus active learning (Graffam, 2007; Kember, 1997). This is a historic relic based on what was modeled to them as a learner in medicine and largely derived from one of the five curricular models within medical education (Papa & Haraysm, 1999). For example, Kost and Chen (2015) referred to the common practice in clinical learning where *pimping* is used as a pedagogical practice to probe the learner using the Socratic method.

In order to address understanding and practice of evidence-based decision-making, models for curriculum design may be used as part of an academic fellowship offered outside of a

clinician's organization. This represents the movement from the internal portion of the diagram where the medical educator leaves the fellowship training and moves back to their home organization (the external ring). This fellowship training, which adopts elements of a six-step approach to curriculum design (Thomas, 2016), assists in scaffolding the medical educator's use of evidence; development of goals, objectives, and educational strategies for later implementation; and evaluation at one's home program. Furthermore, it can assist in improving learner confidence with using evidence to drive curriculum development. Support for such education comes from a study by Uy et al. (2014). They evaluated post graduate year resident physicians (PGY1–PGY4) noting a general trend in increased confidence as the years increased due to building their knowledge and skills. However, this evaluation of the curriculum will reflect elements needed in data-driven decision-making, where it will be important to look at the following: (a) what needs assessment data is collected to drive curricular design; (b) how the data align to educational goals, objectives, strategies, elements of implementation, and maintenance; and (3) how the data selected within the needs align between the educator's autonomy, stakeholder needs, learner needs, and community/patient needs.

The secondary external level in the framework represents the movement of the medical educator (fellow) back to their home organization; where the structure, culture, and values may be inherently different. An organizational structure directs its culture that will later influence the values and behaviors adopted. This applies to how the needs assessments within the designed curriculum are contextualized and if the medical educator indicates barriers reflective of a hierarchal organizational. Chance (2013) expands on culture: ". . . like a tree, [it] has deep roots which serve as the life force of the organization" (p. 63). In reference to this idea that organizational culture has deep roots, it is apparent that the culture appears to be an immovable force acting within and outside a system. Camacho et al. (2018) referred to culture as lacking a

center, possessing norms and traditions that impact organizational behavior. Thus, use of needs assessment data from an educator's (fellow's) home organization will address how evidence is used to shape their own curriculum and will reflect organizational values.

The organizational values assist members within the system in shaping how they will behave in response to various decisions. In short, values are contextual in the very nature of the organization, across organizational cultures, and emphasize an ideology (Zajda, 2009). Just as the structure influences the culture of an organization, the same is true for how both structure and culture shape overall values held within the organization. External environmental factors that are part of the broader organization assist the members in knowing how to behave towards a set of directed goals. These factors are important to reflect on at this secondary level, particularly from the medical educator's point of view. For example, failure to feel confident in implementing designed curriculum at the primary level may be due to problems at this level within the fellowship or may be attributed to larger organizational factors inhibiting such implementation. Casiro and Regehr (2018) suggested that medical educators address these curricular barriers by: (a) developing a high level of communication across the organization, (b) acknowledging the roles and responsibilities for decision-making, and (c) accounting for the authority for decisions (made or not made) as part of the decision-making, noting input from stakeholders.

Conclusion

Historical curricular reforms aid in illustrating the complexity of medical education over the last 100 years. Integration of organizational theory, data-driven decision-making, and social learning theory assist in understanding how evidence is used to design curriculum, which in turn shapes the future pedagogical practice. Application of these theories allows the reader to view the medical educational system as a complex array of individual systems within a larger organization that responds to each other and eventually produces a behavior based on this

interaction. Through this lens, one can begin to see how individuals within and outside the systems respond in relation to one another, all of which eventually lead to their own cumulative effect on how the medical education system functions in a non-linear way to produce curriculum that is put into practice.

Coburn et al. (2009) noted collaborative data use is challenging due to the non-linearity of use and alignment to various policies and standards. Bias associated with selection of evidence can also cloud improvement efforts. Farley-Ripple and Cho (2014) referred to evidence-based decision-making in that it "assumes that a straight line can be drawn between what the evidence 'says' and what decision-makers ought to conclude" (p. 231). However, this linearity is not the case as individuals may make inferences from the data even when the data should not lead to proposed solutions (Honig & Coburn, 2008). Consequently, the primary challenges regarding organizational data use involve the following: lack of availability of appropriate evidence, the interpretability of the evidence, evidence selection based on worldviews, and lastly the way evidence is used for decision-making (Coburn et al., 2009). As technology expands and data becomes more readily available, leaders must address these barriers while being cognizant of their own internal epistemological motivation towards defining evidence.

Use of data to drive decisions begins with addressing how it is defined, used, and interpreted within the context of the organizational framework. In data-driven decision-making, observation leads to empirical data that is qualitative and/or quantitative where one can make inferences (Buck et al., 2014). This process is further explained by Jimerson and Wayman (2015), who delineate between *data use* and *effective data use*, noting how one hinders practice and the second aligns with educator practice. Thus, to develop the skills of evidence-based decision-making, training must help medical educators understand *effective data use*.

CHAPTER THREE: METHODOLOGY

Understanding how medical education training supports physicians that may lack formal education in the learning sciences and pedagogy is necessary. Evaluation of physician confidence in using a variety of evidence sources associated with medical curriculum design pre- and post-instruction assisted in understanding the value of external medical fellowships. To evaluate confidence with making evidence-based decisions with curriculum, I engaged in quantitative and qualitative analysis of archival data in response to the following research questions:

Q1: How and to what degree does instruction in medical curriculum development impact confidence in using evidence to inform curriculum?

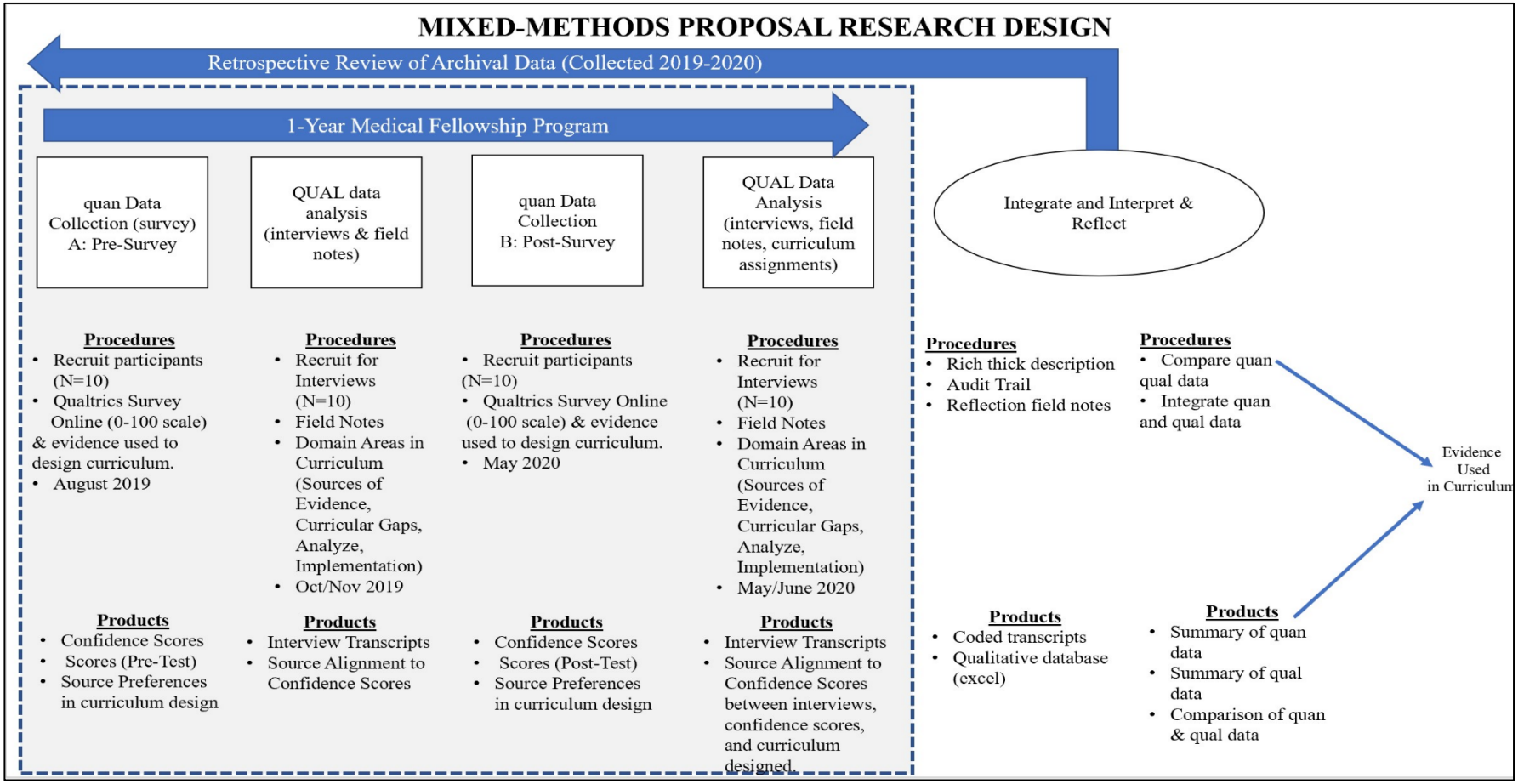
Q2: What factors influence the ways in which medical educators design and implement curriculum?

Study Design

For this study, I used a mixed-methods approach applied to archival data originally collected for a study focused on medical curriculum development and evidence-based decision-making, and augmented by document analysis of materials related to the program that was the focus of the original study. Tashakkori and Creswell (2007) defined mixed methods "as research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry" (p. 4). A mixed methods approach (see Figure 4) was used to assess reported confidence prior to and after exposure to a 1-year medical education fellowship program.

Figure 4

Mixed-Methods Proposal Design



A mixed methods analysis of the data was essential for this research, because it not only aimed at assessing reported confidence prior to and after instruction, but it also assisted in evaluating sources of evidence that were put into curriculum designed by physicians for physician practice. Specifically, data collection occurred using an explanatory sequential mixed methods design (quantitative to qualitative), where the alignment between the quantitative data and qualitative data assisted in addressing alignment between participant internal confidence and sources of evidence used for curricular practice.

Study Context

As the researcher, I made use of archival data as well as document analyses. The archival data were collected for a broader evaluation of an academic medical fellowship program. That study focused on an academic medical fellowship program at a north Texas university (see Appendix A). In what follows, I provide an overview of how data for that study were collected, before moving to a description of how I collected other documents pertinent to the present study and how I subsequently analyzed those data.

The broader study included collection of pre- and post-survey data, semi-structured interviews, and curriculum design documents. Academic medical fellows participating in the fellowship (N = 11) were recruited to participate in August of 2019. Following consent, a total of (N = 10) completed the initial pre-fellowship survey (see Appendix B). Over the course of the academic year (2019-2020), fellows completed a fall semi-structured interview (see Appendix C), a spring 2020 post-fellowship survey (see Appendix D), and a final semi-structured interview. All aspects of the study took place in the context of the academic health center that hosts a 1-year graduate academic medical fellowship program. This academic health center also supports UME and GME. This 1-year fellowship met a total of seven times starting in August and commencing in June with capstone projects in research and academic medical curriculum

development. The fellowship emphasized academic skills and foundational skills in the following areas: (a) clinical teaching, (b) professional academic development, (c) academic medical curriculum development, and (d) research. This specific context was necessary for the study because this fellowship is housed within an academic health center in Texas and serves a diverse array of health professionals that are either currently in residency or have completed residency and are practicing medical educators. Thus, archival evaluation of participants from this site assisted in understanding both the impact of external instruction in the education domain, and in understanding of how medical educators navigate designing curriculum while balancing home organizational demands. Since this is an archival evaluation, the review entails analysis of the fellowship which ran during 2019-2020. It is important to note that COVID-19 could have interfered with methods of teaching delivery and data collection between April 2020 to June 2020. Historically, all seven sessions have run over the course of a year and meet face-to-face for 4 to 5 days. Fellows met for 5 days in the months of August and January (see Table 2: Overview of medical education fellowship), and for 5 days in September, November, February-March, April, and June. Instruction time varied in each content area (see Figure 5 for time spent on instruction for the four content areas for 2019-2020). Due to the spread of coronavirus (COVID-19), the April and June sessions were hosted virtually via Zoom.

Prior to the start of the 2019-2020 fellowship program, I redesigned the curriculum course to follow a sequential modular format where elements of program evaluation were built into the course (see Figures 6-7: Fall 2019 and spring 2020 format). At the culmination of the fellowship program, medical educators were required to complete a comprehensive curriculum that embedded elements of the six-step approach to curriculum design (Kern, 2016). While the fellowship followed the format addressed in Figure 6, the flow and requirements changed within the second half of the curriculum course by spring 2020.

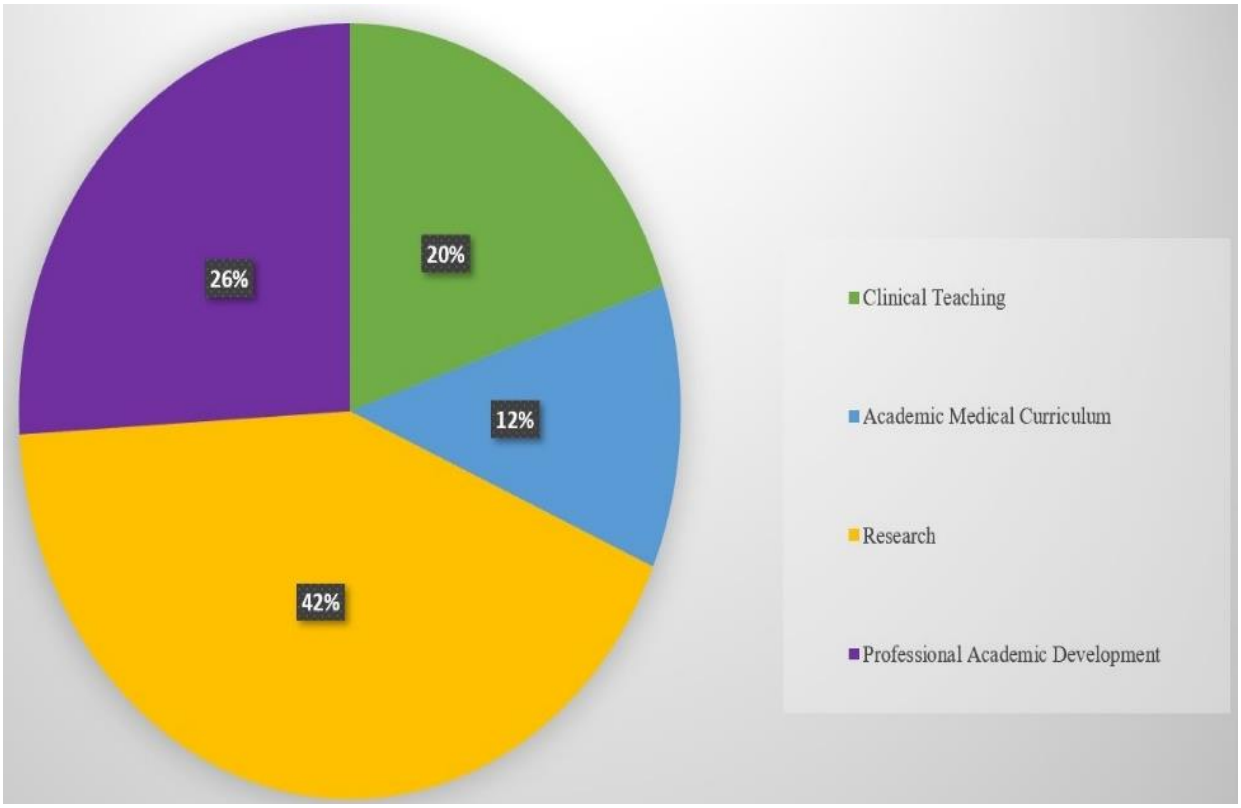
Table 2

Overview of Medical Education Fellowship by Content Topics Covered in 2019-2020

Timeframe for Session of Content Taught	Clinical Teaching Content Covered (2 credit hrs.)	Academic Medical Curriculum Content Covered (2.5 credit hrs.)	Research Content Covered (6 credit hrs.)	Professional Academic Development Content Covered (3.5 credit hrs.)	Total Time on Content Area either Face to Face or via Zoom
August 2019 Pre-Survey	I. Overview/Master Teacher (1) II. Assessment Instruments-CTPI (1) III. Goals & Results (1.5) IV. Goals: Self Inventory (1.5)	I. Overview & Proposed Topics (1) II. Intro & Workshop (3) III. Problem ID & Needs Assessment (2)	I. Overview/Searching with EndNote (1.5) II. Shark Tank (0.25) III. Research Design (1.5) IV. Research Consults & Literature Searching (5.5) V. IRB (1) VI. Research Skills (4)	I. Computer Access Issues & Time Management (1) II. Using Myers-Briggs (4)	I. Clinical: 4 hrs. II. Curriculum:6 hrs. III. Research: ~9 hrs. IV. Professional Development: 5 hrs.
September 2019 Interviews Scheduled	I. Creating a Supportive Environment (1.5) II. Observation Skills (1.5)	I. Goals & Objectives (2.5) II. Curriculum Design with History of Curricular Reform (2.5) III. Curriculum Design Workshop (2.5)	I. Questionnaire & Survey Research (1.5) II. Step Back Consultation & Project Refinement (4.5) III. IRB Proposal: My Experience: (1.5) IV. Research Workshop (2.5) V. Sampling & Measurement (2)	I. Using Your Strengths (2.5) II. Wellness Check-in: I need my mummy (1.5)	I. Clinical: 3 hrs. II. Curriculum: 7.5 hrs. III. Research: 12 hrs. IV. Professional Development: 4 hrs.
November 2019	I. Instructional Planning & Developing Learning Goals (1.5) II. Modes of Instruction & Active Learning (2)	I. Educational Strategies (1.5) II. Models of Mind (1.5) III. Project Consults (2)	I. Application of Writing Research (1.5) II. Successful Writing (2) III. Presentation of Project Progress & Refining Data (3.5) IV. Project Consults (2)	I. Focus on Wellness (0.5) II. Issues Confronting New Academic Physicians (1.5) III. Negotiating Skills "Getting to Yes" (2) IV. Micro-Teaching (6) V. Improving Your Presentation (3)	I. Clinical: 3.5 hrs. II. Curriculum: 5 hrs. III. Research: 9 hrs. IV. Professional Development: 13 hrs.
January 2020	I. TCOM AME-GME Struggling Learner Part 1 (1.75) II. Developmental Models (1.5) III. Observation & Feedback & Evaluation (2)	I. Implementation, Initiating & Maintaining Change* (3) –Did not occur due to illness of speaker (Replaced with Research Course on T-Tests)	I. Introduction to Statistics & Descriptive Statistics (2.5) II. T-Test (1.5) III. Probability & T-Tests (3.5) IV. Consults for Research (5.5) V. Woes of Waterfall Falls Cases (1.5) VI. Extra Time on T-Tests (3)	I. Tree of Life (1) II. Focus on Diversity (1.25) III. Finance Strategies 1.5) IV. Educator Portfolio 1.5) V. Portfolio Work (2) VI. Interprofessional Education (1.5)	I. Clinical: ~5 hrs. II. Curriculum: 0 hrs. III. Research: 17.5 hrs. IV. Professional Development: ~9 hrs.
February-March 2020	I. Identifying & Remediating Academic Performance (3) II. Classroom Management (2)	I. Optional Curriculum Consults by Request from Learner	I. Correlation & Regression (4) II. Individual Consults & Update (2) III. Non-Parametric Stats: (1.5) IV. ANOVA (1.5) V. Mixed Methods (2)	I. Medical Ethics (1.5) II. Medicine & Humanities (1.5) III. Conflict Management 1.5)	I. Clinical: 5 hrs. II. Curriculum: 0 hrs. (note consults) III. Research: 11 hrs. IV. Professional Development: 4.5 hrs.
April 2020 *Note COVID-19 Interruption Post-Survey & Interviews Scheduled	I. Evaluation Due Process (1.5) II. Residents in Difficulty (2.5)		I. Evidence-Based Medicine (2) II. Critical Appraisal of Literature and Conducting Journal Club (2) III. Publishing Your Work (2) IV. Research & Writing (3.5) V. Peer Review Process (1.5)	I. US Healthcare System (1.5) II. Leadership & Involvement (1.5) III. Directing Your Career (1) IV. Grant Writing (1.5) V. Strengths Finders Revisited (1.5) VI. Writing for Presentation (Independent)	I. Clinical: 4 hrs. II. Curriculum:0 hrs. III. Research: 11 hrs. IV. Professional Development: 7 hrs.
June 2020-Capstone (1 credit hour)	I. Microteaching (7) II. Clinical Teaching-Personal Goals (2)	I. Maintaining, Enhancing & Disseminating (1.5) II. Posters Displayed Online	I. Making Research Part of Your Life: (2.5) II. Posters Displayed Online from Curriculum Work	I. Disruptive Innovations (1.5)	I. Clinical: 9 hrs. II. Curriculum: 1.5 hrs. III. Research: 2.5 hrs. IV. Professional Development: 1.5 hrs.

Figure 5

Time Spent on Instruction for the Four Content Areas in the 2019-2020 Fellowship



This was based upon course feedback from fellowship program staff, noting that course adjustments needed to be made to support the medical educators' needs regarding their other fellowship course assignments. Thus, all assignments that were intended to run in Figure 7 for spring 2020, did not occur, and instead the fellows were only required to present their curriculum projects that had been drafted in the fall 2019. As a result, I was unable to teach elements of evidence-based approaches to curriculum evaluation, specifically related to taking the curriculum drafts from the fall 2019 course and embedding that work into a research approach of long-term programmatic evaluation. Thus, concepts of applying the developed curriculum to an institutional review board (IRB) proposal for research, followed by mock presentations and drafting of a program evaluation management plan did not occur.

Figure 6

Fall 2019 Medical Education Fellowship Curriculum Flow (occurred)

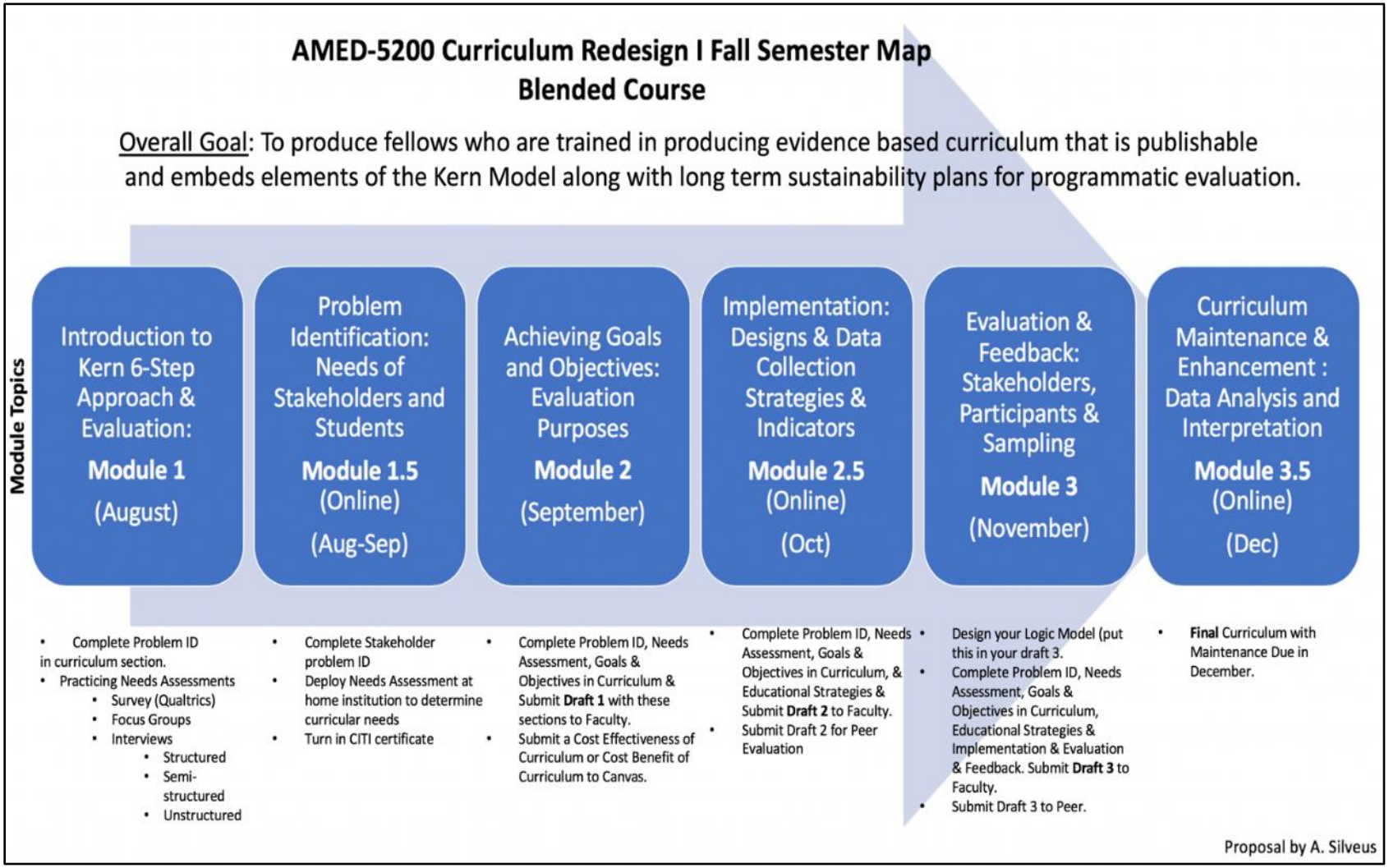
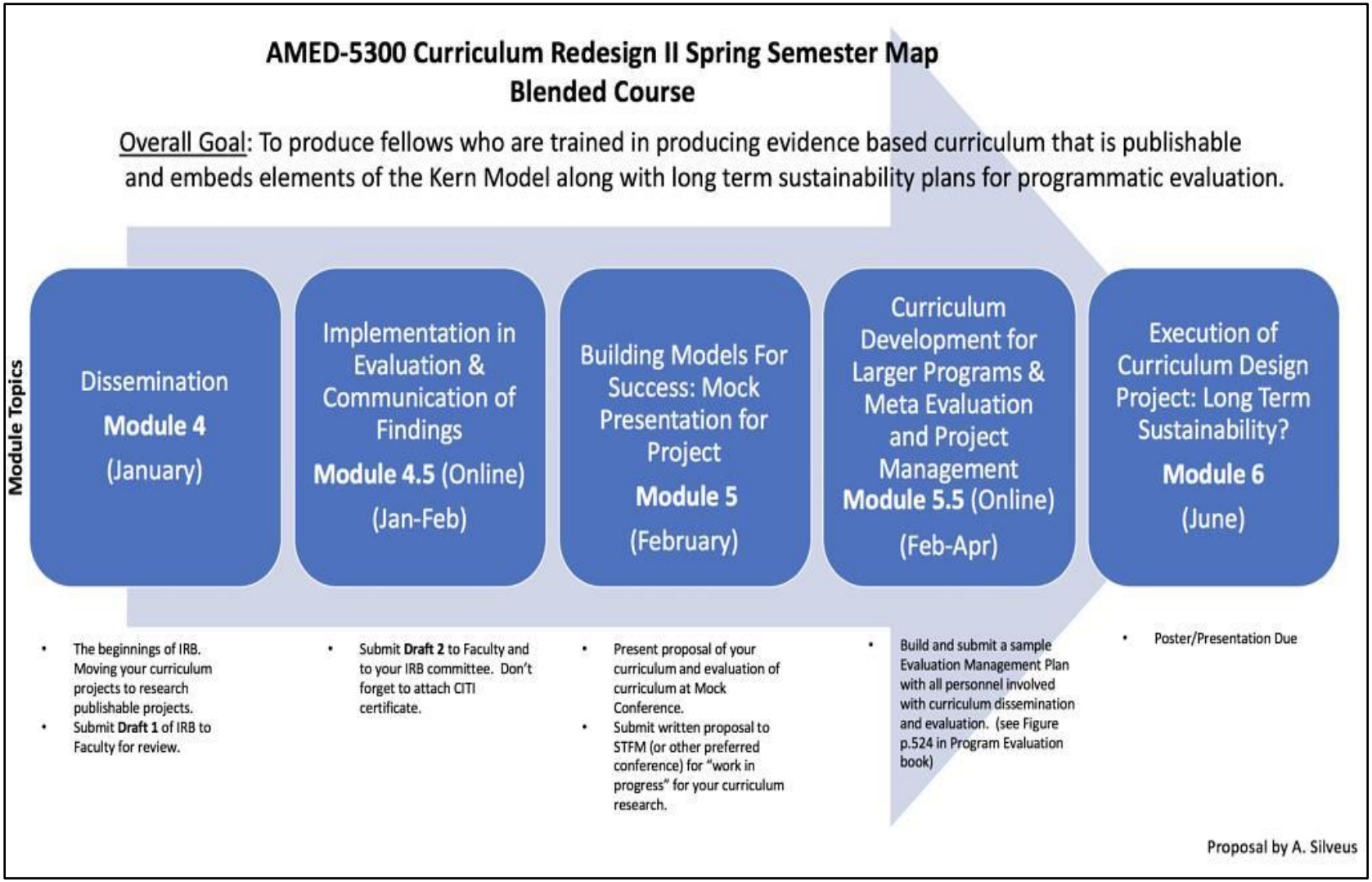


Figure 7

Spring 2020 Medical Education Fellowship Curriculum Flow (intended)



However, the medical educators were still able to turn in a comprehensive curriculum project and poster upon completion of the program. Therefore, I was able to review that designed curriculum as part of this study. Furthermore, this course structure change is pertinent to this study, as it represents a factor to be discussed as part of the results presented within this chapter.

Participants

An evaluation of medical education fellows' (N = 10) surveys, interview transcripts, and documents as part of a 2019-2020 academic medical fellowship that consented to the IRB approved study were studied for this research. While a total of (N = 11) were recruited during 2019-2020, only (N = 10) consented to the study. This number was chosen as it was the maximum number that enrolled in the 1-year fellowship and completed the program.

While the fellowship program runs on a yearly basis, it enrolls roughly 10-12 fellows each year. Fellows who enrolled in the program between 2019-2020 ranged in age, gender, and location of home program. Of the 10 that consented, four fellows were female and six were male. All fellows except one came from a home program within the state of Texas. One fellow came from a home program based out of New Mexico.

Data Collection

Data Instrumentation

Several instruments were used for the 2019-2020 study, and data collected from those instruments were analyzed for this study. For the quantitative component, participants' scores were analyzed from a modified survey (Salbach & Jaglal, 2011; Szucs et al., 2017) based on evidence-based practice, which adopted a confidence scale that used a combination of Likert scales. The questions were a combination of open-ended questions (n=1), "check all that apply" items (n=1), and continuous scale questions (n=18) regarding confidence in using evidence based on completion of an evidence-based approach to curriculum. The total number of questions in

the survey was 20, excluding consent and an identification question used to link the quantitative data to the qualitative data. The survey data were analyzed to assist in addressing Q1 for this study.

Survey Questionnaire

The surveys used for this study (see Appendices B and C) was modified from a prior survey on evidence-based practice and confidence (Salbach & Jaglal, 2011; Szucs et al., 2017), where a combination of 5-point and 10-point Likert scale questions were used to address interest and comfort with dimensions to evidence-based practice. Additionally, modifications to the scales for the 2019-2020 study included changes from a Likert scale to a continuous scale, where the participant selected confidence levels from a score of 0 = *lowest confidence* to 100 = *highest confidence*. Following consent, the survey instrument asked a question about how one would go about designing curriculum at their home institution. This was an open-ended question which was positioned before the scale questions and assisted in gauging understanding of how a medical educator used evidence to design curriculum. The remaining scale questions used a sliding bar from 0 to 100 to assess one's relative confidence across 18 scales as it pertained to evidence use in curriculum development, to identifying curricular gaps, and to applying research to curriculum. The additional three scales at the end pertained to confidence in doing qualitative, quantitative, and mixed methods within curricular design. The last question related to evidence/sources used in designing curriculum.

Semi-Structured Interview Schedule

Analysis of data from semi-structured pre-interviews (fall 2019) and post-interviews (spring 2020) were used (see Appendix D: Semi-Structured Interview Questions). These questions were open-ended questions that were separated into the following four domains: (a) using research to design curriculum, (b) identifying curricular gaps, (c) analyzing curriculum,

and (d) implementing curriculum based on evidence. Use of data from these interviews helped to capture the participants' growth and confidence with specific domains related to curricular design and content covered within the fellowship instruction. This also helped address Q2 of this study.

Document Analysis

Analysis of archived field notes and curriculum design project assignments, which emphasized the use of the six-step approach to curriculum development (Bass & Chen, 2016) assisted in rounding out and supporting findings from the surveys and interviews. Field notes assisted in capturing how instruction impacts confidence in using evidence to inform the curriculum. Field notes also assisted in capturing any observational data around how the fellows interacted within the fellowship program and with their peers. Analysis of this data informed both Q1 and Q2 of this study.

Procedures. The broader investigation that produced the data from which the current study drew was conducted following four phases within an IRB approved study held at the researcher's home institution. Phases 1 and 3 were primarily quantitative in nature, except for one open-ended question and one question on selection of sources of evidence. Phases 2 and 4 were qualitative in nature and consisted of interviews. Collection of field notes and curriculum documents occurred throughout the entire academic year (2019-2020).

A total of fellows (N = 10) consented to the broader study. Participants that consented to the study were assigned random-ID codes in order to de-identity participants as data collection proceeded. Survey data from participants of the 2019-2020 study (N = 10) was reviewed. The primary (pre-) and secondary (post-) survey was administered through a direct hyperlink to an Internet-based survey using Qualtrics software. The questions asked in the survey were sent pre-fellowship experience (August) and post-fellowship experience (May-June) during a year of

instruction. Following consent to the study, the participants were asked if they were interested in participating in the survey through a “consent” and “do not consent” option. Individuals that choose to not consent or not complete the survey still had the ability to participate in all fellowship experiences and instruction. After consenting, the participants were asked to complete the survey questions mentioned in the previous section, which included recording of name for the purpose of document linking within the study, an open-ended question about how one would design curriculum, confidence scale questions, and multiple choice of sources of evidence used in designing curriculum. Following collection of this data, a mid-semester interview was completed to address growth in four domains of curriculum design.

The second and fourth phase of the study occurred after collection of the survey data from Phase 1 and Phase 3. The results of the quantitative phase were linked to the results from the qualitative phase using the random-ID code linkage. Prior to the interview process, participants were asked if they consent to being interviewed. Analysis of the archived qualitative data helped in further exploration of the quantitative findings. The interviews were conducted using a semi-structured interview (see Appendix D) guide either in person, via Skype (2021) video conference, or Zoom (2021). All interviews were audio-recorded using a digital recording device. Only the audio portion of the interviews were recorded and later transcribed using a transcription service.

Data Analysis

In alignment with the study’s mixed-methods design, the analysis occurred in two phases. First, the quantitative data were analyzed with attention paid to changes between the pre-survey and post-survey in order to understand if any changes occurred over the course of a year of instruction in medical curriculum. The open-ended question and the multiple-choice question between the pre-survey and post-survey was also be analyzed for evidence use in designing a

curriculum for one's institution. Following quantitative analysis, the interview data were analyzed alongside analysis of curriculum documents and field notes. Once all the data were analyzed, I integrated the findings and made relevant conclusions.

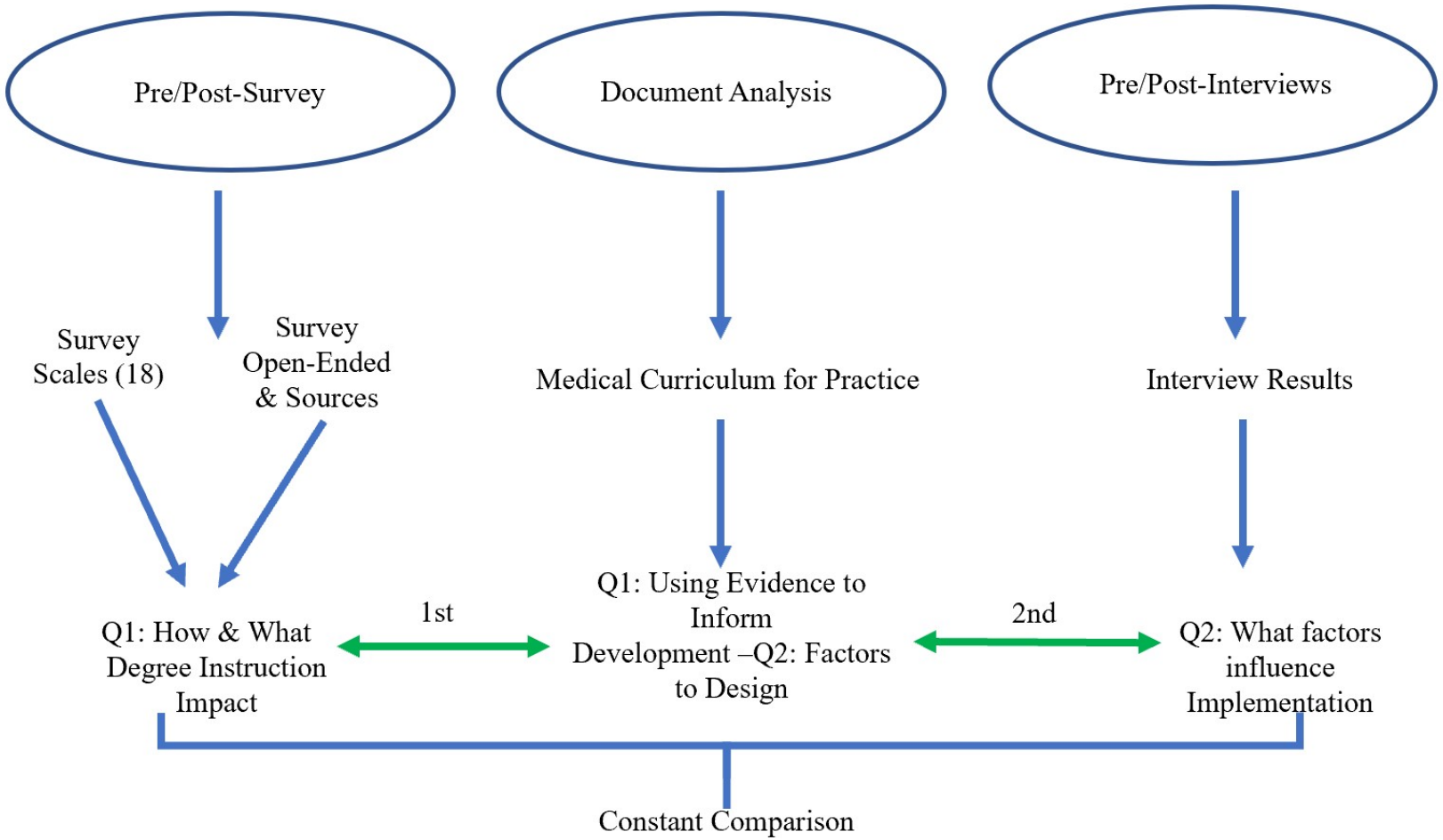
Procedures

The survey data were examined for inconsistencies and data cleaning. Once the data were cleaned, I analyzed the data using Microsoft Excel. Following this process, I began calculating descriptive statistics (means, standard deviations, etc.). Furthermore, a paired *t*-test was applied to the continuous (scale) data between the pre-scores and post-scores. This assisted in addressing if there was a true difference between pre-scores and post-scores. Furthermore, exploration of the curriculum projects/field notes in combination with the interviews provided opportunities to explore how evidence was used to design curriculum and factors associated with implementation of curriculum (see Figure 8).

All interviews were transcribed verbatim using a professional transcription service and were reviewed. A combination of software packages was used for the analysis including but not limited to Excel and Dedoose (2021). I coded the data, organized the data into themes, and connected the data to the relative literature of evidence-based decision making. Specifically, the interviews were analyzed using thematic content analysis (Charmaz, 2014). Thus, I went through iterations of primary open coding, secondary focused coding, and thematic coding (Charmaz, 2014; Saldaña, 2016). By using focused coding, I was able to compare across participants' data to assess the comparability between fellows while searching for the most frequent and significant codes as it relates to evidence-based decision-making in curriculum (Saldaña, 2016).

Figure 8

Mixed-Methods Analysis



To address Q1 (How and to what degree does instruction in medical curriculum development impact confidence in using evidence to inform curriculum?), I used archived quantitative and qualitative data. To check if there is a difference prior to and after instruction, I used a paired *t*-test to address this question using hypothesis testing. While the sample size is small ($N = 10$), de Winter (2013) noted that a paired *t*-test is possible with a small sample size if the "within-pair correlation is high" (p. 1). This test helped in addressing a comparison between the mean differences of the scores across the scales within the surveys before and after intervention (i.e., instruction).

H_0 = There is no change after instruction in medical curriculum development.

H_1 = There is a change after instruction on curriculum development.

The fellows receive instruction which emphasizes quantitative approaches to research, therefore, it was essential to capture how instruction impacts evidence selection and confidence prior to and after the fellowship. To address this, the open-ended question regarding the data sources used to design curriculum as part of the survey, were quantitatively and qualitatively analyzed. These data sources were analyzed using descriptive statistics to evaluate the association between sources used prior to and after a year of instruction. This data source question was further analyzed in how it corresponds to the open-ended question regarding how one would design a curriculum. In this open-ended question evidence sources mentioned was compared to the quantitative data both pre- and post-instruction. Once this was complete, the medical curriculum designed as part of the fellowship ($N = 10$) was analyzed for evidence sources used as it relates to the problem identification, and assessment data collected, which fundamentally drives the overall curriculum. The problem identification and needs assessments are two key portions of the six-step approach in medical curriculum development (Bass & Chen, 2016).

To address Q2—What factors influence the ways in which medical educators design and implement curriculum?—I used archived qualitative data. Here I reviewed field notes from the fellowship experience, curriculum design projects completed by the fellows, and pre- and post-interview data. First, I evaluated how the evidence from the needs assessment was applied to design and intended implementation plan. This was an iterative process of in-vivo coding followed by focused coding among the participants. Furthermore, data was categorized relative to if it pertained to the fellowship program instruction, or if it pertained to the home program organization. This process involved review of how the participant described what evidence would be used, how it was used in the organization and who was directing the evidence use (Farley-Ripple & Cho; 2014; Hamilton et al. 2009); thus, allowing the researcher to come up with a total of seven instructional program factor themes and ten organizational factor themes. Second, I compared this designed curriculum to the interview datum. This involved analysis of how the needs assessment data were used in the design of the curriculum and how it was associated with year-long development between pre- and post-interviews. This was particularly pertinent in their confidence on implementing the designed curriculum and obtaining stakeholder buy-in. Secondary qualitative reviews helped in addressing factors that influence the design and implementation which assisted in addressing any areas of growth in confidence relative to use of research, ability to identify curricular gaps, and analyze curriculum. Use of a constant comparative method as defined as the comparison of "data with data to find similarities and differences" helped in addressing how the designed curriculum spoke to the interview datum (Charmaz, 2014, p. 132).

Data Integration

After the analysis of both the quantitative and qualitative data, I engaged in data integration. The qualitative data was used to support, contradict, or expand on the pre- and post-

confidence scores within the quantitative findings. Integrating the data and comparing the data across each participant allowed for the formation of joint display tables which reflected individual trajectories post instruction. The goal of these tables was to compare the overall possible change in each participant to coded segments within documents and interviews, thus allowing me to visualize the combined influence of the fellowship, home program and factors associated with decision-making.

Role of Theoretical Framework

The framework that informed this study draws from elements of organizational theory, data-driven decision making, and social learning theory (Bandura, 1976), whereby modeling and the organizational environment influence how one learns and practices. Since this fellowship provides education analogous to focused professional development, it is essential to understand how both instruction, peers, and team members within one's organization drive learning. As an example of this, Allen et al. (2020) used continuing professional development with health professionals noting the influence of social learning from their network, formation of a stronger identity in applying learning to practice, and achieving scholarly recognition. Use of the theoretical framework allowed me to understand how confidence, instruction, and a participant's home organization influence evidence selection within the needs assessments and how external stakeholders may or may not influence the overall design. This approach allowed me to (a) understand data-driven decision making regarding the alignment to educational goals, objectives, strategies, elements of implementation, and maintenance, and (3) how the data selected within the needs align between the educator's autonomy, stakeholder needs, learner needs, and community/patient needs.

Reliability/Credibility

Since it is essential to establish reliability/credibility in a mixed-methods study, the research attempted to use a formerly validated tool on evidence-based practice confidence (Salbach & Jaglal, 2011; Szucs et al., 2017). To address the reliability of the modified tool, reliability analysis (Cronbach's alpha) was calculated in the survey results. This helped to establish internal consistency among the 18 continuous scale items, which ranged from 0 = *lowest confidence* to 100 = *highest confidence*. This assisted in establishing consistency among the items and their corresponding measurement of the construct. To address the credibility of the qualitative section, a codebook grounded in evidence-based decision making and social learning theory (Bandura, 1976) was developed using *in vivo* codes (Charmaz, 2014). This codebook helped establish a systematic process of the coding that aligned with the literature on evidence-based decision-making. The interviews were reviewed twice using this codebook in order to ensure alignment to codes.

Validity/Trustworthiness

In addition to establishing reliability/credibility, I attempted to establish validity/trustworthiness. For the quantitative component on the survey data, the research focused on use of content validity, in that the tool used within the study was modified from a prior tool (Salbach & Jaglal, 2011; Szucs et al., 2017) on evidence-based practice confidence. Since the survey in this study addressed evidence-based practice in curriculum, it was tailored towards curriculum and the Likert scales from 1 to 5 were modified to a continuous scale. Trustworthiness was addressed using thick rich descriptions to see the participants actual language within their curriculum projects and their interview data. This provided transparency on the interpretation of the participants data and the interpretations made.

In order to ensure that quality meta-inferences were formed within the mixed-methods study, use of the legitimation model by Onwuegbuzie and Johnson (2006) was used where I attempted to use conversion between the quantitative and qualitative data. Here, I took the overall quantitative data and aligned it to the qualitative data in order to check the quality of the data and the consistency among the two different data types. In this legitimation model, findings from the quantitative data were interpreted relative to the qualitative data while accounting for various threats to validity and credibility. Additionally, as the qualitative data was analyzed, I was able to rely on informal peer debriefings with an expert faculty member who was close to the fellowship, but not part of this research. This process allowed me to review statements made within the study relative to their respective relational categories (Strauss & Corbin, 1990). Ultimately, the statements made were checked against one another by analyzing the sequentially collected data with respect to the actions that occurred both in and outside the fellowship programming. For example, interview datum collected during the fellowship was compared to curriculum documents developed when participants were in their home organizations. This analytical process assisted in capturing associative patterns or variations between statements made inside and outside of the fellowship program. Furthermore, this variation where alignment did not occur between the quantitative data and the qualitative data provided opportunities to identify factors associated with misalignment.

Limitations

Since this research is isolated to an academic medical fellowship held within the state of Texas, possible limitations include the enrollment patterns of the fellowship, noting that the fellowship primarily serves physicians in the state of Texas. Additionally, the fellowship size is limited to provide higher quality instruction. Therefore, findings cannot be generalized to other fellowships held at different locations, though the findings may still provide insights relevant to

other, similarly situated programs. Since the size of the fellowship is limited, most of the quantitative data are in the form of descriptive statistics. It is also important to monitor barriers to evidence-based decision-making within the larger home program/hospital setting; this is best done on site, but physical travel to locations to monitor progression was not possible, and this presents a limitation. Despite limitations, this study can provide is insight into medical educators' internal confidence and growth or lack thereof as a byproduct of instruction which heavily emphasizes clinical teaching, curriculum, research, and professional development.

In the Spring of 2020 coronavirus (COVID-19) spread across the globe. By the end of March 2020, fellowship participants pivoted to online instruction/interaction, which may have impacted the data and quality of instruction.

Because the research content from the instruction heavily emphasized quantitative approaches to research, with a total of two hours of mixed-methods instruction, it is possible that this might impact sources of evidence used in the ultimate design of the fellows' curriculum design projects. This is not a limitation, but rather an acknowledgment that this may impact the researcher's analysis since teacher instruction, as it relates to one's worldview, has been shown to impact decision making (Charlier et al., 2019). For example, if a medical educator collected only quantitative sources of data to drive curriculum design and indicated strong positivist sources of evidence in making decisions, this could be due instruction received within the fellowship, prior instruction/experiences giving rise to a particular epistemological stance, or a combination of these factors.

CHAPTER FOUR: RESULTS

This chapter begins by outlining a description of the sequence of curricular course content, specifically related to the medical curriculum course within the 2019-2020 fellowship program. The purpose of this study was to evaluate a 1-year medical fellowship program which ran from 2019-2020, along with the influence of home organizational factors on the practice of evidence-based decision-making in curricular design and implementation. This study not only aimed to address factors that support or inhibit such evidence-based practices, but to also evaluated each medical educators' trajectory carefully over the course of a year. The following questions were used as guiding questions to frame this study:

Q1: How and to what degree does instruction in medical curriculum development impact confidence in using evidence to inform curriculum?

Q2: What factors influence the ways in which medical educators design and implement curriculum?

In what proceeds, I explain the results from an archival review of pre-post-survey data, pre-post-interview data, and documents pertaining to designed curriculum as a byproduct of the fellowship program and field notes.

Research Question 1: Instruction in Curriculum Impact Confidence with Evidence

To address Q1, "How and to what degree does instruction in medical curriculum development impact confidence in using evidence to inform curriculum?" I reviewed archived data. Descriptive statistics were calculated for the participants samples along with a difference between scores. To check if there was a difference prior to and after instruction, I used a paired *t*-test to address this question using hypothesis testing. Results of the descriptive statistics and *t*-test are reflected in tables (see Tables 3 and 4: Descriptive statistics between pre-post-test and *t*-test scores).

Table 3

Descriptive Statistics Between Pre- and Post-Test

Random-ID	Mean Pre-Test Score across 18 scales	Mean Post-Test Score across 18 scales
2019.1	37.11	74.89
2019.2	44.89	93.61
2019.3	41.72	84.72
2019.4	47.50	86.39
2019.5	18.56	77.28
2019.6	32.72	82.28
2019.7	70.00*	70.56
2019.8	51.72	83.44
2019.9	18.33	88.61
2019.10	19.76	63.28

In general, the pre-test means scores for (N = 10) averaged around 38.23 as compared to the post-test mean score of 80.51. While gains were made across all participants in the fellowship, Participant 2019.7 only saw a 0.56 mean change between pre- and post-test. The largest gain was made in Participant 2019.9 who saw an average increase by 70.28 following a year of instruction (see Figure 9). Median change between the pre- and post- scores were compared relative to the mean pre- and post- scores (see Figure 10). Variation (7.11-13.33-point difference) occurred in the pre-test mean scores relative to the pre-test median scores for Participants 2019.1, 2019.2, 2019.7, 2019.9, and 2019.10.

Table 4

T-Test Results Between Pre- and Post-Test

Results	Pre-Test Scores	Post-Test Scores
Mean	38.23	80.51
Cronbach alpha (18 items)	0.93	0.93
Variance for Sample	276.61	82.13
Standard Deviation	16.63	9.06
Observations	10	
α	0.05	
Degrees of Freedom	9	
t-statistic	7.28	
P(T <= t) 1-tail (noting post-test should be higher)	0.000023	
t Critical 1-tail	1.833113	
P(T <= t) 2-tail	0.000047	
t Critical 2-tail	2.262157	

The aggregate median score across all participants was 31.25 in the pre-test and 85.5 in the post-test, reflecting that the aggregate mean score in the pre-test of 38.25 was influenced by the outlier 2019.7. One possible explanation for this variation exhibited by Participant 2019.7 may be explained by this participant's higher confidence reflecting little room for growth in evidence-based decision-making regarding curricular design. This participant was also unique to the program in that they entered the fellowship selecting medicine as a second career, noting they had worked for several years prior to medicine in another field.

Figure 9

Individual Pre- and Post-Score Changes

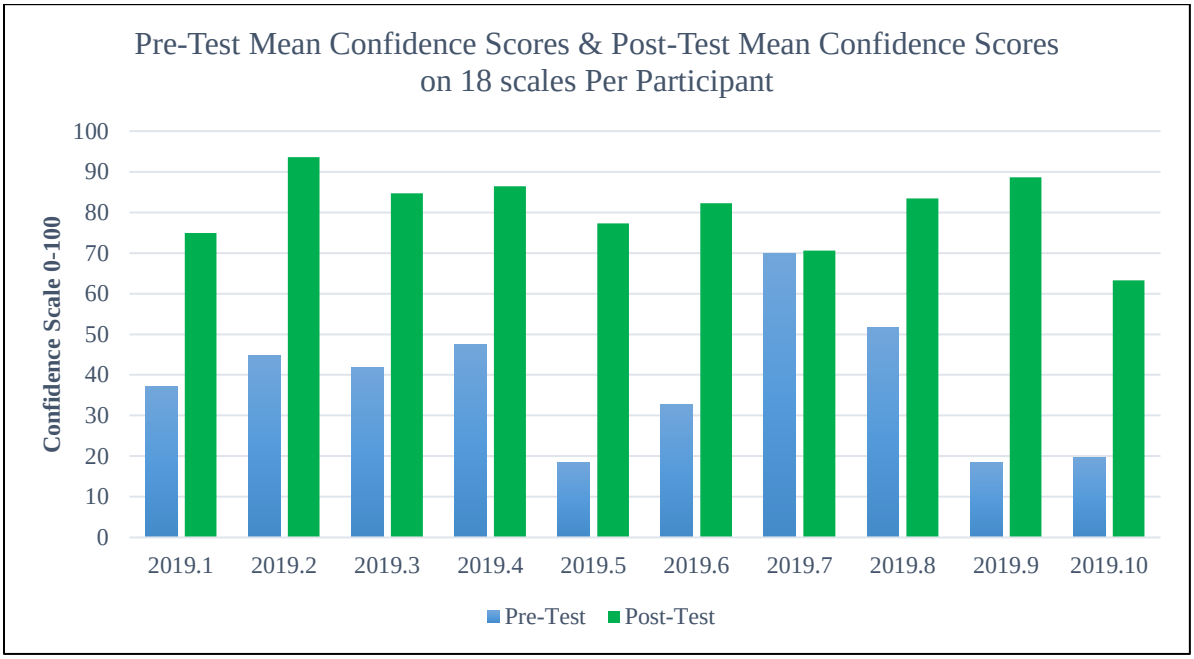
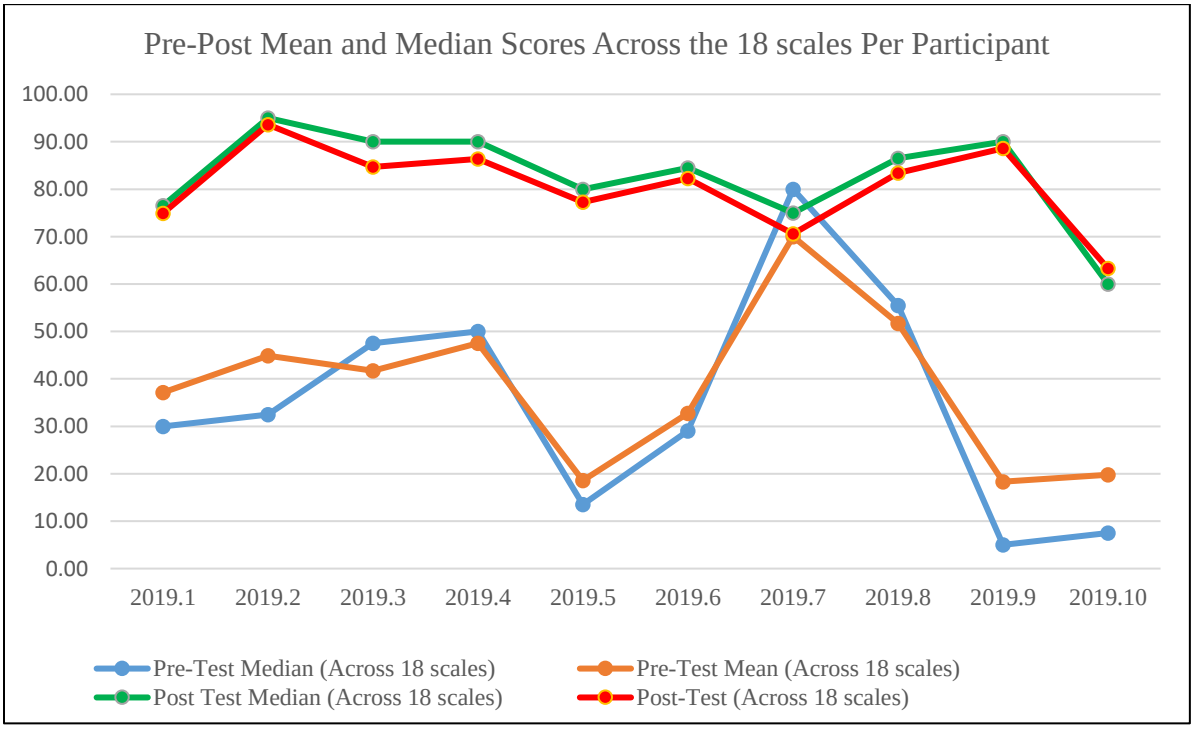


Figure 10

Individual Pre- and Post-Score Mean Change Relative to Median Change



To address the impact of the medical curriculum development on the aggregate of the participants, a *t*-test was used. In this *t*-test, I assumed the following:

H_0 = There is no change after instruction in medical curriculum development.

H_1 = There is a change after instruction on curriculum development.

Results from the *t*-test reflect a significant difference with an alpha (0.05), reflecting that it is possible to reject the null hypothesis in favor of the alternative hypothesis (H_1). The *t*-test score of 7.28 (see Table 4) reflects that there is a difference due to something other than chance with a $P<0.05$. This is further supported by the calculated obtained value ($t_{obt} = 7.28 \geq t_{cri} = 1.83$) being more than the critical value and the exact *p* value, 0.000023, being less than 0.05. This finding was supported by the high Cronbach's alpha score of 0.93, higher than the standard 0.80 standard threshold, across all the items in the survey. Thus, the modified survey (Salbach & Jaglal, 2011; Szucs et al., 2017) for this study did indeed reflect reliability across the scale items for this study.

While the *t*-test reflects change post instruction, disaggregation of the data across each scale items revealed all participants ($N = 10$) on average struggled with Scale 7 between pre- (13.6) and post-instruction (70.1)—interpreting data results from curriculum evaluation using statistical procedures such as linear and logistic regression—(see Figure 11-12: Mean pre-post change across the 18 scales). However, on average, participants ($N = 10$) maintained relatively high levels pre- (78.8) and post-instruction (81.5) on maintaining interest in research (Item 11). This finding at Scale 7 may be explained by the fact that the research portion of the fellowship does not cover linear and logistic regression; therefore, it would be expected that participants would not feel as confident in their skill sets of such application. Research elements related to statistical tests and forming a research question are heavily emphasized throughout the fellowship, which also explains why item 11 exhibited little change pre- and post- instruction.

Figure 11

Mean Pre-Post Change for N = 10 Across Scales 1-9

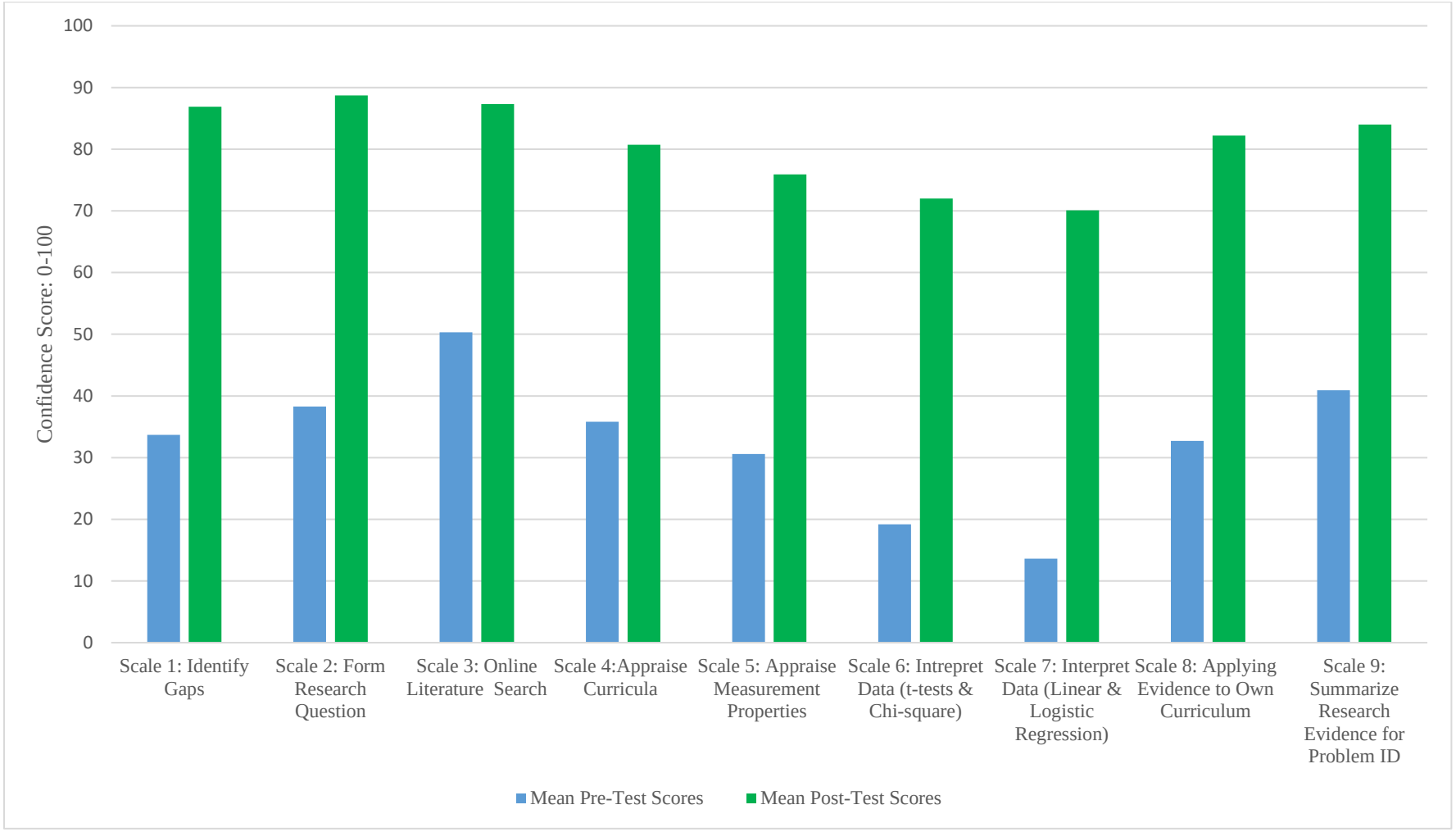
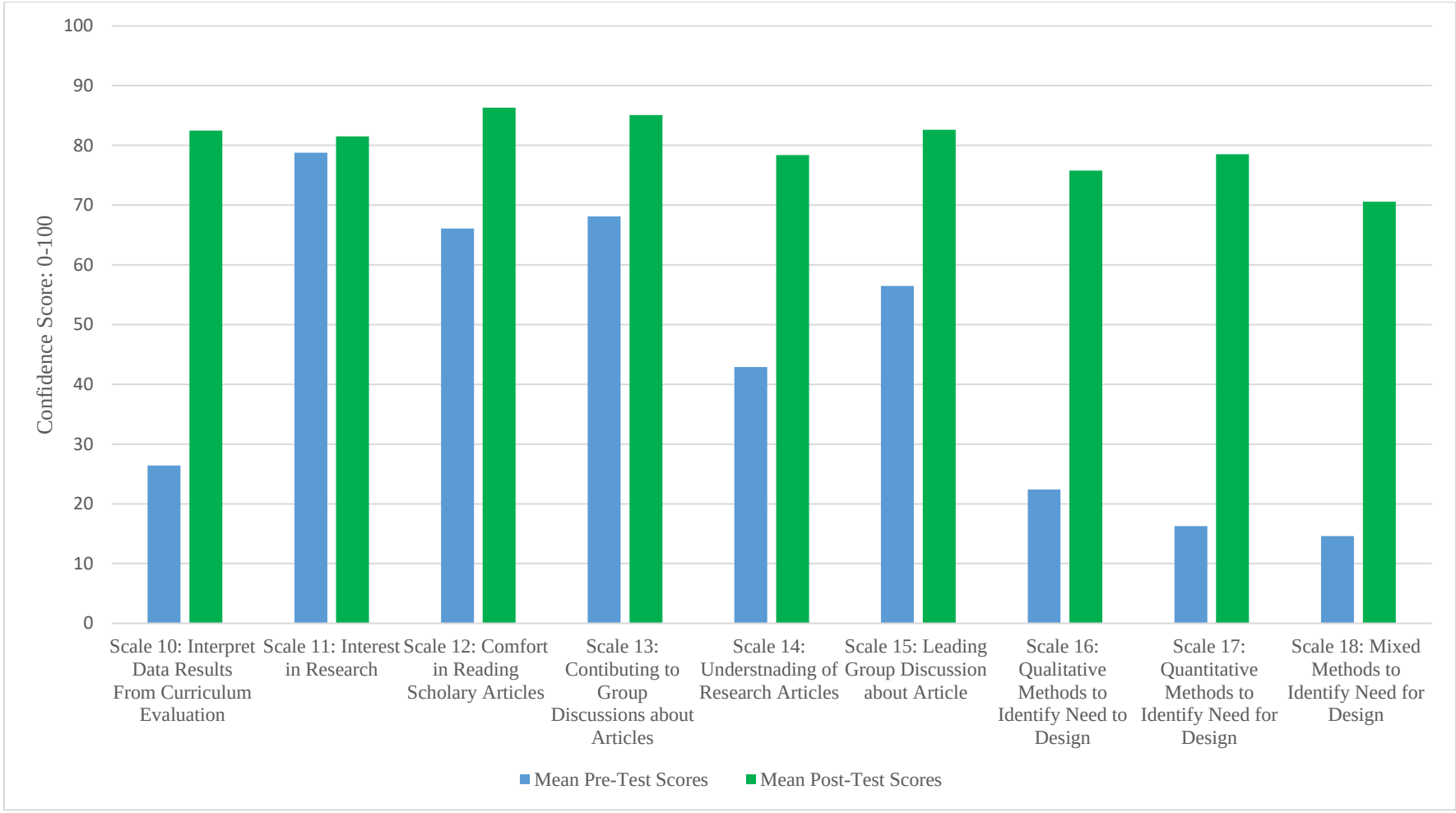


Figure 12

Mean Pre-Post Change for N = 10 Across Scales 10-18



Research Question 1: Sources of Evidence Reflective of Instruction

In comparing the sources of evidence between the pre- and post-surveys regarding the sources used to design curriculum, most participants (n = 9) selected observations to design curriculum in the pre-survey (see Figure 13: Sources of evidence pre-post instruction). However, after 1 year of instruction all participants (N = 10) selected four categories of evidence that they would use to design curriculum: (a) observations, (b) student-teacher feedback, (c) literature search, and (d) interviews. Even though instruction heavily focused on methods using quantitative methodology (see Table 2: Overview of medical education fellowship), a small portion of the research course in February-March 2020 did cover qualitative and mixed methods research. This finding suggests instruction expanded learner knowledge and raised awareness into collecting targeted needs-based data to design a curriculum. However, because the survey was written with an emphasis placed on how one would design a curriculum in theory, it was valuable to compare this to an open-ended question within the same survey to see if similar findings were observed. Within the open-ended pre-survey question, Participants 2019.1, 2019.2, 2019.7, 2019.9, and 2019.10 noted evidence use that was built around adoption of existing curriculum. As an example of this finding, one participant notes in the survey "I would reach out to colleagues that were familiar with curriculum development (as I am currently NOT) and *take a previously created curriculum* and modify it to fit my needs and institution." This finding suggested learner autonomy was absent at this stage in the program along with understanding of using targeting needs assessment data to design curriculum. At the conclusion of the program, all participants' open-ended responses except for Participants 2019.7 and 2019.6 reflect increased understanding of collection of evidence that targets the home-program. For example, one participant notes a growth in contextualized needs assessment evidence noting in their post-survey the following:

> First, I would identify an *area in need of improvement* at my institution. Then, conduct a needs assessment to ascertain the specifics of what is needed pertaining to this area. I would create a logic model and budget to present to the major stakeholders; then gaining approval and confirmation of tangible and informational support. I would create a curriculum that is easily evaluated in measurable ways. Then I will institute the curriculum as a dynamic entity that I may *change as new needs are identified*.

Furthermore, at the conclusion of the program, Participant 2019.6 notes "Using the Six Step approach and looking up other curriculums available on STFM." While instruction emphasized the six-step approach to curriculum development (Kern, 2016), the response aligns with review of this participants' orientation towards evidence that formed (Burned-out Negotiator) at the conclusion of the program due to organizational factors which were evaluated as part of Q2. Furthermore, Participant 2019.6 exhibited a uniqueness as their survey response, while lacking in understanding of collecting targeted needs data, differed from what was done in practice within the curriculum designed. Upon investigation of why this difference occurred between the survey datum response to application of targeted needs data, the researcher noted Participant 2019.6 was influenced by reviewing peers' work as part of the fellowship experience reflective of social learning (Bandura, 1976). In the post-interview, Participant 2019.6 noted

> . . . when I'm analyzing something especially *because when you gave me [peers] project* and then I could use this book along with *someone else's project*, it really helped me to see what they were doing and what I was supposed to do.

Since the 1-year fellowship program emphasized collection of targeted needs assessment data as a form of evidence that drives curriculum formation, it was essential to understand if the medical educators emphasized this need in theory. While all the

participants increased in their awareness of using diverse forms of evidence (see Figure 13: sources of evidence pre- and post-instruction), Participant 2019.7 maintained a consistent view of adopting existing curriculum.

In conclusion, the findings related to Q1 reflects that instruction in medical curriculum development influenced the aggregate performance of all the participants in the study. This was exemplified by the *t*-test, which reflects change post instruction. However, disaggregation of the data between the participants reflects that some participants came in with higher confidence prior to the fellowship, such as the case with Participant 2019.7. While the instruction reflects changes within the participant's self-declared confidence, it does not address how evidence was used or not used due to various factors either internal or external to the medical fellowship programming. Furthermore, open-ended responses regarding declared approaches to designing curriculum shifted in most participants with understanding of the value of collecting targeted data. However, Participants 2019.6 and 2019.7 reflected views that lacked understanding of the need to collect contextualized evidence to design curriculum. This finding was reflected in their open-ended survey data, indicating a lack of understanding in these two participants which seemed contradictory to the overall change in the individual mean scores both pre- and post-instruction. For example, Participant 2019.7 saw little to no change (0.56) and Participant 2019.6 exhibited a mean change of (49.6) (see Table 5: Synthesis of quantitative measures pre-post instruction relative to qualitative evidence codes in practice). Thus, variation existed among the individuals pre-post scores, yet as an aggregate reflected a positive impact because of instruction. Therefore, data were further analyzed with regard to the curriculum put in practice.

Figure 13

Sources of Evidence Pre- and Post-Instruction

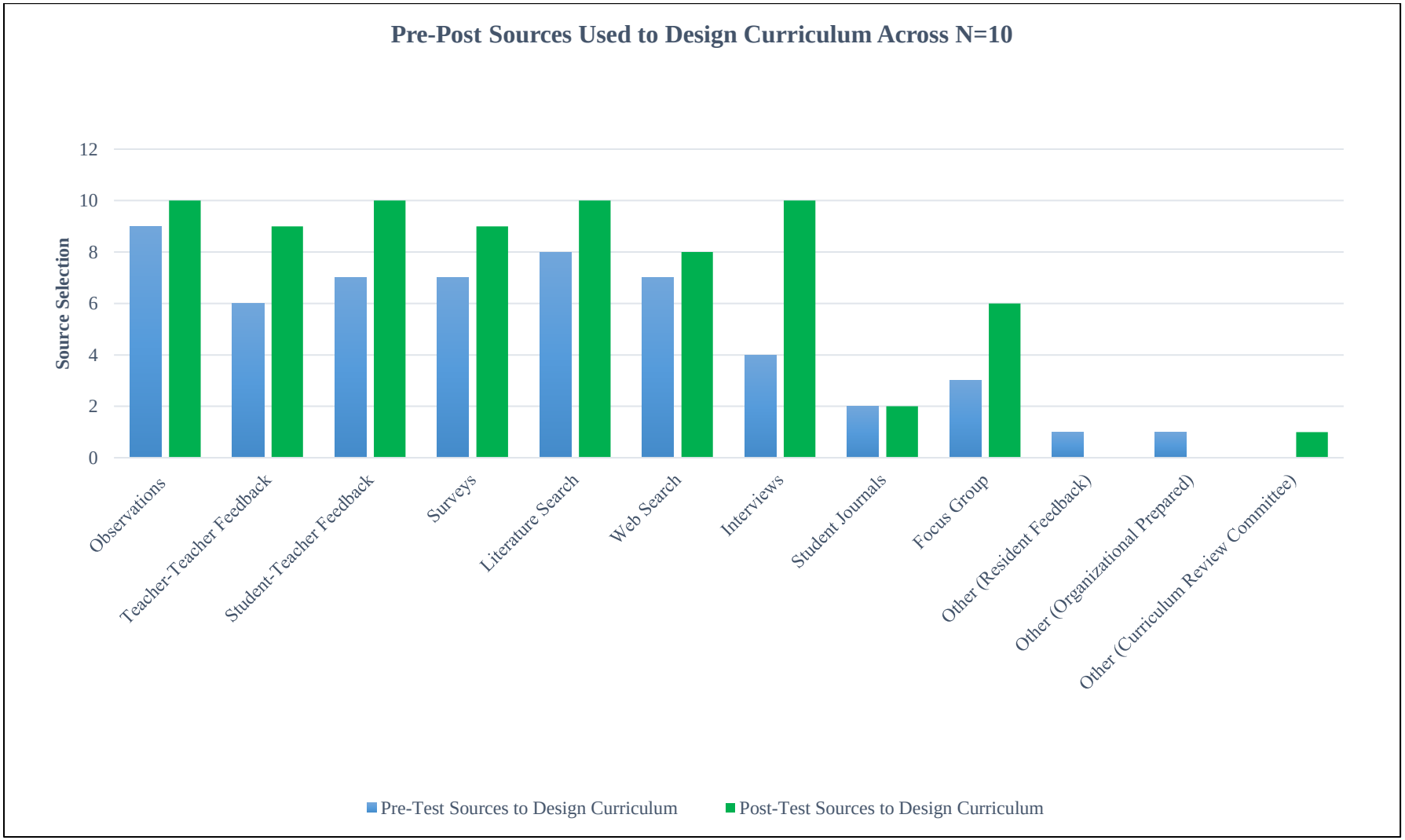


Table 5

Synthesis of Quantitative Measures Pre-Post Instruction Relative to Qualitative Evidence Codes in Practice

Random ID No.	Methodology & Evidence Used in Curricular Design After Instruction (Practice)	Mean Change in Confidence After 1-Year of Instruction
2019.1	Quantitative-Surveys (Closed + Qual-Open) (Target: Faculty Attending Physicians) (*N* = 9) + (Residents) (*N* = 21) Literature +ACGME+ Logic Model (Needs Assessments align to need)-Data Attached	37.78
2019.2	Quantitative-Survey (Target: Team Participants, Stakeholders) (*N* = Unk.)+ Qualitative (Informal Interviews + Observations with Charge Nurses, Hospitalists) (*N* = Unk.) + Literature + Cost+ Logic Model (Unclear where Needs Assessments statements of need came from)-No Data Attached	48.72
2019.3	Quantitative-9 Item Closed-Ended Survey (Target: Residents) (*N* = 12) + Logic Model+ Literature+ Core Competencies for ACGME (Needs Assessments align to need)-Data Attached	43
2019.4	Quantitative Survey (Target: Faculty) (*N* = 8) + (Residents) (*N* = 24) + Qualitative (Semi-structured Interviews) (*N* = 2 Faculty) (*N* = 2 Residents) (*N* = 3 Graduates from Program) + AAFP+ Literature +Cost Benefit (Needs Assessments align to need with qualitative themes formed)-Data Attached	38.89
2019.5	Quantitative-7 Item Survey (Targeted 3rd Year Family Medicine Residents) +1 Question is Open Ended (Qualitative). (*N* = 8)+ Logic Model+ Literature (Needs Assessments statements align to need)-Data Attached	58.72
2019.6	Quantitative-4 Item Survey (Target Residents) (*N* = 16) +1 Question is Open Ended (Qualitative)+ Qualitative (Informal Conversations of Residents & Review of Prior Curriculum) (*N* = Unk.) +Literature + Logic Model +ACGME Core Competencies +AAFP+ (Survey Data Attached with Summary Sentences of Mixed Feedback from Residents)-Data Attached	49.56
2019.7	Qualitative (Informal Conversation with Fellows (1st & 3rd Year), Fellow Teaching Attending, DIO) (*N* = Unk.) + Literature+ Logic Model + ACGME Core Competencies + COCATS Recommendations +ACC+ Sister Curriculum at Another Location (Needs Assessment Geared Towards ACGME Requirements + Unclear on Data from Informal Conversations)-No Data Attached	0.56
2019.8	Quantitative Survey-3 Item Survey (Target Residents) (*N* = 4) +Literature (75% would not participate in program for which curriculum is designed)-Data Attached*	31.72*
2019.9	Qualitative (Informal Interviews Observations) (1st, 2nd, 3rd Year Medical Students & Faculty) (*N* = Unk.) Literature+ Logic Model+ ACGME Core Competencies+ AGS + AACOM + AAMC (Unclear where Needs Assessments statements of need came from)-No Data Attached	70.28
2019.10	Quantitative Survey (*N* = Unk.) + Qualitative Interview of Stakeholders (*N* = Unk.) +ACGME+AAFP Milestone Criteria (Unclear where Needs Assessments statements of need came from)-No Data Attached	43.52

Note. Unk. = Unknown; * symbol indicated they collected data, but the participant's data went against a true need for their curriculum that they developed.

Research Question 2: Factors in Design and Implementation

To address Q2—What factors influence the ways in which medical educators design and implement curriculum?—the researcher used archived qualitative data. Here I reviewed field notes from the fellowship experience, designed curriculum from the fellows, and archived pre- and post-interviews. First, I evaluated how the evidence from the needs assessment was applied to design and intended implementation plan. Second, I compared this designed curriculum to the interview datum. This approach involved analysis of how the needs assessment data were used in the design of the curriculum and how it is associated with year-long development between pre- and post-interviews. Furthermore, it assisted in understanding the influence of home clinical site and the organization relative to the medical educators' development.

Upon review of the needs assessment data as a form of evidence to design the medical curriculum for the home program, I discovered that only Participants 2019.1, 2019.3, 2019.4, 2019.5, 2019.6, and 2019.8* collected, attached, and used the targeted needs assessment data from their home organization to design their curriculum (see Table 5: Synthesis of quantitative measures pre-post instruction relative to qualitative evidence codes in practice). Furthermore, because data from Q1 reflected growth in confidence of evidence-based decision-making, noting the highest increases in theoretical use by the end of the year in use of (a) observations, (b) student-teacher feedback, (c) literature search, and (d) interviews, it was essential to understand the finding regarding this gap between theory and practice. Specially, it was necessary to see if alignment occurred between the stated forms of evidence used in theory within the survey relative to the actual evidence utilized in the designed curriculums (see Table 6: Comparison of sources of evidence between post-survey and evidence sources adopted in curriculum projects).

Table 6

Comparison of Sources of Evidence Between Post-Survey and Evidence Sources Adopted in Curriculum Projects

Evidence	Mentioned in Theory at Culmination of Instruction (1 yr. later)	Practiced in Design (1 yr. of instruction)
Observations	10	2
Teacher-Teacher feedback	9	*See survey breakdown
Student-Teacher Feedback	10	*See survey breakdown
Web Search	8	6
Survey	9	6
a. (survey focus on resident/students)-attached	N/A	6
b. (survey focus on faculty/attending/teachers)-attached	N/A	2
Interviews	10	1
Student Journals	2	0
Focus Group	6	0
Review and Reference to Peer Reviewed Literature	10	9
Accreditation Council for Graduate Medical Education (ACGME) or Other Specialty Guidelines	N/A	6
American Academy of Family Physicians or other Formal Association	N/A	5
Logic Model	N/A	7
Cost	N/A	3
Informal Discussion	N/A	4

Note. Anything listed as N/A means that it was an item that was not directly listed in the pre-post survey.

The largest discrepancy between evidence sources stated in the post-survey as compared to the designed curriculum were noticed in all areas, particularly regarding declines in use of observations and interviews. Only Participant 2019.4 utilized interview data and thematically coded the data into themes later attaching these themes as a form of data synthesis. Participants 2019.1, 2019.3, 2019.4, 2019.5, 2019.6, and 2019.8* used survey data, and three of those participants used open-ended questions in their surveys that were not coded, but rather listed as raw data. Upon review of the survey data used by the six participants, all six targeted their residents/students and only two targeted their home program faculty (Participants 2019.1 and 2019.4). Observational data were utilized by Participants 2019.2 and 2019.9, both of which did not attach any data from their home program justifying a direct need for the curriculums. Upon review of the curriculum projects, all projects except for Participant 2019.10 included references to peer reviewed literature. The use of literature was a consistent finding both after instruction and something that was incorporated into practice within the design. Upon further evaluation of the curriculum documents, it was noted that Participant 2019.8* collected data for the development of a curriculum for their home program; however, the data suggested a lack of true "need" for development of said curriculum, as 75% (n = 4) indicated they would not participate in such a program. This finding suggested there were other possible factors associated with this decision exhibited by Participant 2019.8*, which reflected a need for comparison to interview data.

Four participants did not collect contextualized data reflective of their home program needs. Evidence in the form of literature and logic modeling was common across these four participants (Participants 2019.2, 2019.7, 2019.9, and 2019.10), although Participant 2019.10 only referenced the ACGME informally and failed to add any formal citations. One similarity consistent among the four participant's curriculum projects was about either having done a

survey, having had informal discussions, or having done interviews; yet, each participant failed to attach such proof of data, refer to how many they talked or interviewed, or summarize qualitative themes regarding their observations. Thus, the researcher had no direct data to review other than summaries of the participants' encounters from the data mentioned above.

Factors that Challenge Theory

Evaluation of the needs assessment data relative to the implementation plan and interview data provided insight into various instructional factors and organizational factors that either supported or inhibited the overall design for implementation. Additionally, through my iterative coding process I was able to evaluate and develop major themes regarding data-driven decision-making—classified as higher authority, autonomy in decision making, or networked decision-making. These codes aligned with prior literature on data-driven decision-making, noting a need to evaluate levels of autonomy (Baldwin et al., 2012), having a shared vision in the organization towards the evidence (Schildkamp & Poortman, 2015), and evaluating if collective practice was adopted (Jimerson & Wayman, 2015) (see Table 7: Data-driven decision-making factors relative to curricular evidence). In what follows, I provide an overview of the results of the decision-making factors, instructional factors, and organizational factors.

Decision-Making Factors

Upon review of the 10 participants, it was noted participants exhibited either a network (n = 3) or higher-authority (n = 7) data-driven approach to use of evidence in their view of designing curriculum at the start of the fellowship. By the end of the program, the 10 participants exhibited either a network (n = 5), autonomous (n = 1) or higher-authority (n = 4) data-driven approach to use of evidence in their view of designing curriculum.

Higher-Authoritative Approach. Higher-authoritative approaches were exemplified by seven of the participants at the beginning of the program (Participants 2019.1, 2019.2, 2019.5,

2019.7, 2019.8, 2019.9, and 2019.10). For example, Participant 2019.1 notes, “Compare I guess other curriculums that I had researched and speak to one of my higher authority [sic] [the] associate program director and the program director of my institution.” Participant 2019.2 exemplified this higher authority decision-making noting, “My curriculum’s going to be based on working with administration department and the quality department.” Four participants who started the program a higher-authority driven approach, maintained this view until the end of the fellowship (Participants 2019.2, 2019.7, 2019.9, and 2019.10). For example, Participant 2019.7 noted,

> One is what existing curriculum data is out there, in terms of what has somebody done before? Why start from scratch when you can start from something that maybe already exists . . . literature search . . . we want to see what’s been published . . . topic discussion with the experts.

This view of adopting existing curriculum was later supported in interview data where Participant 2019.7 stated, “Why start from scratch when you can start from something that maybe already exists?” The dependency on what higher authoritative figures believed was a common pattern exemplified within the theme of higher-authoritative approaches. Individuals who adopted this approach consistently relied on the opinions of their administration regarding decisions of what would or would not be included in the curriculum for their respective home program. Periodically, individuals that adopted this approach mentioned the need to talk to administration or experts before deciding to do anything. Some of the participants that adopted this approach also failed to incorporate data, which was later associated with organizational factors that prevented them from finding the *right* authority figure to provide the answer. This approach also paralyzed some participants curriculums from fully developing after 1-year of training; usually

producing frustrated academic medical educators who were already overwhelmed with various other organizational factors that existed. Thus, an orientation towards evidence developed within these participants, which was reflective of their challenges and their views towards collecting data within their organization (see Table 7: Data-driven decision-making factors relative to curricular evidence). Additional participants, such as the prudent plagiarist worked within a system where authority stated the program would happen. This authoritative view produced an orientation that lacked the desire to find data to justify the curricular need.

Network Approach. Three participants began the fellowship with a network approach (Participants 2019.3, 2019.4, and 2019.6). As an example of this network approach, Participant 2019.4 began the fellowship noting:

> . . . having really informal discussions about what we're doing now, what we could be doing better, whether it's formalizing some of our informal curricular pieces, or completely adding new things . . . then the biggest thing I've relied on . . . you've seen, their surveys . . . taking the pulse of faculty residents to help formalize and direct the initial idea.

Additionally, Participant 2019.6 mentioned

> . . . definitely anonymous surveys. I think also just from direct feedback but also making sure that those are, you know, documented and put down . . . I haven't had a formal interview with residents, but the ones that have given me feedback, have been giving me very good feedback that other faculty have voiced too.

Table 7

Data-Driven Decision-Making Factors Relative to Curricular Evidence

Orientation Towards Evidence	Orientation Description	Decision-Making (Pre-Post)	Used Contextualized Data to Drive Curriculum Development	Successful Use in Data to Drive Curriculum Forward
Burned-Out Negotiator 2019.6	Learned from peers and program about using actual evidence to design curriculum but struggled with resource scarcity and bias leaving them overwhelmed.	Network-Network	Started program with a need to collect data from different sources. This included contextualized survey needs assessments and mixed feedback discussions with learners. Finished program finding it necessary to have all key community personnel involved in curriculum for curricular change.	√
Tired Visionary 2019.3	Learned and intellectually grew as a data-driven curriculum developer, but questions things that do not make sense and has progressively gotten tired of the lack of change/hurdles encountered in hospital (money, insurance, readmission rates).	Network-Network	Started program with a need to collect data from different sources. This included contextualized survey needs assessments and discussions with stakeholders. Finished program finding it necessary to have all key personnel involved in curriculum included in curricular changes.	√
Profitable Realist 2019.5	Acquired knowledge but also observed how the system works when emphasis is placed on maximizing return based on financial incentives.	Higher Authority-Network	Started program looking to the administrative leaders for decision-making. Learned that curriculum was tied to financial incentives, and collected contextualized survey needs assessments to drive a profitable curriculum forward.	√
Soldiering Salesman 2019.4	Eager for knowledge and application of data-driven approaches and has applied data-driven skill sets to prepare for battle on the sales floor for implementing medical curricular change, as this method pays off.	Network-Network	Started program with a need to collect data from different sources. This included contextualized survey needs assessments and interviews with different groups. Finished program finding it necessary to have all key personnel involved in curriculum included in curricular changes.	√
Hopeful Cynic 2019.1	Learned and became aware of the structure of curriculum, but realizes barriers are in place (time, pandemic) and will not stay at home program and feels like personal efforts will be overlooked after leaving.	Higher Authority-Autonomy	Started program looking to experts in decision-making. Collected contextualized survey needs assessment data to drive curriculum forward. Finished program seeing implementation done through a singular lens, as opposed to a team.	√

Table 7 Continues.

Orientation Towards Evidence	Orientation Description	Decision-Making (Pre-Post)	Used Contextualized Data to Drive Curriculum Development	Successful Use in Data to Drive Curriculum Forward
Amiable Realist 2019.2	Learned and became aware of the structure of curriculum and how education is undervalued; yet allows the stakeholders who have the real monetary real power to dictate what curriculum will look like for program.	Higher Authority-Higher Authority	Started program looking to the administrative leaders for decision-making. Curriculum was going to happen, thus no needs data needed to be collected or reflected in curriculum to drive it forward since administration made directives. Unclear on contextualized source of data presumed to have been collected, as it was absent in design but that is okay because administration desire curriculum.	✖
Prudent Plagiarist 2019.7	Realized the science of curriculum development and effort needed to produce a curriculum but attempts to mitigate all risk whenever possible by finding existing curricula and experts to justify need.	Higher Authority-Higher Authority	Started program looking to the administrative leaders for decision-making. Curriculum was going to happen, thus no needs data needed to be collected or reflected in curriculum to drive it forward since administration made directives. Unclear on contextualized source of data presumed to have been collected, as it was absent in design but was noted as informal conversation with administration.	✖
Confused Conformist 2019.9	Acquired data-driven skill sets but was confused by poor communication about what program was doing and saw large turnover; resulted in fear of speaking up.	Higher Authority-Higher Authority	Started program looking to the administrative leaders for decision-making. Curriculum was going to happen, and because administrative decision-makers controlled how it would occur, participant ran into barriers with collection of needs data. Contextualized source of data was missing, and it was unclear on what the process looked like when participant had informal discussions.	✖
Disgruntled Dragon Warrior 2019.10	Frustrated at systemic organizational problems that prevented successful acquisition of knowledge and practice of such knowledge; eventually became dependent on online materials.	Higher Authority-Higher Authority	Started program looking to the administrative leaders for decision-making. Curriculum was going to happen and due to poor communication and constant flux of stakeholder roles, participant did not attach any contextualized source of data presumed to have been collected, as it was absent in design.	✖
Appeasing Rejectionist 2019.8	Learned the overall value of data-driven approaches but allowed authoritative structure of home program to impair data-driven practice.	Higher Authority-Network*	Started program looking to the administrative leaders for decision-making, as program was going to happen. Learned that curriculum needed a form of data, so collected contextualized survey needs assessments only to find out many people would not enroll in proposed program. Continued to develop curriculum in light of the data.	✖

The three participants who started the fellowship with a network approach, maintained this same view by the end of the fellowship (Participants 2019.3, 2019.4, 2019.6). For example, Participant 2019.3 mentioned "*Discussion with faculty* about what needs to be developed in the residency program . . . I want to check *on their documentation*, on their *patient satisfaction*, on their *readmission rate* to the hospitals or admission rate to the hospital." However, additional gains were made with this network approach to using evidence-based approaches in Participants 2019.5 and 2019.8 where Participant 2019.8 noted,

> I would need to go out there and start talking to people, doing some needs assessment and opinions of people who are stakeholders, who would allow it to happen if I want it to happen. I would have to talk to the university too and figure out what I need to do to add a curriculum or change a curriculum. Every university has a curriculum committee.

Participant 2019.8 was unique; in that they adopted a network approach only after having a discussion with me regarding the need to collect data prior to developing a program. After this discussion, this participant did collect data and later approached me about findings that they were uncomfortable with, noting concern over lack of interest in their proposed curriculum.

This network approach to decision-making exhibited characteristics of involving diverse team members in the curriculum design process. Many participants that adopted this approach saw value in collecting data from their home program. These participants also saw value in collecting data from their residents, which represented their target learner within many of their curriculums. Participants that came from programs with this approach also had less trouble or resistance in finding the data to justify their curriculum, and therefore, did not become paralyzed in their curriculum development progression. Their orientation towards evidence was reflective of their experiences and successes in their organization. Additionally, one participant (profitable realist) learned how success was attributed to attaching curriculum to monetary gains, and thus

used their experience working with stakeholders to collect data that supported such monetary gain.

Autonomous Approach. Only one of the participants by the end of the fellowship exhibited an autonomous view to approaching the design of a curriculum. Participant 2019.1, who began the program with a higher-authority approach, finished with a more autonomous view noting, "I would go to the STFM database or the Academic Family Medicine database, or even the AAMC . . . AMA, they have resources." This participant is the only participant of the 10 that began to exhibit a more independent view towards curriculum design by the end of the fellowship reflecting a sense of being disconnected from peers. Furthermore, the orientation towards evidence reflected a sense of frustration, where comments were made about wanting individual recognition for the work. This orientation developed out of frustration from organizational barriers such as lack of time and the recent pandemic, which later isolated this participant. Each of the data-driven approaches to curriculum design represented data-driven factors which influenced the development of an orientation towards evidence by the culmination of the fellowship program. However, I recognize that these factors where not created in a silo, but rather were also influenced by instructional program factors and home program organizational factors. Thus, the finalized trajectory that developed in each of the participants orientations towards evidence must be analyzed alongside these additional factors.

Instructional Factors

Upon review of the interview data, five themes emerged related directly to the instruction within the fellowship. Of those five themes, the most common two themes that emerged were related to the realization of the structure of curriculum development and serving as a modeled framework.

Realization of the Structure of Developing Curriculum. A common theme emerged around the structure of developing curriculum, in that many participants noted never realizing there was a methodical way of developing a designing curriculum. Participant 2019.2 mentioned this awareness referring to their prior teaching noting, "We were just looking at what randomly was important, the doctor healed, but it was just *throwing stuff out there*." The realization related to prior educational experiences signified that the fellowship impacted perceptions for those that had not been exposed to frameworks utilized within the fellowship. For example, Participant 2019.3 noted,

> . . . in the *residency they tried* to teach us curriculum development. It doesn't have any. . . [pause] *It doesn't make any sense.* And when I started the [sic] going into the GCAM and you started giving us the . . . [pause] *when you started teaching us about the curriculum*, it was really easy to just have on part one day, and then digest it in my brain and kind of understand.

At one point, Participant 2019.9 discussed a prior experience in residency where they stated,

> I came to this brand new residency program where a lot of the *faculty put* into the *leadership positions did not have residency training as faculty members* or experiences as faculty members of a residency program, nor did they do what I would've expected them to do . . . and that's very evident in even our *didactic schedule with things that are just missing* . . . if the faculty member doesn't feel like they can stand in front of a group of residents and teach that . . . it's not going to get taught and leave a *big gap*.

This perception of there being a real way to develop and systematically follow sections of the curriculum over time was commonly noted within this theme. Additionally, many participants referred to their prior medical training comparing that education to the education they received in the fellowship. The evidence-based approach to design was supported by Participant 2019.4, who posited,

> . . .has been much more fruitful . . . especially with surveys, numbers don't lie . . . is empowering in that sense, and adds another layer of security, . . . our internal stakeholders . . . more of an appreciation for the kind of *systematic way that things are laid out*, *both with the GCAM program*, in general and with the current curriculum model . . . teaching like change whenever there's a systematic and formulaic way about implementing that change.

This finding suggested these medical educators were exposed to a different way of developing curriculum that had largely been absent in their own training. Furthermore, as an instructional factor, it illustrated the need for additional training within these medical educators who had largely been trained as clinicians yet lacked exposure to the method for developing a scaffolded curriculum.

Science of Curriculum Development. A subtheme of the science of curricular development emerged secondary to realizing the structure of curriculum development. For example, Participant 2019.3 referred to prior educational experiences noting,

> I didn't have any ideas . . . Before, I didn't even know what it meant qualitative, quantitative, and researching or developing curriculum . . . it has giving me the data to show them what's going on in a more professional manner.

This insight related to the structure of developing curriculum, but as a subtheme was characterized by comments related to scientific processes such as using various methodologies.

Furthermore, the application of the evidence-based approaches to curriculum development in the fellowship instruction heightened awareness of using data to justify the needs for a curriculum. This formalized approach was emphasized when Participant 2019.7 stated,

> . . . curriculum course has been real eye-opening because it's brought formality to the science of curriculum development . . . of how you do it . . . I just had never been formally taught that here's all the boxes you want to check off when you develop. This whole course has changed my perspective.

Thus, this instructional factor acted on participants' prior experiences within their medical training by adding an element of reflective practice. Many of these participants had never been exposed to this formal structured approach, and once exposed to the approach, appreciated learning the process. However, some participants did use this reflective practice to point out concern for what was occurring in their home organization. Thus, while this knowledge acquisition provided the participants with useful methodologies of developing curriculum, it also created tensions when they attempted to use this learned approach.

Intensive Modeled Experience. The second theme within this study related to modeling. Participants referred to being provided examples which assisted in supporting their own understanding of how they were supposed to systemically develop curriculum. This modeling experience was particularly important for Participant 2019.6, where after being exposed to a peer curriculum project they noted, "*the example* I saw was just beautifully designed too; *it looked very* professional . . . curriculum presented to me had these objectives that were never met in the curriculum, you know?" This experience as part of the instruction assisted in shaping the understanding of what needed to be included in a curriculum, including objectives that were intended to be met through various educational strategies. Therefore, the process of including peer curriculum as part of the instruction provided what Participant 2019.5 stated when they

noted it "provided me a *framework*." Since the fellowship emphasized the development of curriculum, it also helped the participants model the development of their own curriculum. Participant 2019.4 recognized this value noting "after *modeling* . . . *curriculum project*, having to extrapolate that, and do that for other things." Experiences of developing and reviewing peer curriculums provided a safe space for the participants to acquire knowledge, identify prior learning gaps, and reflect on their own approach to designing curriculum for their respective institution.

Appeal to Stakeholders Using Data. The third theme as part of the instructional factors related to appealing to stakeholders using data. Instruction as part of this fellowship emphasized an evidence-based approach to developing curriculum using stakeholder and contextualized needs assessment. Therefore, this factor supported the value added in teaching the process of collecting data to justify the need for curriculum. For instance, Participant 2019.2 mentioned, "we don't learn how to appeal to the stakeholders as well unless you complete a course like this." While the approach to collecting data to justify a need was taught as part of the instruction, the other factors such as decision-making factors and organizational factors interacted with each other in a way that challenged the concept of appealing to stakeholders. For instance, some participants' orientation towards evidence were impacted by this appeal as a factor and with Participant 2019.2, produced an orientation of being an amiable realist (see Table 7). In this case, the participant became aware of appealing to stakeholders, but it did not create as much of an impact on the ultimate data-driven design within the curriculum itself. This was not always consistent among the participants, as some participants like Participant 2019.6 understood the process and mentioned it: ". . . gives me buy-in . . . sit down and talk about the actual data . . . actual evidence on why this is important." While the evidence-based approach that was embedded as part of the instruction influenced the participants understanding of the added value,

only some participants were able to apply the approach in their own curriculum. However, this appeal towards stakeholders was largely driven by the data-driven approach used within the home organization.

Some of the factors that pertained to the instruction were indirectly related to decision-making and organizational factors. Thus, while they appeared as an instructional factor, they occurred as a byproduct of the home program. Furthermore, it was noted earlier that the researcher as instructor was unable to follow the idealized evidence-based format (see Figures 5 and 6). This was not only based on a request from other staff members, but also due to observational notes taken by the researcher regarding struggles the participants had with dedicating time to the fellowship program itself. The themes related to their organization to which appeared as instructional factors were convenience and feeling split in many directions.

Convenience. The fourth theme as part of the instructional factors related to convenience. This appeared in a few participants such as Participant 2019.10 who mentioned,

> there are times I wish that these lectures were, I don't know if they are being recorded . . . your video, the first one you showed us as a group, I think that was in the first week and I mean that really, I think that video should be your starter video.

Participant 2019.10 dealt with organizational challenges related to communication and politics, which later impacted the application of evidence to their curriculum. Therefore, this participant emphasized the need for instructional elements that reduced time of direct instruction but only because of the challenges faced as it related to decision-making factors and organizational factors. This was an important finding, in that it reflected how an organization can impair its own growth in educators indirectly. This desire was not consistent among all the participants who failed to utilize data in their own curriculum. In fact, Participant 2019.3 who used data mentioned the instruction was "really easy for you when you *teach your videos*, and you teach

the graphics." The discrepancy between Participant 2019.3 and Participant 2019.10 is illustrated in the decision-making approach, where Participant 2019.3 came from a program that adopted a network approach and Participant 2019.10 came from a program with a higher-authoritative approach (see Table 7). One approach supported and fostered learning through the adoption of all the instructional resources, such as the videos, and the other forced the learner to depend on the videos to grasp the knowledge from the fellowship.

Split in Directions. The last theme as part of the instructional factors related to a sense of feeling split in many directions. Participants that join the fellowship are not always given the appropriate amount of time to study and focus on instruction. This unequal time resulted in many of the participants having to take calls for billable patient encounters. This was illustrated when Participant 2019.8 stated they

> feel bad when the patients are calling and, you know . . . it's different for some others who have to travel, and they have to put in the holidays in and requests and things like that . . . downside is Zoom fatigue.

This participant was one of the participants who was consistently pulled out of fellowship. Thus, while the organization placed demands regarding billable patient encounters, the participant in this case recognized the choice between income and forced online learning should they be unavailable for face-to-face instruction. While Participant 2019.8 accepted this split, Participant 2019.10 became increasingly frustrated where they noted "I'm doing a minimal job . . . when I get home, it's home. . . . I mean I got kids that are heading out the door . . . you can't get that time back." While both Participant 2019.8 and Participant 2019.10 came from the same organization, their perceptions on being split in multiple directions created different orientations towards evidence. However, this finding could be explained by the previously mentioned family dynamics that Participant 2019.10 mentioned.

The last factor related to this study was specific to the home organizational factors. This factor was one of the most influential, in that it influenced both the decision-making and the instruction. Interaction between the three factors produced the orientation towards evidence, which was referenced above (see Table 7).

Organizational Factors

Upon review of the interview data, eight themes emerged related directly to the organizational factors within their home programs. Of those eight themes, the most common two themes that emerged were related to the challenge's medical educators face regarding *resources* and *political-personal biases*. However, in review of these eight themes other themes also emerged around administrative directive decision-making, which further supported the decision-making factors seen in participants where higher authority decision-making was adopted (see Table 7: Data-driven decision-making factors relative to curricular evidence).

Resources. The most prominent theme that emerged from the organizational factors related to lack of resources. Resources included money, time, and staffing. Many of the participants such as Participant 2019.2 mentioned the value added in

> . . . showing the low cost and the relatively *low use of resources like staffing and time* to perform the curriculum versus the benefit of it . . . as physicians, we just don't think that way, but it matters to the stakeholders specifically.

This understanding drove a few curriculums, where several participants adjusted their orientation towards evidence so that it aligned with such financial incentives. For instance, Participant 2019.5 said,

> Something I've just kind of had to learn . . . it's been in the back, I assume that's a big part of things, but I thought being a university-based residency, it wouldn't matter as much, but that's not the case. We *still have to balance the budget*.

Furthermore, the understanding of where resources were and how they were emphasized changed the curriculum for Participant 2019.5, who oriented and aligned the evidence in favor of billable encounters. Participant 2019.5, as a profitable realist (see Table 7) mentioned,

> I think unfortunately, *financial incentives* affect that. . . . there's a financial gain from that . . . if you have 30 residents, if that adds only 10 joint injections in a year, well that's still a lot of money for just adding that in and of itself one procedure would definitely cover the cost of having a good curriculum . . . the financial incentive . . . *seems to be driving everything*.

Resources were not limited to only money, but also included lack of getting faculty-staff involvement when it came to developing the curriculum. Participant 2019.6 noted,

> *I don't know what resources are available*. I want to work with somebody, but there are physicians too who have a tendency to ignore their emails and text messages unless it has to deal with someone who's on their contact list.

Furthermore, when several of the participants sought out help for who to contact about collecting data to drive their curriculum, many were confronted with lack of time that prohibited them from adequately collecting enough data. Participant 2019.6 stated, "To be honest . . . *time limits* . . . spent most of my time negotiating" in reference to barriers in their designed curriculum. While most of the participants struggled with resources, Participants 2019.6 and 2019.5 were unique in that they came from the same home program. However, Participant 2019.5 caught on early to developing a profit producing curriculum that would satisfy home stakeholders, where Participant 2019.6 focused on a community-focused curriculum that was not driven by profits. This discrepancy in their curriculum's importance could explain why Participant 2019.5 focused more on money as an aspect of resources, while Participant 2019.6 emphasized faculty-staff involvement.

Political Personal Biases. The next theme to emerge related to political and personal biases that participants encountered in their home programs. Some of the participants noted there were challenges particularly in who to talk to about certain things in the curriculum. For instance, Participant 2019.9 stated,

> It's like we know what *everybody's supposed to know*, if that makes sense, but then no one feels very confident with giving me the exact answer . . . has to do with a *sensitivity* of (Institution Name) still going through this accreditation process.

The challenge in this situation related to navigating collection of data, while being sensitive of what data could be collected without the home program looking a particular way. This came at a fear of losing a job where Participant 2019.9 went on to explain concern stating there". . . has been [largely] *large turnover* at (Institution Name) already . . . have fought over this case versus that case and *exactly what should be included*." The inclusion and exclusion of what should go in the curriculum as a byproduct of the politics in the organization left this participant with a confused outlook on their orientation towards evidence. While some of the participants were overwhelmed by these political realities, others, such as Participant 2019.4 recognized that there are ". . . some *political realities* that you have to navigate . . . you really have to sell yourself sometimes and sell these ideas . . . collect and gather data in the most efficient an effective way really helps selling those ideas." This comment by Participant 2019.4 suggests that the organizational factors were well understood regarding the need to use data to justify curricular need. While Participant 2019.4 oriented their approach to evidence towards selling, Participant 2019.9 spent endless amounts of time navigating a political arena that was not quite well understood.

Administrative Decision-Making. The third theme pertinent to the organizational factors was associated with administrative decision-making. This theme was closely related the

to the higher-authoritative approach to decision-making. Specifically, participants that failed to collect data from their home institution commonly mentioned ease of adopting a curriculum since their administration told them what to focus on. This was specifically mentioned by Participants 2019.2, 2019.7, 2019.8, and 2019.10. Participant 2019.8 stated the proposed curriculum was something where they ". . . *already have it* . . . really didn't have to try very hard cause everybody was kind of on board." When administration told the participants to develop a curriculum that was going to run, these participants either failed to collect data or, in the case of Participant 2019.8, collected data when I became insistent on the collection, later going against the findings. For Participant 2019.10, this participant dealt with too many administrative decisions-makers. In reference to this finding, Participant 2019.10 posited,

> There's probably about *50 heads to the dragon here*. It'd be different people who will give you some guidance, but that's . . . you want to push ahead . . . not really going to matter at the end of the day, *because we're going to bring this in*.

This participant felt as though too many decision-makers were left to make the final decision on the curriculum. The reference to the dragons, Participant 2019.10 felt overwhelmed by those with more power to make decisions, leaving them hopeless regarding having the power to develop the curriculum effectively. For example, Participant 2019.10 mentioned,

> . . . one of the big things right now that is just naturally happening . . . is *who is really in charge,* like organizational maps. Part of the problem is, I think we've started identifying that with our new directors. *What are the organizational maps we have, so that I know who are my stakeholders,* as far as academically in that level.

Communication. The fourth theme to emerge related to either poor communication between organizational subgroups or fear of communication, due to an organizational culture.

Participant 2019.9 struggled with knowing who to talk to because of an organizational culture issue. This fear was reflected where Participant 2019.9 noted ". . . because of the culture of my program . . . better for me to *not speak up*." Since the organizational culture made it difficult to speak up, this participant finished the fellowship without attaching any data. This made it difficult for this participant where instruction supported evidence-based approaches, but the home organization devalued questioning. In reference to poor communication between subgroups, Participant 2019.10 mentioned challenges

> . . . we're (Institution Name 1), but we're (Institution Name 2) . . . two bodies right now that I have to work off of with budgets and (Institution Name 2) doesn't really . . . *They're not clear at communicating* how you access the budget . . . (Institution Name 1) is like, "Well, that's (Institution Name 2) job." So, we're a little bit in *limbo* constantly.

The poor communication between the two subgroups of the home organization added an additional layer of frustration for Participant 2019.10, who already was feeling frustrated due to administrative and resource constraints.

Pandemic. The fifth theme, which only appeared as a byproduct of the coronavirus (COVID-19) pandemic, influenced a few of the participants. However, COVID-19 only influenced the April 2020 and June 2020 sessions as part of the fellowship. It would be expected that had the fellowship occurred during a majority of the pandemic, this theme would have been much more prominent. The pandemic did, however, influence our own instruction and the demand placed on our healthcare staff, who were already exhibiting challenges with the above organizational factors. Participant 2019.6 referenced this influence when they stated, ". . . much has already changed with *the pandemic* . . . prior to this pandemic, *the resources that I had* initially for my curriculum design, *they changed* . . . using different resources, in regards to

teachers." This small glimpse into the influence of the pandemic on an already constrained healthcare system, provides insight into potential side effects that should be expected regarding medical education for the future. Several of the participants were already mentioning challenges with resources prior to the pandemic, and this experience has shed light on how resource allotment changed regarding medical curriculum.

Exhaustion. The sixth theme as part of the organizational factors was related to exhaustion. Participant 2019.3 stated,

> I'm *tired of just* . . . I don't like it *when it doesn't move* . . . readmission rate for here . . . less monetary investment on patients, so that when you tell them money, they will be saying yes, but that comes from a better education in the resident, a better patient care, a better patient satisfaction.

This participant saw value in the evidence-based approach to curriculum design as a part of the instruction, and as time progressed, they became increasingly frustrated with little visible change. Specifically, Participant 2019.3 exhibited an orientation towards evidence that would be described as the tired visionary (see Table 7). For this participant, the instruction ignited a passion to change the system, but the lack of change made this participant tired by the end of the fellowship noting a desire to eventually leave their home program.

Desire to Leave. The seventh theme as part of the organizational factors related to remarks of leaving, like comments made by Participant 2019.3, but were unrelated to elements of exhaustion. In this case, some participants mentioned a desire to leave due to a poor organizational culture. While it could be argued that desire to leave and exhaustion were related, Participant 2019.1 referred their desire stating,

> I don't know what's really going to happen after the year that *I leave*, but I think that the way I'm lined up with the curriculum . . . I think it will be nice to add and

> hopefully they'll just say it's perfect since Participant 2019.1 made it, but probably not.

This desire to leave theme was associated with an internal recognition of their own self-worth, which culminated in a way that left them feeling that superior organizations existed beyond their current organization. Participant 2019.9 exemplified this desire to leave when they stated, "*To go on to places* where I can actually make a positive impact in improvement." It is impossible to know if the fellowship as an entirety changed their perspectives on leaving, or if it was related to the new acquisition of evidence-based approaches to curriculum that challenged their core values. This finding did illustrate that fellowships can impact how academic medical educators feel regarding staying in their home academic organization.

Working on the Fly. The eighth and final theme was related to working on the fly. Participant 2019.7 summarized this feeling noting,

> A lot of curriculum that we have . . . is stuff that has been just adopted and so we don't have the needs assessment readily available . . . *working on the fly* becomes necessary . . . bare bones.

This theme illustrated that many of the medical educators struggle to develop evidence-based curriculum, in large part due to an interaction among the other organizational factors. The medical educators are resource constrained, exhausted, challenged with mis directives of who to obtain advice from and the result leaves many clinicians with the only option but to *work on the fly*. Thus, the curriculum that is put into practice is largely shaped by the organizational factors which interact with the decision-making factors to produce either an evidence-backed curriculum or a previously adopted curriculum for the sake of time.

Since several participants (Participants 2019.2, 2019.7, 2019. 9, and 2019.10) finished the program at the end of the year with higher authority decision-making, it was essential to

understand how that dynamic interacted with year-long growth and development in evidence-based decision-making. For example, at the start of the program Participant 2019.9 mentioned,

> I'm still having difficulty finding where they're doing certain things within [Program's] curriculum, or how they're accomplishing certain tasks within the curriculum. And that's not necessarily a problem with GCAM, it's more . . . It's like we know what everybody's supposed to know, if that makes sense, but then no one feels very confident with giving me the exact answer.

These comments mentioned previously reflected common patterns where the participants were actively searching for answers to decide, yet, lacked understanding of who had the autonomy to make the decision. Thus, the final decision of what to assess for development of these participants' curriculums for the fellowship suffered. However, it was apparent that the participants were able to separate out the challenges due to their home organization, as opposed to blaming it on the fellowship training. However, had these factors not been analyzed on a deeper level, the analysis would have only revealed impacts from the fellowship training itself. This analysis could have led to an inaccurate conclusion due to linear evaluation, meaning the participants either used evidence-based practices or not. These organizational factors thus acted as confounders that later impacted the participants ultimate practice and persona trajectory.

Participants 2019.5 and 2019.8, who started the program with higher-authority decision-making, finished with a network approach as it relates to an organizational factor of *resources*. For example, Participant 2019.5 began to realize the value of relating curriculum adoption to money, and through this view, it was noted,

> It's getting that cost benefit analysis . . . It's pretty easy because we have all our billers and coders here that know what we're billing out for procedures and the cost of, because it's hard for me to know all the ins and the outs of the

finances . . . as long as I have all the help I need, it's pretty easy to put together.

But it's mostly other people doing it for me.

While Participant 2019.5 refers to resources, over time this participant and Participant 2019.8 were both able to understand to maintain an overall understanding of the value of resources relative to the curriculum. The primary difference between the two participants was related to how they recognized their resources. Participant 2019.5 became more financially incentivized, allowing this participant to use costs to get a more networked buy-in on adoption of the curriculum. Participant 2019.8 mentions their success noting that "figuring out where your resources are is not easy . . . but once you know it, the support's pretty strong. Everybody's very encouraging."

Upon review of the organizational factors, it is apparent that these factors either directly or indirectly impacted instruction and overall curriculum design for later implementation. Furthermore, upon review of each participant's growth in confidence relative to these various factors, the researcher as instructor understood the complexity of the challenges medical educators face. It also is apparent that many of societal linear views of assessment based on only program outcomes, irrespective of these factors, can lead to misinterpretation of how one values educational programs. However, just as these factors impacted the participants, they also had an impact on this researcher's instruction. On January 11, 2020, I was asked to drop the assignments in the second half of the curriculum course (see Figure 6: Spring 2020 medical education fellowship curriculum flow (intended), excluding the final presentation-poster project. This request was a difficult decision that impacted the future structure and design of the curriculum course for the following year. Specifically, emphasis placed on evidence-based practices, such as having the participants collect contextualized needs assessment data to drive curriculum forward was removed for the following year. Content related to survey design, focus groups, and

interviewing processes as a method of collecting data were removed from the curriculum course. While a necessary step, particularly considering the COVID-19 pandemic, it left the instructor-researcher with a sense of loss of autonomy over the course.

Conclusion

This chapter provided a description of a 1-year academic medical education fellowship as it relates to the impact on confidence on using evidence relative to the actual practice of using such evidence for designing medical curriculum. Furthermore, it provides a non-linear view of understanding educational programs and their respective outcomes. In answering the research question, "How and to what degree does instruction in medical curriculum development impact confidence in using evidence to inform curriculum?" the data showed the instruction did improve confidence in making evidence-based decisions towards the curriculum (*t*-test score of 7.28). Further analysis beyond their confidence reflected increased awareness of adopting the practices of using (a) observations, (b) student-teacher feedback, (c) literature search, and (d) interviews by the end of the program. However, while participants became aware of a variety of evidence-based methods, their individual trajectories due of various factors resulted in a different understanding of how one can measure effect.

In answering the research question "What factors influence the ways in which medical educators design and implement curriculum?" the data revealed factors associated with the actual practice of using evidence. Specifically, I noted decision-making factors, instructional factors, and organizational factors all interacted with one another in a way that drove how the participants used evidence in practice.

Decision-Making Factors

There were three themes as a part of decision-making factors, and these were classified as either (a) higher-authoritative approaches, (b) network approaches, or (c) autonomous

approaches. Participants that came from programs where higher authorities were making decisions exhibited less success in conducting evidence-based practice in their design of the curriculum, as they became dependent on their administration for all decision-making. Those participants that came from programs where collective network approaches were utilized to make data-driven decisions towards the curriculum had larger success on using such evidence in their practice. Those with an autonomous view exhibited a singular view of approaching curricular design and change. Each of these decision-making factors were a byproduct of the organizational factors and did impact the instructional factors. Specifically, those that had higher-authoritative approaches to decision making typically bypassed collection of evidence either because the curriculum was going to happen per a directive, or they simply had too many higher authorities that evidence became impossible to collect.

Instructional Factors

Five themes emerged related to instructional factors. Those themes were (a) a realization of the structure of curricular development, (b) an intensive modeled experience, (c) appealing to stakeholders, (d) convenience, and (e) feeling split in many directions. Instructional factors based on awareness of the science of curriculum development as a part of realizing the structure of developing curriculum challenged some of the participants' orientations towards evidence that developed over time. This finding resulted in a few of the participants referring to a future where they saw themselves leaving their home organization after completion of the fellowship.

Organizational Factors

Eight themes emerged related directly to the organizational factors: (a) resources, (b) political-personal biases, (c) administrative decision-making, (d) communication, (e) pandemic, (f) exhaustion, (g) desire to leave, and (h) working on the fly. Each of the organizational factors represented challenges; however, lack of resources in the form on money, staff, or time was the

most prominent. However, political biases and poor administrative decision-making typically resulted in producing frustrated academic medical educators who at times noted future desires to leave their organization. The results and their implications on leadership, policy, and medical education along with the limitations of the study are discussed in the following chapter.

CHAPTER FIVE: DISCUSSION

This chapter provides a discussion of the results based on each of the research questions along with an overview of their implications for the policy leaders and medical education faculty who are addressing budget shortfalls in medical education. Discussion points will highlight the gap between evidence-based decision-making in theory and in practice, and the factors that can potentially explain these gaps in relation to medical education training. Additionally, suggestions are made for policy leaders and medical educators in reference to this research, in hopes that it can serve as a mechanism for understanding the potential pitfalls with reviewing program outcomes that are siloed from the influence of their respective organizations. This chapter culminates with addressing the limitations of the study and areas for future research in medical education.

Implications of Results

The results of this study reflected various gaps between evidence-based decision-making in theory as part of instruction within the fellowship program, and what was done in practice within curriculum design. Specifically, findings from this study revealed the medical education fellowship training improved confidence in all the medical educators; however, the use of evidence for designing curriculum was different than what they stated in theory. This discrepancy is known as the Dunning-Kruger effect and is a result of the lack of knowledge of one's own expertise (Dunning, 2011). These differences can be explained through discussion of the instructional and organizational factors that influenced each medical educator's trajectory towards an evidence-based practitioner. Fundamentally, the orientations towards evidence developed through this medical education fellowship program and were a product of decision-making factors, instructional factors, and organizational factors. These factors can also serve as a valuable resource in explaining why Pololi et al. (2012) found that a quarter of academic

medicine faculty leave the profession due to poor culture, moral distress, lack of engagement, and low institutional support.

Gaps in Using Evidence in Theory and in Practice

The practice of working with evidence assists practitioners in understanding how to make data-driven decisions that can shape their modeled curriculum for practice. While Sackett, the father of EBM posited levels of evidence ranging from randomized control trials to opinions from respected authorities (Zimerman, 2013), in this study evidence was related to the needs of the learner, stakeholders, organization, and community relative to the medical curriculum. Specifically, evidence was viewed through a lens of how a medical educator models and directs what is done in curricular practice for later implementation using various research practices with evidence (Committee on the Health Professions, 2003). For example, L. Chan et al. (2017) found the use of web-based videos on using research assisted public-health professionals in supporting evidence-informed decision-making relative to a sense of confidence in developing better program interventions and designing evaluations. However, medical educators who operate in dual roles as clinicians and as educators struggle with barriers when it comes to using evidence to direct such practice. When working in clinical practice, many clinicians struggle with using research evidence, structured tools, and assessment outcome measures to make decisions (Stewart et al., 2018). Thus, while confidence in understanding or having knowledge may increase after instruction, there are various factors that may be limiting the actual use or practice of using evidence to direct and shape medical curriculum. There are two reasons that can explain why these gaps exist between theory and practice: (a) one's own worldview and the Dunning-Kruger effect (Dunning, 2011) can impact perception of evidence-based decision-making, and (b) the instructional, decision-making, and organizational factors which encompass their medical

education practice can act as barriers to their own ability to apply evidence. In what follows, an explanation of both reasons is presented.

Confidence in Working with Evidence: Explanation 1

Overall, the fellowship program had an impact on confidence in all participants with a noted change after instruction. While growth occurred on this scale after instruction, comparison between the learner's growth relative to sources they would use for design and the open-ended question on how they would design curriculum revealed design and implementation gaps. For example, sources that were selected in the survey that were the highest evidence sources selected for use in design were (a) observations, (b) student-teacher feedback, (c) literature search, and (d) interviews after instruction. Since the designed curriculum served as the focal point for evaluating evidence used in practice, this data was compared to the sources adopted in practice. This constant comparison (Saldaña, 2016) between the survey datum and the curriculum documents provided insight into explaining why alignment or misalignment occurred relative to perceived confidence. Furthermore, this study illustrates there are barriers to how medical educators perceive themselves in evidence-based decision-making, which may be explained relative to their worldviews and the Dunning-Kruger effect (Dunning, 2011).

Confidence Relative to Worldview. Some of the participants mentioned adoption of curriculum from other programs as a form of evidence, without directly addressing the contextualized need. This approach to curricular design aligned with individual worldviews. For example, these participants adopted evidence sources to justify a need based on existing program curriculum in another location, thus, aligning with prior research that demonstrated individuals search for evidence that aligns with pre-existing beliefs and/or their working knowledge, especially when it yields positive results (David, 1978; Farley-Ripple & Cho, 2014; Spillane, 2000). For example, Chan and Wong (2014) found individuals' personal worldviews such as

religion and their overall philosophy of life can impact their own mathematics teaching. This is particularly important since teachers serve as potential role models to how evidence is portrayed within the curriculum. Chan and Wong (2014) posit,

> The social political and even economic and cultural/religious backgrounds of a period generate a social mood that affects the curriculum worldview, which in turn affects the teachers who are delivering the curriculum as well as the students who are "consuming" the curriculum. (p. 274)

Although confidence increased post-instruction, the views towards evidence use and practice reflected differences that suggest a possible impact of pre-existing beliefs. Instruction represents one of the many stimuli that influenced the participants' views towards evidence-based practice. For example, Charles and Yeung (2019) evaluated confidence and error detection relative to stimuli before and after decision-making noting confidence was influenced by balancing the evidence before and after a decision was made. Thus, the confidence on using sources of evidence will be fluid even after the decision is made. Additionally, this research study demonstrated one's declarative confidence on working with evidence did not necessarily align to the evidence that they adopted for their curriculum, even when instruction on evidence-based decision-making was provided.

Since one's worldview is impacted by the social elements (Y. C. Chan & Wong, 2014), the discrepancy between confidence and evidence use may be explained by the decision-making approaches in the home organization. For instance, in this study, worldview was shaped by the home programs where authoritative style decisions were made about the curriculum. This is an example of a type of hidden curriculum. For example, Braschi et al. (2020) noted it is fundamental to identify the hidden curriculum in

clinical didactics and teaching, prior to addressing EBM and shared decision-making. This hidden curriculum can include issues related to this authoritative approach to decision-making, particularly where Bandini et al. (2017) found issues related to the hierarchy of medicine and behavioral modeling as issues in the hidden curriculum for medical students. The views of adoption of existing curriculum, as seen in this study, demonstrates a lack of linearity in how data drives decision-making noting ideologies can impact decision-making (Honig & Coburn, 2008), even if instruction might provide alternative perspectives.

Confidence and the Dunning-Kruger Effect. Review of the participants application of evidence in their curriculum design relative to their confidence and selected sources they would use in theory reflected further differences. Variation in confidence scores among a few participants was not necessarily associated with the application of using evidence or using the evidence correctly. One of the participants who collected data and had a positive change in confidence, incorrectly applied the targeted needs assessment data, where the data revealed little to no interest in the proposed curriculum for a medical program. This variation between confidence scores and performance may be explained by the Dunning-Kruger effect, where high performers tend to underestimate their performance and low performers overestimate their respective abilities (Muller et al., 2021). For example, Mahmood (2016) found low performers tend to overestimate their own performance with information literacy skills. Therefore, high confidence and poor use of evidence could be explained by an individual's over estimation of ability (Muller et al., 2021) and influence of worldviews.

This discrepancy also supported the finding that gaps exist not only between confidence levels towards evidence-based decision-making, but also between what medical educators think they will use relative to what they actually adopt in practice. However, this gap could be due to

external factors that may impact how a medical educator searches for evidence to drive their curriculum forward. Therefore, it is necessary to evaluate the factors associated with implementation to explain why some participants may have confidence or knowledge in using evidence-based practices, but yet fail to collect contextualized needs data that support a true need.

Factors that Impact Implementation Relative to Confidence: Explanation 2

Challenges with EBM have been evaluated, noting knowledge does not necessarily translate into practice, where barriers to implementation were largely dependent on the culture of medical decision-making (Oude Rengerink et al., 2011). Furthermore, Oude Rengerink et al. (2011) found barriers to EBM were due to lack of time in practice, lack of curriculum requirements for teaching such practice, and hierarchal nature of the organization. This is an important finding, because many of the participants in this study noted issues around time, resources, and administrative directive style decision-making. Upon review of the data, various factors emerged that were associated with implementation and were classified as (a) instructional factors, (b) decision-making factors, and (c) organizational factors.

Instructional Factors and Implementation. The fellowship training did assist in scaffolding medical educators' awareness in the science and methodology of curriculum development, with several participants reflecting on their prior learning experiences relative to the fellowship training. Themes that emerged from the instruction were directly related to concepts of there being a real systemic way of doing curriculum. This finding was a commonality noting that as participants gained awareness of using targeted evidence to drive their curriculum forward, they also became increasingly aware and sometimes frustrated at educational gaps they had experienced prior to this training. The raised awareness towards a real way of developing curriculum was largely associated with the overall structure of the GCAM

curriculum, noting many participants referred to aligning objectives with evaluation and assessment, as opposed to what was just being *thrown out there*. Thus, this instruction modeled a different systematic way of developing curriculum, whereas adult learners were able to engage with each other and within the new practice of curriculum development (Bandura, 1976; Wenger et al., 2002). This new systematic practice provided an opportunity for the development of other worldviews, which might have challenged current epistemological perspectives, or sustained current views on best practices for collaborative data use that was reflective of their home organization.

While the instruction from the fellowship did improve overall confidence in knowledge of evidence-based decision-making, similar to Uy et al. (2014) where confidence gains were made, factors did impact the ultimate learner trajectory. Review of the data and evidence selected as it relates to the medical educator autonomy suggests larger factors associated with decision-making in relation to the stakeholders impacted evidence use of what was put in curricular practice. These decision-making factors thus acted on the instructional factors, often at times creating barriers in seeking out evidence. For example, one participant who failed to collect and attach contextualized data to drive their curriculum forward, struggled with higher-authority decision-making both pre- and post-instruction along with organizational factors that led to learner frustration. This finding suggests evaluation is not always as linear as it may appear, and external factors can either support, inhibit, or maintain a status-quo in relation to what is currently done in an organization.

Decision-Making Factors. As the participants transitioned from the fellowship training back to their home organization, decision-making factors emerged related to what data were collected, how it was collected, and how it was incorporated into the overall design of the curriculum. Specifically, when comparing the movement from the training back to the

organization, a type of decision-making developed. Participants came from home programs where they

- heavily depended on authority for decision-making regarding the curriculum (higher authority),
- philosophically held the belief it was a team or network that would make decisions regarding the curriculum (network), or
- held the independent belief they were the only individual who could make a change (autonomous).

Seven of the participants came into the program noting their development would be heavily dependent on views and perceptions of what their stakeholders believed. Some of the views shifted over the course of the year; however, those that finished with higher-authority decision-making and started with this view failed to attach contextualized data to justify their curriculums. This result should not reflect directly on the participant, but rather reflect that this type of decision-making prior to external training can influence how evidence is directed and selected. These participants did, however, reference other forms of evidence such as peer-reviewed literature.

Barriers to collaborative data use are centralized around concepts of determination of selecting data based on worldview alignment, as mentioned previously, what counts as evidence and understanding of the evidence as a form of data literacy (Farley-Ripple & Cho, 2014; Kruglanski & Ajzen, 1983; Patton et al., 2016). For instance, those that came into the program with higher-authority decision-making where justifications were made regarding leaderships' decisions to put the program in place, lacked having data to justify such a need. This supports prior research on the challenges with decision making, where faculty and administration must attempt to acknowledge their own biases (Charlier et al.,

2019) towards what needs to be included in a curriculum. Instead, leadership must provide opportunities for faculty, who are the implementers of the curriculum, to collect and provide feedback on needs data relative to the needs of the intended learners (Spillane, 2000).

Each of these barriers will impact how data is used in the form of improvement or accountability. While the goal for collaborative data use may serve as a mechanism for transparency, these barriers if left unchecked will perpetuate leading to increased levels of complexity in the organization. Thus, the participants, that came in with strong worldviews supported by higher-authority decision-making, failed to collect the appropriate data needed to support and align their curriculum. However, the organizational factors largely explained why these barriers were seen in this study.

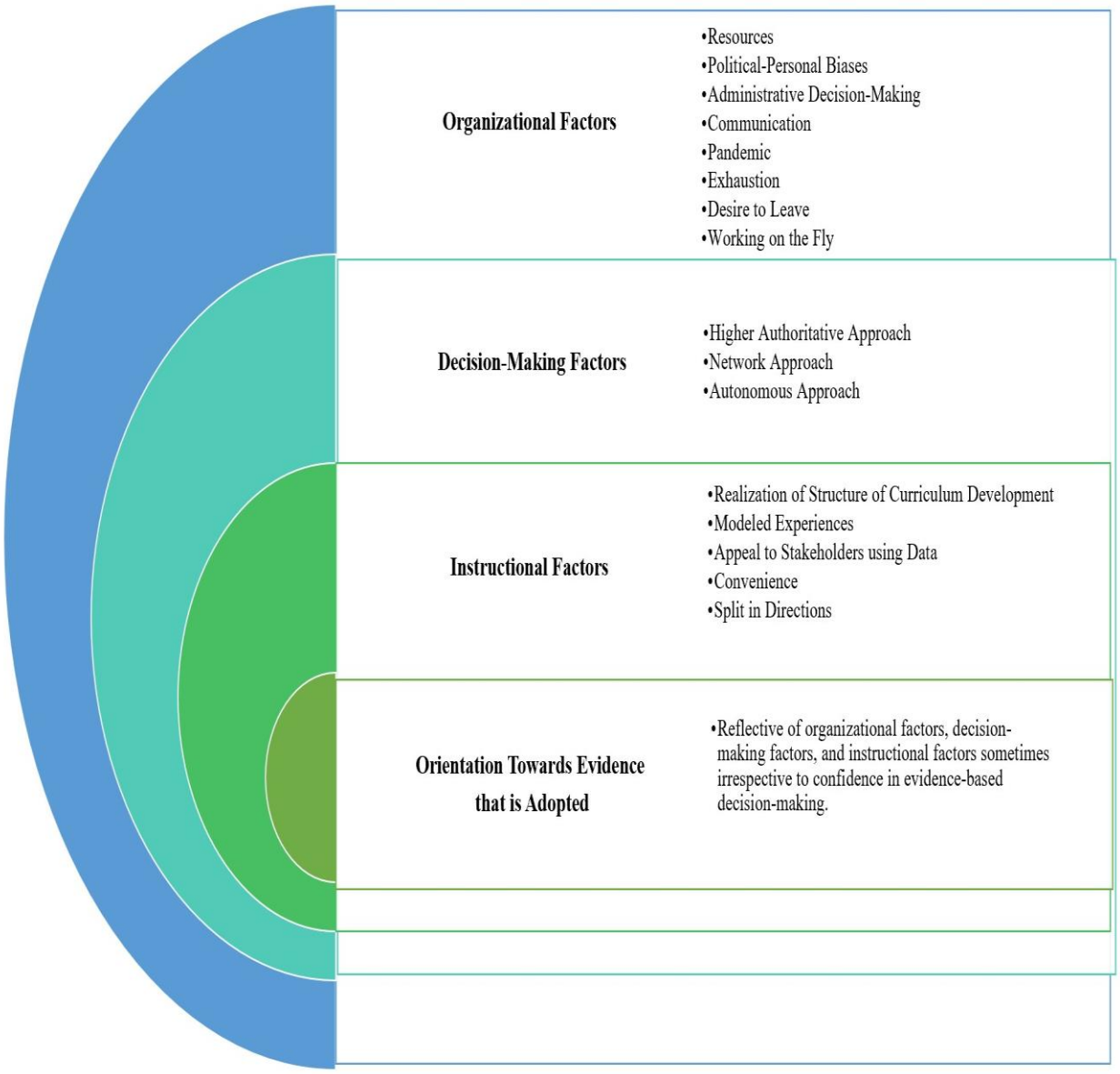
Organizational Factors. As the medical educators moved back to their home organization; where the structure, culture, and values are unique, notable differences emerged. While lack of time was consistent to prior literature (Oude Rengerink et al., 2011), it was not the most common organizational factor for this research. However, resources mentioned—time, money, and manpower—were commonalities among many of the participants. Those that came into the program and finished the program with the higher-authority decision making view also noted elements with directive decision-making where administration provided them with a directive on what would be done for their curriculum projects. This meant they entered the fellowship training with a directive, that ultimately led to a bypass of collecting contextualized data from home program learners (users of the curriculum). The one participant that also came in with higher-authority decision-making but later shifted to a network approach, did collect targeted data, even though their data demonstrated no interest in the curriculum that was designed.

Political realities that participants either learned to accept or become frustrated with over time influenced the organizational culture. Some of the participants noted feeling lost and confused about who their stakeholders were, since they were the true decision-makers. Two participants noted frustration with time or organizational culture that led them to make comments regarding eventually leaving their home program. This organizational culture issue, as mentioned by one participant, influenced the participant's level of comfort with speaking up about concerns over their curriculum. Thus, even though confidence in the process of curriculum development improved during instruction, the organizational culture regarding poor communication, bias, and lack of resources prevented some of the participants from feeling comfortable speaking up in their own organization. The desire to leave their program as a product of poor organizational culture, thus produced norms leading to a change in the behavior (Camacho et al., 2018) towards evidence-based decision-making. These organizational factors, which impacted targeted evidence use, reflected the values of the organization, and produced an orientation towards evidence use in the participant over time. That orientation represented a culmination of knowledge acquired both within and external to the fellowship, autonomy in decision making either lost or gained, and values of the organization sometimes irrespective of their confidence in evidence-based decision-making (see Figure 14: Factors that influence orientation towards evidence).

The factors that emerged as byproducts of the organization reflected structural communicative and hierarchal problems that later prevented some participants from collecting contextual data beyond use of peer reviewed literature or informal conversations. It is fundamental that the leaders in medical education reflect on these factors that might inhibit curricular implementation.

Figure 14

Factors That Influence Orientation Towards Evidence



Furthermore, these organizations are large and encompass several layers of subsystems (UME, CME, GME) making the measurement of change efforts hard to assess quickly. Changing an organization's culture is challenging (Hrabowski et al., 2019), and to do so effectively, Dalal (2019) posited structural changes must facilitate joint problem-solving as opposed to analysis in independent silos. To facilitate structural change, administrators and leaders need to include

those that are implementing the effects of policies in discussions as this implementation can impact classroom pedagogy (Spillane, 2000). Thus, suggested steps for medical education policy leaders for addressing these issues are in the next section.

Areas for Future Research

Results from this study revealed a complex dynamic between learning evidence-based decision-making towards curricular design and factors associated with the implementation of evidence-based curriculum. Based on the research findings, it is essential for organizational leadership to recognize the factors that both inhibit and support use of evidence to drive all forms of decision-making, particularly in training future clinicians where educational gaps are present. The Institute of Medicine Committee on the Work Environment for Nurses and Patient Safety (2004) recommends the adoption of transformational leadership for evidence-based management in healthcare organizations, where the medical organizations must collectively participate in decision making, improve communication, facilitate input in decision-making, and provide resources that support dissemination of knowledge to support decision-making. To support this, healthcare organizations must assess their own institutional organizational resources, structure, and culture. To improve decision-making within medical curriculum, institutional leaders must agree to approach medical curriculum design through a collaborative approach where the learning sciences are included.

Suggestions for Medical Education Policy Leaders

Fowler (2009) discussed the value of including the implementers, who oversee the implementation, as a way of ensuring success. However, barriers to successful implementation include issues related to teachers not understanding the changes, not knowing how to enact the pedagogy, lacking resources, having organizational cultural issues related to new agenda put forward, and feelings associated with being discouraged (Fowler, 2009). These barriers are also

factors associated with poor implementation of evidence-based decision-making in medical curriculum, as presented in this current research study. It is fundamental that leaders, policy experts, and medical educators understand the influence of educational scholarship and the home organizational factors that can support, inhibit, or contradict what literature states regarding evidence-based practices. Furthermore, Thompson et al. (2011) noted evaluation of medical fellowships has largely been limited to satisfaction evaluations and suggested research studies must begin addressing changes in knowledge, attitudes, skills, or quality of projects in teaching that are reflective of the fellowship training.

Medical Education Leaders as Implementers

The Institute of Education Sciences, making recommendations on best evidence-based practices, characterizes evidence into three categories: (a) strong, indicating high levels of generalizability and validity; (b) moderate, with evidence of causal conclusions; and (c) low, with evidence from case studies or descriptive studies (Hamilton et al., 2009). This perspective posited by Hamilton et al. (2009) reflects the relationship between evidence selection and how worldview is associated with perspectives on defining evidence. To align with values put forth in evidence-based medicine, leaders must be transparent on defining evidence-based practices in curriculum development for their respective programs and must support their medical educators by providing autonomous or network approaches to modeling such approaches as an implementer of the curriculum. Thus, it is recommended that a similar study be held concurrently to the evaluation of medical educators' decision-making in curriculum implementation when returning to their home program. This would help to establish a link between external instruction provided and evidence-based practice when curriculum is put into practice.

Curriculum serves as a roadmap of what is intended to be covered, while the pedagogical practices that are adopted assist in modeling the application of evidence. Modeling the use of

evidence within the curriculum can assist in developing these roadmaps that specifically address the needs of the community. While medical education has experienced five curriculum reforms (Joyner, 2004; Ludmerer, 1999; Papa & Harasym, 1999; Thelin, 2011), the reviews of the reforms have overlooked how the organizational systems created actions or inactions that contributed to curricular change. These reforms have yet to consider the social fabric of the organization (Bloom, 1998). To improve the quality of the medical education curriculum our leaders as implementers must adopt what Hrabowski et al. (2019) refer to as adopting a "culture of curiosity" (p. 55). In this culture, medical education leaders and educators work to build out multi-year roadmaps for the curriculum that outline milestones and outcomes. Medical educators who have little to no training on education, yet possess interest and skill in training, are tracked to participate in an additional year of fellowship training which emphasizes sound pedagogical practices and evidence-based decision-making within medical curricular design. Curricular gaps that exist are confronted within this new model and the organization serves as a space where people can be honest about issues within the hidden curriculum. Thus, this multi-year design serves as a communication tool of the organizations values and as a model of what evidence-based practice means for the medical education that resides in the institution.

Leadership Intent Towards Decision-Making for Improvement

Medical education leaders must communicate who is responsible for making decisions related to the curriculum while navigating an operational space that values feedback from the implementers of the curriculum. Barriers in collaborative data use involve how the organization intends to select and interpret the data, the role of data, and the situation or context with which it is being applied to address a problem (Supovitz & Sirinides, 2018). This barrier suggests the way that data is viewed by the decision-maker shifts based on overall intent. This intent of selecting evidence is explained by Farley-Ripple and Cho (2014) who posit that focus should be placed on

the practice of using evidence, where organizations address if the evidence is for accountability purposes or if it is for deep organizational understanding to assist in improvement. The challenge with this dualistic approach is that it divides accountability from improvement. Technically, all organizations should have an innate drive to continuously improve or evolve, even if it is not part of a fundamental accountability standard that is measured on a larger scale. Organizations that divide their evidence into these categories are further perpetuating a data problem revolving around confusion of what evidence works, who is using the evidence, and how it impacts the organization on a larger scale.

If organizations are driven to improve, then technically the evidence should be used as a tool to measure improvement later aligning with measures for accountability. Unfortunately, some educational organizations have shifted away from this notion and instead have attempted to separate out evidence use. Honig and Coburn (2008) support this separation by noting how administrators may interpret the data in a way that leads to an inaccurate inference for a new program. This was exemplified in this study, where one participant went against what the evidence suggested, even though feedback suggested little to no interest in the curriculum. The divisions of evidence and assumptions based on poor interpretation of the data can potentially impact educational costs, where little transparency already exits. For instance, Farley-Ripple and Cho (2014) evaluated the Hamilton School District to address evidence use, noting high pressures from accountability agencies led to educational reform with one administrator making changes to the professional development program based on secondary sources or the mimicking of efforts from other districts. This mimicking or perception of adoption of previously written curriculum, even when the context or demographics were different, was also seen in this study. This pattern further exemplifies poor understanding of the contextual nature of evidence and interpretation of evidence for organizational use.

Furthermore, social learning theory (Bandura, 1976) suggests that learners acquire skills from their respective coaches and peers. If leaders in the organizational systems are driven to improve, while being cost conscious, then they must begin to acknowledge their own biases towards the implemented curriculum. Leaders should adopt two strategies: (a) communicate the intent of the organizations goals and its respective curriculum for future practitioners, and (b) provide network approaches to testing the needs of the respective curriculum put forth by the organization, thus modeling evidence use in practice. Once these two strategies are adopted, the leaders themselves can serve as models to how evidence is used both for practice and for improvement. Failure to acknowledge the need to test the needs of the curriculum put forth can potentially perpetuate poor use of evidence-based practice, as exemplified in this study where participants failed to collect contextualized data.

The increasing amount of data available to organizations often leaves leaders confused on which data is best suited to address the problem at hand. Analytics offers a possible streamlined solution, but challenges with using analytics have been vocalized on its role in discrimination based on demographics (Ekowo & Palmer, 2016). Coburn et al. (2009) note that decision-makers are overwhelmed with evidence and often lack the exact evidence they need. This lack of evidence needed to justify the curriculum was exemplified as an organizational factor among some participants, where many noted issues around communication, or knowing what resources were even available to them. Additionally, it takes time to review data and select the correct data that is needed to address the problem at hand. For instance, Farley-Ripple and Cho (2014) found in their study on a school district that varying degrees of time spent with the evidence existed. The lack of time to select and review the data with compounding concerns over how it is being used for improvement or political gain (Honig & Coburn, 2008), pose concern over long-term collaborative data use efforts. Thus, while time and lack of resources may be a barrier to

evidence-based decision-making in curricular design, it serves as an identifier for organizations where they can embed networked improvement practices to adjust their programming while being cognizant of these factors. However, for these network approaches to work, we as leaders must be willing to provide our medical educators with the time it takes to review, understand, and implement curricular change. Furthermore, as leaders one must be willing to review the contextualized data and determine if it meets the needs of the communities they are trying to serve; or if the proposals put forth are coming out of directive style decision making from higher authority.

Limitations

This study transected across higher education, organizational leadership, and medical education and assisted in illuminating the barriers to evidence-based decision-making within medical education. However, it did not come without the need to address certain limitations. First, the study occurred at a Texas based medical fellowship program which serves a large majority of Texas family medicine physicians. Furthermore, the fellowship program enrolled a small sample of fellows who were interested in academic medicine. While the study added value to understanding the multidimensionality of how researchers can study evidence-based decision-making, the small sample size in this study is a limitation that prevents the findings from being generalizable. Thus, evaluation is necessary regarding addressing if similar findings occur in other medical specialties and in other fellowship programs that are outside of Texas. Second, evaluation over the course of the year could have been impacted by the pandemic (COVID-19), which was brought up as a minor theme within the organizational factors of this study. The pandemic forced all instructional delivery to be shifted online for the April and June sessions in 2020, therefore, this could have been a confounding variable in the analysis.

Lastly, this study evaluated confidence in evidence-based decision-making relative to various factors that were associated with implementation. The factors that emerged were reflective of the participants' feelings towards their organization, and do not necessarily reflect the words or feelings of the organization themselves. Therefore, the researcher recommends a continued longitudinal evaluation where medical educators are evaluated post-instruction about the persona that develops after instruction. This type of evaluation would assist in understanding the high attrition seen in academic medicine (Pololi et al., 2012), and could possibly serve as a mechanism for understanding how the organizations themselves might be promoting such attrition due to failure to address the factors mentioned in this current study.

Conclusions

Medical fellowships have been around since the 1980s (Searle et al., 2006) and are a byproduct of serving the needs of the medical student/resident and medical educator who lack knowledge in the learning sciences (McLeod et al., 2003). Evidence-based medicine arose as a product of the problem-based learning curriculum which placed value in using evidence for decision-making within medicine, and prior research reflects common barriers to EBM are (a) barriers to doing research, (b) few resources, (c) little time, (d) inadequate skills, (e) poor access, (f) lack of knowledge, and (g) fiscal barriers (Sadeghi-Bazargani et al., 2014). This study aimed to address the impact of how additional training bridges the gap between education and medicine, while simultaneously considering the factors that support/inhibit implementation respective to a medical educator's home organization. It is apparent that medical educators are under enormous strain—a strain that seems to accelerate their own frustration with organizational challenges once they have become aware of the need for more systematic structure in their own practice, as opposed to just throwing stuff out there. Our policy leaders in medical education need to be aware that educational fellowships cannot be evaluated in a

vacuum, but instead must be evaluated relative to how the fellowship interacts with the overall medical system. Failure to recognize this new evaluation need, and the need to reevaluate our GME funding respective of these systematic outcomes, could potentially lead to the decline and progressively increasing rates of burnout for medical educators.

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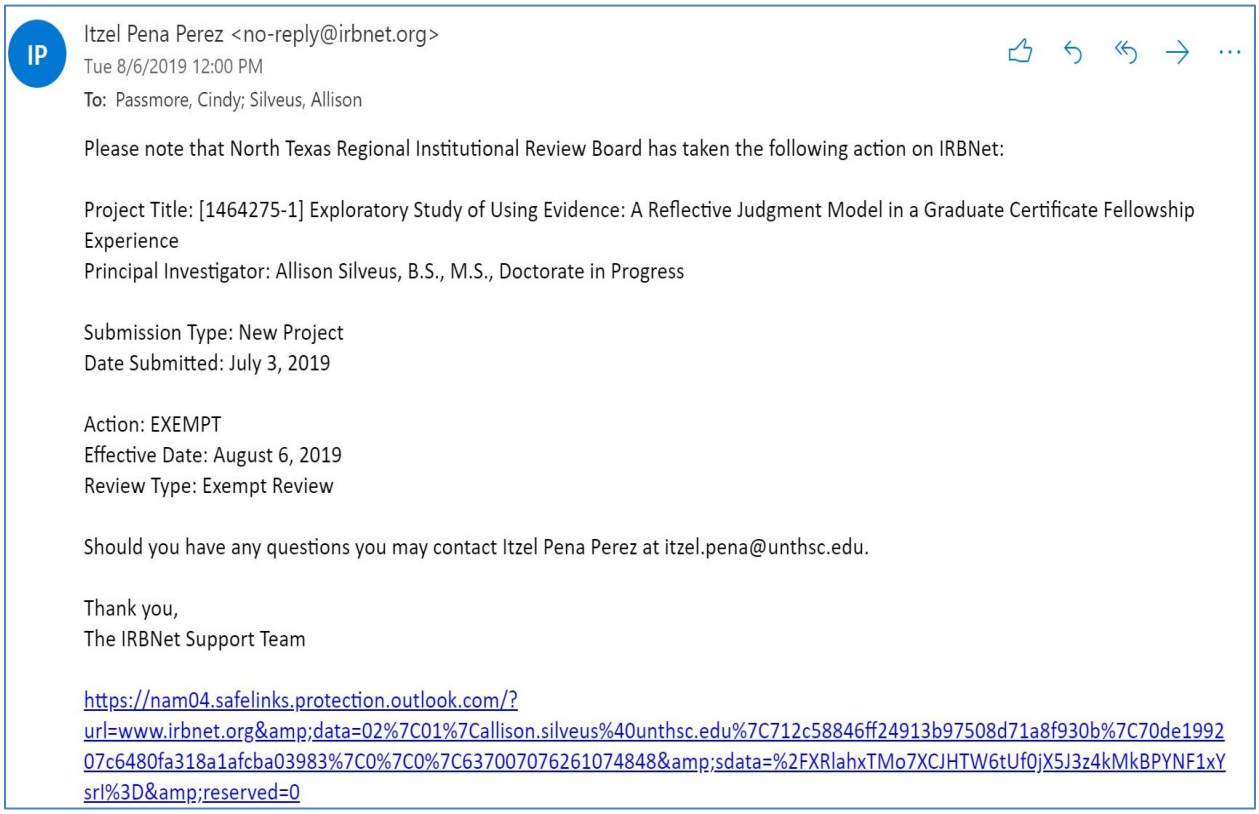
APPENDIX A: Proof of Approval from UNTHSC IRB Net for Package 14642275-1



IP

Itzel Pena Perez <no-reply@irbnet.org>
Tue 8/6/2019 12:00 PM
To: Passmore, Cindy; Silveus, Allison

Please note that North Texas Regional Institutional Review Board has taken the following action on IRBNet:

Project Title: [1464275-1] Exploratory Study of Using Evidence: A Reflective Judgment Model in a Graduate Certificate Fellowship Experience
Principal Investigator: Allison Silveus, B.S., M.S., Doctorate in Progress

Submission Type: New Project
Date Submitted: July 3, 2019

Action: EXEMPT
Effective Date: August 6, 2019
Review Type: Exempt Review

Should you have any questions you may contact Itzel Pena Perez at itzel.pena@unthsc.edu.

Thank you,
The IRBNet Support Team

https://nam04.safelinks.protection.outlook.com/?url=www.irbnet.org&data=02%7C01%7Callison.silveus%40unthsc.edu%7C712c58846ff24913b97508d71a8f930b%7C70de199207c6480fa318a1afcba03983%7C0%7C0%7C637007076261074848&sdata=%2FXRlahxTMo7XCJHTW6tUf0jX5J3z4kMkBPYNF1xYsrI%3D&reserved=0

APPENDIX B: Evidence Based Decision Making Pre-Test

Please indicate your name below. This is only for the purpose of interview selection and your name will be removed and assigned to a random number for all presentations and future work.

_____

Page Break

How do you or would you go about designing a curriculum for your home institution?

_____

_____

_____

_____

_____

Page Break

On a scale from 0=Not at all Confident to 100=Extremely Confident, please pull the sliding bar to reflect how confident are you in your ability to.....

Not at all Confident Extremely Confident

Identify a gap in your knowledge related to curriculum design/implementation.	
Formulate a research question to guide a literature search based on a gap in your knowledge regarding the curriculum.	
Effectively conduct an online literature search to address the question regarding the curriculum.	
Critically appraise the strengths and weaknesses of current curriculums based on evidence.	
Critically appraise the measurement properties (e.g. reliability & validity, sensitivity & specificity) of standardized tests or assessment tools you are considering using in your curriculum development.	
Interpret data results obtained from curriculum evaluation by using statistical tests such as t-test or chi-square tests.	
Interpret data results obtained from curriculum evaluation using statistical procedures such as linear or logistic regression.	
Determine if evidence from the curriculum design research literature applies to your curriculum maintenance or enhancement.	
Summarize the research evidence to answer your problem identification as it pertains to development of a curriculum.	
Interpret data results obtained from curriculum evaluation by using focus groups, interviews or other qualitative methods.	
I am interested in research/learning more about research.	
I feel comfortable in reading scholarly articles.	
I feel comfortable contributing to group discussions about articles.	
I understand research articles thoroughly.	
I can lead a group discussion about an article comfortably.	

On a scale from 0=Not at all Confident to 100=Extremely Confident, please pull the sliding bar to reflect how confident are you in .....

	Low Level of Confidence	High Level of Confidence
Conducting *qualitative* research to identify a need and design curriculum.		
Conducting *quantitative* research to identify a need and design curriculum.		
Conducting *mixed methods* research to identify a need and design curriculum.		

End of Block: Background

Start of Block: Sources of Evidence

What sources would you use to design a curriculum at your institution? Check all that apply.

- [ ] Observations
- [ ] Teacher-Teacher Feedback
- [ ] Student-Teacher Feedback
- [ ] Focus Group
- [ ] Interviews
- [ ] Surveys
- [ ] Student Journals
- [ ] Literature Search
- [ ] Web Search
- [ ] Other _____
- [ ] None

End of Block: Sources of Evidence

Start of Block: Thank you!

Thank you for participating!

End of Block: Thank you!

APPENDIX C: Semi-Structured Interview from IRB-14642275-1

Consent & Background

1. Do you agree to participate in this interview?
2. Could you please state your name?
3. Can you tell me about where you work and what you do?

Domain 1 (Using Research Evidence for Design)

1. What sources would you use to support the design for your curriculum?
2. How confident do you feel in using these sources for curriculum design purposes?
3. How confident do you feel in presenting your curriculum to a group based on these sources?
4. How would you describe your level of comfort with using research to design curriculum?

Domain 2 (Identifying Curricular Gaps)

1. What sources would you use to identify the current curriculum gap at your home institution?
2. How confident do you feel in presenting your curriculum to a group based on your identified curriculum gap?
3. How would you describe your level of comfort in identifying curricular gaps?

Domain 3 (Analyzing Curriculum)

1. What tools would you use to appraise a medical curriculum?
2. How confident do you feel in appraising/analyzing medical curriculum?
3. How would you describe your comfort level with analyzing current curriculum?

Domain 4 (Implementation of Curriculum Based on Evidence)

1. How confident are you in implementing your proposed curriculum?
2. What would you plan to utilize to create stakeholder buy-in on the implementation of your curriculum at your home program?
3. How confident are you in using the above sources mentioned to get the buy-in?
4. How would you describe your comfort level with implementing and redesign curriculum year after year?

Follow up-

1. Is there anything you would like to say that you have not had the opportunity to say in the interview?

APPENDIX D: Post-Survey on Evidence-Based Decision-Making Associated with

(UNTHSC-IRB NET 14642275-1)

Page Break

How do you or would you go about designing a curriculum for your home institution?

_____

_____

_____

_____

_____

Page Break

On a scale from 0=Not at all Confident to 100=Extremely Confident, please pull the sliding bar to reflect how confident are you in your ability to.....

Not at all Confident Extremely Confident

Identify a gap in your knowledge related to curriculum design/implementation.	
Formulate a research question to guide a literature search based on a gap in your knowledge regarding the curriculum.	
Effectively conduct an online literature search to address the question regarding the curriculum.	
Critically appraise the strengths and weaknesses of current curriculums based on evidence.	
Critically appraise the measurement properties (e.g. reliability & validity, sensitivity & specificity) of standardized tests or assessment tools you are considering using in your curriculum development.	
Interpret data results obtained from curriculum evaluation by using statistical tests such as t-test or chi-square tests.	
Interpret data results obtained from curriculum evaluation using statistical procedures such as linear or logistic regression.	
Determine if evidence from the curriculum design research literature applies to your curriculum maintenance or enhancement.	
Summarize the research evidence to answer your problem identification as it pertains to development of a curriculum.	
Interpret data results obtained from curriculum evaluation by using focus groups, interviews or other qualitative methods.	
I am interested in research/learning more about research.	
I feel comfortable in reading scholarly articles.	
I feel comfortable contributing to group discussions about articles.	
I understand research articles thoroughly.	
I can lead a group discussion about an article comfortably.	

On a scale from 0=Not at all Confident to 100=Extremely Confident, please pull the sliding bar to reflect how confident are you in .....

	Low Level of Confidence	High Level of Confidence
Conducting *qualitative* research to identify a need and design curriculum.		
Conducting *quantitative* research to identify a need and design curriculum.		
Conducting *mixed methods* research to identify a need and design curriculum.		

End of Block: Background

Start of Block: Sources of Evidence

What sources would you use to design a curriculum at your institution? Check all that apply.

- [ ] Observations
- [ ] Teacher-Teacher Feedback
- [ ] Student-Teacher Feedback
- [ ] Focus Group
- [ ] Interviews
- [ ] Surveys
- [ ] Student Journals
- [ ] Literature Search
- [ ] Web Search
- [ ] Other _____
- [ ] None

End of Block: Sources of Evidence

Start of Block: Thank you!

Thank you for participating!

End of Block: Thank you!

VITA

Allison Brown Silveus, MS
University of North Texas Health Science Center
Texas College of Osteopathic Medicine
Email: Allison.silveus@unthsc.edu

Area of Expertise

Allison Silveus is an Educational Program Manager for the University of North Texas Health Science Center Texas College of Osteopathic Medicine Faculty Development Center. Prior to this role, she was a research assistant at UT Southwestern Medical Center, where she performed DNA typing. While at Texas Christian University (TCU), she had the privilege of being accepted for the TCU Global Outlooks Leadership program, publishing work on English Language Learners use of hybrid language (2018), and presentation of research on in-group bias in a STEM program (2018). She co-founded Unbent Inc., which is a neurodiversity tool for assessing decision-making.

Qualifications

B.S. Biology, University of Texas at Arlington

M.S. Forensic Genetics, University of North Texas Health Science Center

Publications

Silveus, A. (2 September 2020). What businesses don't understand about recruiter bias when it comes to diversity, equity and inclusion. *Fort Worth Business Press*. https://fortworthbusiness.com/opinion/commentary-what-businesses-dont-understand-about-recruiter-bias-when-it-comes-to-diversity-equity-and-inclusion/

(Accepted Submission to Star Scholar Book Series) **Silveus, A.**, & Ekpe, L. The evolution revolution: The application of a leadership adaptation continuum to the future of global higher education post COVID-19.

Przymus, S., Sparks, D., Garcia, S., **Silveus, A**., & Cartmill, C. (Submitted to Journal). From imagined to in-practice and performed STEM identities: Measuring the impact of a Latina STEM fellowship on the educational trajectories of Latina high school students. Cultural Studies in Science Education.

Sparks, D., Przymus, S., **Silveus**, **A**., de la Fuente, Y., & Cartmill, C. (Submitted to Journal). Navigating the intersectionality of race, culture, and gender identity as an aspiring Latina STEM student. Race, Ethnicity & Education.

Wu, S., **Silveus**, **A**., Vasquez, S., Biffi, D., Silva, C., & Weinburgh, M. (2018). Supporting ELLs' use of hybrid language and argumentation during science instruction. *Journal of Science Teacher Education*, *30*(1), 24–43. https://doi.org/10.1080/1046560X.2018.1529520

Zou, Y., Qin, Z., **Silveus,** A., Fan, Y., & Stastny, P. (2009). Polymorphisms of MICA recognized by human alloantibodies. *Immunogenetics*, *61*(2), 91–100. https://doi.org/10.1007/s00251-008-0344-9