Assessing Learning Outcomes of a Novel Health Equity Module Among Residents at Vanderbilt

University Medical Center

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In partial fulfillment of the requirements for the degree of

Doctor of Education in Leadership and Learning in Organizations

Peabody College of Education and Human Development

Acknowledgements

To my parents, including my beloved mother who passed earlier this year, without whom none of this would be possible. Thank you for always having confidence in my abilities—even when I struggled to do so—and for your endless support. I hope I made you proud. This is for you, Mom.

To my husband, Adam. Your encouragement and belief in me enabled me to go on when I didn't think I could. I would not be where I am today without you. I love you.

To my son, whom, as of this submission, we expect any day now. Thank you for giving me the strength to get through the most difficult challenge I've ever faced. We love you so much already, and are so fortunate to be your parents.

To Tom and Annie. Thank you for your championship and for encouraging me to apply to Vanderbilt. I owe you a debt of gratitude that can never be repaid.

To Michael Neel. Thank you for your patience, guidance, and unending support when I struggled to find my footing.

Executive Summary

Partner Organizations

Vanderbilt University Medical Center:

- Serves ~2M patients per year
- ACGME Sponsoring Institution
- 100 residency and fellowship programs
- ~1060 physician trainees

University of Mississippi Medical Center:

- Largest academic medical center in MS
- ACGME Sponsoring Institution
- 64 residency and fellowship programs
- ~635 physician trainees (ACGME, 2021d)

Organizational Context

Goals of Life and Learning Delineated (GOL²D)

Joint project funded by the American Medical Association's Reimagining Residency grant program

"The goal of Reimagining Residency…is to transform residency training to best address the workplace needs of our current and future health care system." (AMA, 2020)

GOL²D Aim

Align the needs of graduate medical education practitioners with those of their patients, communities, and healthcare systems (Semler, 2018)
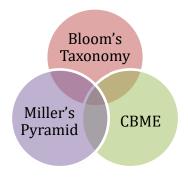

GOL²D Innovative Curriculum

Problem of Practice

The GOL²D project aims to prepare VUMC and UMMC residents for practice in today's diverse and complex health systems.

To do so, the organizations must cultivate a research-informed approach to assessing resident learning outcomes as they pertain to the GOL²D baseline health equity module to determine its effectiveness.

Conceptual Frameworks

REDCap Survey Tool

- Pre-module/post-module surveys
- Sample size: all 2021 incoming Vanderbilt residents (n=195)
- Setting: incoming resident week – June 2021
- 10 competency-based statements
- 6-point Likert-style response scale
- Also included demographic and prior experience questions

Example Competency-Based Statement:

Based on your experience in the health equity elective sessions, please answer the following questions regarding your knowledge, skills, intended behaviors, and beliefs. Your answers are anonymous.

	Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I can describe social determinants of health common to the general population.	☐	☐	☐	☐	☐	☐

Findings: Guiding Research Questions

Research Questions – Categorized by Competency	Findings: Agree + Strongly Agree		
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **knowledge**? (n=2)	Pre-Survey	Post-Survey	Difference
	93%	98%	↑5%
	54%	96%	↑42%
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **clinical skills**? (n=5)	Pre-Survey	Post-Survey	Difference
	92%	97%	↑5%
	91%	97%	↑6%
	86%	96%	↑10%
	37%	92%	↑55%
	36%	91%	↑55%
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **behaviors**? (n=1)	Pre-Survey	Post-Survey	Difference
	74%	96%	↑21%
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **attitudes**? (n=2)	Pre-Survey	Post-Survey	Difference
	97%	98%	↑1%
	98%	99%	↑1%

Recommendations

01

Change REDCap anonymity response settings to allow for broader statistical analysis

02

Incorporate objective assessment methods into tiers 1-4 (e.g., tracking resident referrals to resource orgs)

03

Use prior experience data to identify gaps in current VUMC curriculum/

potential learning opportunities

04

Consider format for future iterations

Is Zoom appropriate for UMMC implementation? VUMC 2.0?

05

Increase sample size for future research by scaling out to other ACGME sponsoring organizations

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Introduction

The COVID-19 pandemic has served as a stark reminder of two longstanding, and undeniably linked, systemic issues in the United States: social inequity and health outcomes disparity (Scheiber, et al., 2020; Moore, et al., 2020). As noted by Moore, et al. (2020), "virtually all the underlying health conditions most strongly associated with negative outcome from COVID-19 are disproportionately higher in minority groups and those in challenging socioeconomic conditions" (p. 11040). To combat these issues at the graduate medical education (GME) level, Vanderbilt University Medical Center (VUMC) developed a novel baseline e-learning module on health equity that was assigned to all incoming residents as part of the 2021 orientation process. The project, "Goals of Life and Learning Delineated" (GOL^{2}D), is funded by the American Medical Association's "Reimagining Residency" grant (AMA, 2020; Semler, 2018), and is a joint venture between VUMC and the University of Mississippi Medical Center (UMMC) (AMA, 2020; Semler, 2018). The purpose of this investigation is to cultivate a research-informed approach to assessing resident learning outcomes as they pertain to the baseline module with the larger goal of readiness for practice in today's diverse and complex health systems (Semler, 2018).

Context

Vanderbilt University Medical Center (VUMC) located in Nashville, Tennessee, is one of the largest academic medical centers in the Southeast United States, providing care to more than 2 million patients per year (VUMC, 2020). It also serves as the sponsoring institution for 100 Accreditation Council for Graduate Medical Education (ACGME) accredited residency and fellowship training programs, comprised of approximately 1060 physician trainees (ACGME, 2021d). Per ACGME (2021c), a sponsoring institution maintains "ultimate authority and…

Oversight of resident/fellow assignments and of the quality of the learning and working environment" of its accredited programs (p. 1). For the purpose of this project, the term "resident" will be used to refer to residents and fellows, interchangeably.

In contrast to VUMC's size and organizational structure, UMMC, also an ACGME sponsoring institution, is home to 64 accredited programs comprised of 635 residents (ACGME, 2021d). The UMMC system encompasses six hospitals, approximately 30 clinics, and more than 200 telehealth sites (Semler, 2018).

The portion of the GOL^{2}D project discussed herein is led by grant Co-Principal Investigators Dr. Kyla Terhune, Vice President for Educational Affairs and Associate Dean for Graduate Medical Education at VUMC, and Dr. Jimmy Stewart, Associate Dean for Graduate Medical Education at UMMC. Also involved in the grant are several Co-Investigators and other key personnel comprised of faculty from both VUMC and UMMC, as well as a dedicated grant manager (Semler, 2018). I was afforded the opportunity to collaborate on the GOL^{2}D project through my role as a doctoral student at Vanderbilt University's Peabody College with nearly ten years' worth of professional experience in graduate medical education. Upon establishing a relationship with Dr. Terhune, I requested to work on the assessment component based on personal and professional interest.

During my tenure in GME at the University at Buffalo, I created a rubric to assist program directors with developing goals and objectives, which are required by ACGME for all educational experiences (commonly referred to as "rotations"). Based on nearly a decade of professional experience, I found that program directors often struggle to define measurable objectives. For example, stating that, by the end of a rotation, a resident will understand issues

common in cancer care. What types of issues, specifically? How will the program director be able to determine that the resident understands them?

As noted above, one of the chief objectives of the GOL^{2}D project is to incorporate issues relating to social inequity and health outcomes disparity into VUMC's and UMMC's resident curricula (Semler, 2018). Specifically, the project "align[s] the evolving needs of GME with those of their patients, their communities, and healthcare systems" (Semler, 2018, p. 1). To do so, members of the GOL^{2}D team identified several crucial "'capacity domains'" relevant to resident education, including the "Structurally Competent, Structurally Humble (SCSH) physician," which served as a focus of this project (Semler, 2018). Core characteristics of the SCSH physician described in a supplement to the grant submission include:

- Understanding the importance of social and cultural context as it relates to patient care

- Collaborating with community organizations outside the healthcare sphere

- Having the humility to learn from the community

- Advocating for policy change

- Effectively building/sustaining trust (Terhune, 2019).

These characteristics represent the competencies (i.e., knowledge, skills, behaviors, and attitudes) needed to deliver equitable care across diverse patient populations (Semler, 2018). In order to incorporate these competencies into their resident curricula, VUMC and UMMC collaborated to develop four tiers of integrated, interdisciplinary experiences (IIEs), which are described below (Semler, 2018). This capstone investigation focuses on assessment of residents' capacities as it relates to the first tier of the SCSH domain, the didactic component, which was developed at VUMC with content input from UMMC. The four tiers are:

1. A core didactic (baseline) module providing exposure to key concepts relating to the SCSH domain

2. An experiential component (i.e., rotation) that will be individualized to learners' needs

3. Iterative, interdisciplinary reflection exercises (e.g., workshops)

4. Additional capstone products for dissemination and/or advancement of the domain (Semler, 2018).

The term assessment may be used with different connotations. For the purpose of this project, assessment will refer to "'systematic methods for collecting valuable and reliable evidence of what [learners] know and can do at various stages'" (Praslova, 2010, p. 217). In this case, the evidence will be based on the module's stated goals and objectives, which will be discussed in detail in a later section. The results of the assessment will inform the second iteration of the GOL^{2}D health equity orientation module administered by both VUMC and UMMC in June 2022. Module objectives were developed by consensus and adapted from objectives for an existing social medicine rotation. Following completion of the orientation curriculum, residents should be able to:

- Recognize health disparities, identify the factors that contribute to them, and formulate approaches to their future practice to address them.

- Recognize that addressing patients' social determinants of health is a key responsibility of all health professionals.

- Describe internal VUMC services and external community resource organizations that address patients' social determinants of health.

- Discuss topics relevant to social and structural factors impacting health and identify patient and community needs that illustrate the core concepts of health equity.

- Demonstrate a sense of ownership and personal empowerment in addressing patients' social determinants of health and making change through humility and empathy.

- Discover levers to create change, demonstrating an understanding of health inequities.

- Create conversations around race, privilege, and bias and their effects on health and well-being using the space provided using respectful language.

Given that this investigation is limited to didactic instruction, I acknowledge that sustained, meaningful change is not likely to occur. The module was developed to serve as an introduction to the social and structural factors impacting health, complemented by the other IIEs.

Problem Statement and Statement of Purpose

Vanderbilt University Medical Center (VUMC), in conjunction with the University of Mississippi Medical Center (UMMC) developed a novel orientation module to instruct residents on the social and structural factors that impact health outcomes, including race and other forms of social inequity (e.g., sexual and gender identity). These factors are apropos to VUMC and UMMC, which have historically served diverse populations. To gauge the effectiveness of the new curriculum, the organizations must identify and employ an appropriate learning outcome assessment method. In light of the potentially devastating adverse impact of health outcomes disparity, which will be described in further detail below and include increased risk of chronic diseases and/or premature death (The Academies, 2017), it is crucial that the organizations are able to measure the effectiveness of the instruction. Therefore, the purpose of this capstone is to investigate, implement, and study the effectiveness of assessment practices in these areas to make recommendations for future iterations of the module.

Literature Review

In this section, I will explore relevant literature regarding three topics central to this capstone project: social inequity and health outcomes disparity; medical education didactic teaching pedagogy; and medical education learning outcomes assessment. I will elaborate on the latter in a later section devoted to conceptual frameworks.

Social Inequity and Health Outcomes Disparity

The U.S. Department of Health and Human Services (HHS) defines social determinants of health as "conditions in the environments where people are born, live, learn, work, play, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks" (HHS, 2021b). While there are many social determinants of health, this investigation focuses on race, socioeconomic status, and LGBT status based on their inclusion in the GOL^{2}D health equity module curriculum. To better focus the questions of learning and assessment in medical education, I will begin with a review of the concepts that form the substance of the model under investigation.

Race

As noted by Hansen and Metzl (2019), social constructs have served as determinants of health in the U.S. for centuries. These constructs include "wealth, employment, health care, housing, incarceration, and education, along with experiences of stigma and discrimination" (Hansen & Metzl, 2019, p. vi). In terms of discrimination, Dr. Samuel Cart, a pre-Civil War physician thought to be an expert in "'Negro medicine,'" argued that forced labor was good for African Americans because they had lower lung capacity than whites (Hansen & Metzl, 2019, p. vi). Today, COVID-19 infection and death rates of predominantly black counties are three times

higher than those in predominantly white counties (Moore, et al., 2020). Per Moore, et al. (2020), this is due to a combination of the constructs noted above:

> "Minority and low-income communities are least likely to have jobs capable of remote working, more likely deemed as essential workers and more likely to live in high-density areas in large metropolitan areas due to affordability, all of which intensifies their chances of getting infected" (p. 11043).

Furthermore, Black women in the U.S. are three times more likely to succumb to maternal death than white women, and Black infants are far more likely to be born premature than whites (Melillo, 2020). Researchers noted stress level, access to prenatal care, and food insecurity as factors contributing to these outcomes (Melillo, 2020).

In terms of relevance to the project, July 2019 data from the U.S. Census Bureau (USCB) showed that 27.6% of the Nashville-Davidson metro population identifies as Black or African American (2019a). In Jackson, Mississippi, where UMMC is located, 82% of the population identifies as Black or African American (USCB, 2019b). Given these circumstances, VUMC and UMMC must be able to assess learning outcomes of the baseline module in order to determine whether its residents are equipped to care for patients from racially diverse backgrounds.

Social determinants of health and health outcomes disparity extend beyond the Black and African American population to other minority groups. According to the HHS, nearly one in six people living in the U.S. (approximately 57 million) identifies as Hispanic (2020). While the Hispanic death rate in the U.S. is 24% less than non-Hispanic whites, Hispanics are still 50% more likely to die of diabetes and/or liver disease (HHS, 2020). Of all the racial and ethnic groups in the U.S., Hispanics have the highest uninsured rates: 49% versus 75.4% for non-Hispanic whites (HHS, 2020). The issue of underinsurance is extremely problematic given the

increased rate of comorbidity noted above and the fact that Hispanics earn far less than their white counterparts (HHS, 2020). According to a 2017 Census Bureau report, Hispanic/Latino households earned $49,793 annually while non-Hispanic white households earned $65,845 (HHS, 2020). As with the findings noted above, these data are relevant given the diverse patient populations treated by VUMC and UMMC residents. According to the 2019 U.S. census, Hispanics or Latinos accounted for 10.4% and 15.9% of Nashville's and Jackson's populations, respectively (USCB, 2019a, USCB, 2019b).

While I refer to "race" within this section and throughout the investigation, I do so with the understanding that race is a social construct and should not be conflated with biological truth (Jones, 2001). Even so, Jones (2001) argued that race is a reliable predictor of health in the U.S., in part because it illuminates race-associated health outcomes disparities.

Socioeconomic Status

Socioeconomic status (SES) has been found to affect health in all phases of the life cycle (Price, et al., 2018). For example, maternal poverty is a strong predictor of low birth weight (Strully, et al., 2010), which is in turn associated with increased risk of conditions such as "diabetes, asthma, heart disease, attention deficit/hyperactivity disorder, infections, and premature mortality" (Price, et al., 2018, p. 171). Research has also revealed a notable discrepancy in life expectancy between the top and bottom 1% of the U.S. income distribution: 10 years for women and 15 years for men (Price, et al., 2018). There are numerous structural factors driven by SES that affect health outcomes, including access to medical care, safe and affordable housing, parks and green space, and quality and affordable food (The Academies, 2017). In addition to the immediate effects experienced at the depravation of these resources,

families also suffer from chronic stress, which may manifest itself through hostility and depression (Price, et al., 2018).

We must acknowledge the intrinsic link between SES and race in the U.S., given that poverty disproportionately affects minoritized individuals, including African Americans and Hispanics (Price, et al. 2018; Sotto-Santiago, 2019). In 2016, African Americans accounted for more than 25% of the population of "'extremely poor neighborhoods,'" those in which 40% or more of inhabitants live below the federal poverty line (Price, et al., 2018, p. 171). The same year, Hispanics had the second highest poverty rate by race/ethnicity: 19.4% versus 22% for African Americans (Price, et al., 2018). These statistics correlate to the disparate health outcomes experienced by African American and Hispanics noted above, such as infant prematurity/low birth weight and higher incidences of chronic diseases such as diabetes.

LGBT Status

Individuals identifying as LGBT (lesbian, gay, bisexual, and transgender), also experience unique health-related struggles and disparities, which serve as a focal element of the orientation module (HHS, 2021a). Perhaps the most devastating effect of LGBT status on health outcomes was the HIV/AIDS epidemic of the 1980s (Valdiserri, et al., 2019) when homophobia resulted in "'Abolish[ing] the practice rather than the virus'" (Poirier, 1988, p. 468). Policy makers were reluctant to promote measures such as the use of condoms and safe sex practices, lest it be interpreted as condoning "'a reprehensible and forever-to-be-prohibited sexual practice'" (Poirier, 1988, p. 468). So much so that in 1987 the U.S. Senate approved, by a vote of 94-2, a measure prohibiting the use of federal funds for AIDS education resources that referenced homosexuality as part of the Labor-HHS-Education appropriations bill (Lawrence, 1987). Any materials produced with the help of Center for Disease Control (CDC) funds would

need to promote abstinence based on concerns raised by Senator Jesse Helms, R-N.C., who argued that "'…We've got to call a spade a spade and a perverted human being a perverted human being, not in anger but in realism'" (Lawrence, 1987). Helms' argument was rebutted by Senator Lowell Weicker, R-Conn, who noted that the moralization of HIV/AIDS education would result in the unnecessary loss of life (Lawrence, 1987). The following year, HIV/AIDS was the third leading cause of death for U.S. men aged 25-44 (CDC, 1991).

Members of the transgender community also face unique challenges when it comes to obtaining equitable health care (Safer, et al., 2016). For example, one frequently cited barrier to care among transgender individuals is lack of access due to a paucity of knowledgeable providers (Safer, et al., 2016; Sanchez, et al., 2009). Care of the transgender patient is not included in mainstream medical curricula (Safer, et al., 2016), making it difficult to find trans-friendly and trans-knowledgeable practitioners (Sanchez, et al., 2009). Trans and other sexual minorities also report disproportionately higher rates of mental health problems, including increased risk of depression, anxiety, and substance abuse disorder (Valdiserri, et al., 2019; Safer, et al., 2016).

Although many physicians are aware that disparities exist amongst these communities (IOM, 2001; Maldonato, et al., 2014), medical education has not historically prioritized engaging trainees in the processes aimed at mitigating such disparities. In what follows, I provide an overview of medical education and then return to considerations of how medical education curricula can be used to help trainees learn about disparate health outcomes.

Medical Education Didactic Teaching Pedagogy

Per Gourevitch (1999), structured didactics have been a part of medical education since the late 10th century. According to the American Psychological Association, didactics are "'planned sessions of instruction'" within a training curriculum (Zuckerman, et al., 2020, p.

194). Prior to its use, "doctors-to-be" functioned as apprentices, rather than students (Gourevitch, 1999, para. 1). At the time didactics were introduced, physician training was mostly based on book learning; however, "didactic methods gave this rational knowledge and its epistemology an academic dignity" (Gourevitch, 1999, para. 1). Centuries later, didactic pedagogy is still prevalent in graduate medical education, and especially central to the first two years of curriculum in most medical schools. The Accreditation Council for Graduate Medical Education (ACGME), which sponsors all graduate medical education programs in the U.S. (2021a), requires programs to provide residents with protected time to participate in didactic activities as a component of accreditation (ACGME, 2021b). Per ACGME (2021b), these activities can include, but are not limited to: "lectures, conferences, courses, labs, asynchronous learning, simulations, drills, case discussions, grand rounds, didactic teaching, and education in critical appraisal of medical evidence" (p. 19). A sample residency didactic schedule from the University of Tennessee Chattanooga Obstetrics and Gynecology (OB/GYN) residency program is seen in Figure 1, below:

	10/4	10/11	10/18	10/25
AT→	Department Conference Room C-720	Department Conference Room C-720	Department Conference Room C-720	Department Conference Room C-720
0715 to 0759	Dr. Kipikasa: "(DKA) Diabetic Ketoacidosis"	Chair/Resident Meeting	Dr. Adair: Drug Theory	Department Research
0800 to 0859	Chief Lecture: CREOG Review	REI: Dr. Donesky	Dr. Connor: "Perioperative Care"	Dr. DePasquale: "Onc Lecture"
0900 to 0959	Dr. Frank Kimsey: "Radiation Basics"	Dr. Sticco: "Introduction of Laparoscopy"	Dr. Sunny "Physician Wellness"	UroGyn Specialty Lecture
1000 to 1059	Elaine Peters-Gannon: "Social Equity in OB/GYN"	Dr. Bossert: "Colposcopy"	MFM: Dr. Torres "Thyroid Disease in Pregnancy" Gabble Ch. 42	Janet Ulm: Genetics Part 2
1100 to 1159	Clinic Committee Meeting			Program Director Meeting

Figure 1. University of Tennessee Chattanooga OB/GYN residency didactic schedule

While didactic pedagogy is widely utilized in modern medical education curricula, it is not without its criticisms, specifically as they relate to lectures. Noted American educator Hamilton Holt, a contemporary of John Dewey, once described lecture as "'that mysterious process by means of which the contents of the professor's notebooks are transferred by means of the fountain pen to the pages of the student's notebooks without passing through the minds of either'" (Cooper & Richards, 2016, p. 376). From an adult learning perspective, this is the result of cognitive load (Wong, et al., 2012). As learners encounter new information, working memory is used to integrate the new material with existing knowledge (Cooper & Richards, 2016). Over the course of a lecture, more information is received than can be adequately processed by working memory, which results in interference, a "decrease in the capacity to effectively incorporate new information in a meaningful and efficient manner" (Cooper & Richards, 2016, p. 377). Wong, et al. (2012),

described this as the transient information effect, which "occurs when instruction procedures [such as lectures] present information in a form that is transient and difficult to retrieve rapidly and when required" (p. 449). VUMC hopes to mitigate against these pitfalls by incorporating quizzing and immediate feedback into the module, both of which have been shown to increase retention (Agarwal, et al., 2012). This brings forth an important question: What is learning, and how can an instructor know when learning has occurred?

Cognitive Science and Cognitive Learning Theory

There are numerous ways to conceptualize human learning (Sfard, 1998). Historically, learning scientists have tended to align with approaches that are more or less oriented toward one of three theories of learning: behaviorist theories (Osgood, 1956), cognitivist theories (Thagard, 2005), or situative theories (Lave & Wenger, 1991). Although each theory presents potentially valuable perspectives on understanding human learning, cognitive science has offered particularly helpful directions for assessment projects' focused capacity to access and retrieve information (Thagard, 2005). Early learning theorists posited that learning was "a process of forming connections between stimuli and responses" (Bransford, et al., 1999, p. 6). However, critics pointed out that this limited empirical investigation of human learning to observable behaviors and conditions alone (Bransford, et al., 1999). By the late 1950s, the study of learning took a multi-disciplinary approach in an acknowledgement of the increasing complexity of humans and human environments (Bransford, et al., 1999). Known as "cognitive science," the field considered aspects of "anthropology, linguistics, philosophy, developmental psychology, computer science, neuroscience, and several branches of psychology" (Bransford, et al., 1999, p. 8). As noted by Nobel Laureate Herbert Simon, "the meaning of 'knowing' has shifted from being able to remember and repeat information to being able to find and use it" (Bransford, et al., 1999, p. 5).

Cognitive science shows us that there is a difference between "'useable knowledge'" and isolated facts (Bransford, et al., 1999, p. 9). Expert knowledge is:

"connected and organized around important concepts (e.g., Newton's second law of motion); it is 'conditionalized' to specify the contexts in which it is applicable; it supports understanding and transfer (to other contexts) rather than only the ability to remember" (Bransford, et al., 1999, p. 9).

An important element of cognitive learning theory is transfer—the ability to apply learning from one context to another (Bransford, et al., 1999). More specifically, Broad (1997) defined learning transfer as "effective and continuing application by learners—to their performance of jobs or other individual, organizational, or community responsibilities—of knowledge and skills gained in the learning activities" (p. 2). Transfer is important because it can be used to assess individuals' learning experiences—allowing us to identify when learning has occurred (Bransford, et al., 1999).

Medical Education Learning Outcomes Assessment

Today, many medical education assessment methods utilize the cognitive model of information storage and retrieval coupled with transfer. For example, during a didactic lecture residents activate stored knowledge from medical school and transfer it to create new knowledge. This new knowledge may be stored in long-term memory for additional application (Schmidt & Mamede, 2020).

In addition to didactics, the Accreditation Council for Graduate Medical Education (ACGME, 2021b), requires both formative and summative assessment of resident physicians. The ACGME defines formative assessment as "*monitoring resident learning* and providing ongoing feedback that can be used by residents to improve their learning in the context of provision of

patient care or other educational opportunities" (2021b, p. 27). Summative assessment involves evaluating residents' learning by comparing residents with the goals and objectives of the educational experience (ACGME, 2021b). Additionally, residents must be evaluated by faculty, peers, themselves (via self-evaluation), and other professional staff members with whom they interact (e.g., registered nurses, social workers, advanced practice providers, etc.) (ACGME, 2021b). While the ACGME is proscriptive insomuch as it relates to these components of assessment, programs are provided leeway in regard to method and modality. These methods and modalities vary based on many factors, which will be discussed in the following section on conceptual frameworks.

The exploration of these pedagogical practices is intended to provide context regarding the application of the assessment models that form the basis of the conceptual frameworks to the field of medical education. Those models are discussed in further detail below.

Conceptual Frameworks

This investigation draws on conceptual elements from three assessment models commonly used in higher education: Bloom's Taxonomy, Miller's Pyramid of Competency, and Competency-Based Medical Education. Together, the models help to identify an effective assessment method that I used to design measures of resident learning outcomes in terms of the health equity module described above.

Bloom's Taxonomy

According to Bloom (1956), the taxonomy that bears his name was developed to aid educators in assessing the effectiveness of their programs by defining and classifying levels of development. These levels included "activities such as remembering and recalling knowledge, thinking, problem solving, creating" (p. 2). In 2001, the model was revised to include five levels

of categorization: remember, understand, apply, analyze, evaluate, and create (Morton & Colbert-Getz, 2017; Anderson, et al., 2001). The revised taxonomy moves from the lowest level of cognition (i.e., remember) to the highest (i.e., create) (Morton & Colbert-Getz, 2017). The updated taxonomy can be seen below in Figure 2:
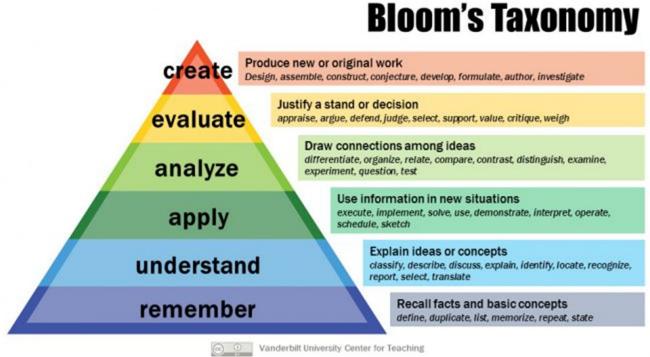

Figure 2: Bloom's Taxonomy, Vanderbilt University Center for Teaching

As seen in Figure 2, the levels of cognition are accompanied by educational objectives, which Bloom, et al. described as "…ways in which students are expected to be changed by the educative process…That is, the ways in which they will change in their thinking, their feelings, and their actions" (1956, p. 26). The objectives are measurable, as Bloom and his colleagues felt that a standard classification would facilitate intersubjectivity, or "common ground" (Bloom, et al., 1956, p. 1).

> "For example, some teachers believe that their students should 'really understand,' others desire their students to 'internalize knowledge,' still others want their students to 'grasp the core or essence' or 'comprehend.' Do they all mean the same thing? Specifically, what

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does a student do who 'really understands' which he does not do when he does not understand?" (Bloom, et al., 1956, p. 1).

This concept of intersubjectivity was alluded to in the earlier anecdote regarding resident goals and objectives (i.e., "How do I know they know?").

Per Morton and Colbert-Getz (2017), medical education assignments should align with the expected level of cognition. Additionally, the ACGME (2021b) requires accredited programs to provide residents with goals and objectives for each distinct educational experience (commonly referred to as a rotation). Bloom's Taxonomy was useful in the development of the orientation module goals and objectives in that it allowed me to articulate specific and measurable learning targets by which the effectiveness of the curriculum could be assessed.

Miller's Pyramid of Competency

Where Bloom's model is helpful in crafting learning aims, Miller's helps to identify the assessment outcomes used to evaluate those performance aims (e.g., Objective Structured Clinical Examinations, or OSTEs). Miller's Pyramid of Competency was introduced by American psychologist George Miller in 1990 (Corbetta, et al., 2019). The model is based on the shape of a pyramid and is comprised of four levels "integrating basic knowledge with clinical skills and personal skills into the actions performed" (Corbetta, et al., 2019, p. 205). Similar to Bloom's Taxonomy, the competency levels move from lowest to highest, but with suggested assessment methods, as noted above. In Miller's original pyramid, there were four tiers each depicting a level of achievement and a corresponding measure: Knows (knowledge); Knows how (competence); Shows how (performance); and Does (action) (Miller, 1990). Per ten Cate and Sargeant (2011), the top level, "Does," is meant to represent "real world" physician practice (p. 453). In 2009 the pyramid was adapted by two British physicians, Drs. Mehay and Burns, to include "the knowledge,

skills and attitudes domains of learning" (Corbetta, et al., 2019, p. 205). The resulting prism is seen in Figure 3:
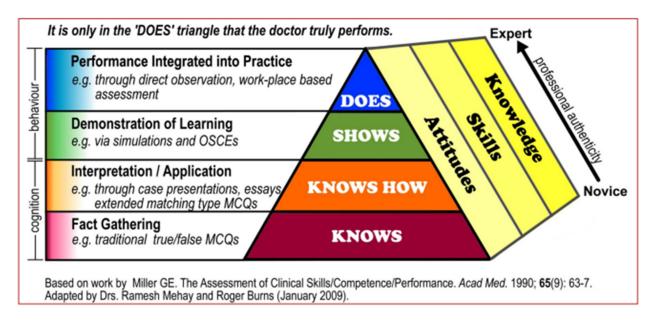

It is only in the 'DOES' triangle that the doctor truly performs.

behaviour	**Performance Integrated into Practice** e.g. through direct observation, work-place based assessment	**DOES**
	Demonstration of Learning e.g. via simulations and OSCEs	**SHOWS**
cognition	**Interpretation / Application** e.g. through case presentations, essays, extended matching type MCQs	**KNOWS HOW**
	Fact Gathering e.g. traditional true/false MCQs	**KNOWS**

Attitudes · Skills · Knowledge

Expert → Novice (professional authenticity)

Based on work by Miller GE. The Assessment of Clinical Skills/Competence/Performance. *Acad Med.* 1990; **65**(9): 63-7. Adapted by Drs. Ramesh Mehay and Roger Burns (January 2009).

Figure 3: Miller's Prism of Clinical Competency (Ballister, 2018)

Miller and Bloom's models are similar in that they conceptualize learning primarily as cognition and portray cognition as hierarchical, moving from knowledge to action. Both also include corresponding behaviors and/or evaluation methods that can be used to measure achievement (e.g., binary true/false multi-choice questions for "Knows"). Miller's Pyramid and the amended Prism are still commonly utilized in graduate medical education assessment today (ten Cate & Sargeant, 2011). Miller's Pyramid was particularly useful in identifying potential assessment methods specific to medical education. For example, in the second level of the pyramid, "Knows how," case presentation is suggested as a method of evaluation. This activity was built into the orientation curriculum, which will be discussed in further detail in the section dedicated to project design.

Competency-Based Medical Education

The competency-based medical education (CBME) framework was adapted from competency-based industrial training models that gained notoriety during the 1920s (ACGME,

2020). These models, often referred to as competency-based education and training (CBET), focused on identification of clearly defined outcomes and the knowledge and skills required to attain them (ACGME, 2020). As described by Sullivan (1995):

> "In a traditional education system, the unit of progression is time and it is teacher-centered. In a [CBET] system, the unit of progression is mastery of specific knowledge and skills and is learner- or participant-centered" (p. 1)

Interest in CBET continued to grow, eventually attracting the interest of the US Office of Education's National Center for Education Research (NCER) during the teacher education reform movement in the 1960s (ACGME, 2020). In collaboration with several universities, NCER developed a set of teaching standards that focused on individual student outcomes (ACGME, 2020). Elam (1971) used these standards to develop a set of cohesive principles and characteristics (Table 1) that could be utilized in the medical education, paving the way for CBME.

Table 1

Principles and Characteristics of Competency-Based Educational (CBE) Models (Elam 1971)

Principles	Characteristics
1. Competencies are role-derived (e.g., physician), specified in behavioral terms, and made public 2. Assessment criteria are competency-based and specify what constitutes mastery level of achievement 3. Assessment requires performance as the prime evidence, but takes knowledge into account 4. Individual learners progress at rates dependent on demonstrated competence 5. The instructional program facilitates development and evaluation of the specific competencies	1. Learning is individualized 2. Feedback to the learner is essential 3. Emphasis is more on the exit criteria (i.e., outcomes) than on the admission criteria (i.e., selection) 4. CBE requires a systems approach to manage a training program 5. Training is modularized 6. Both the learner and the program have accountability

Today, CBME is the cornerstone of the ACGME accreditation model (ACGME, 2020). Residents and fellows in accredited training programs are assessed across six core-competency domains:

Medical Knowledge; Patient Care and Procedural Skills; Interpersonal and Communication Skills; Professionalism; Practice-based Learning and Improvement; and Systems-based Practice (ACGME, 2021b). Each domain is associated with specialty-specific milestones, which serve as descriptors (e.g., skills, knowledge, and behaviors, etc.) of expected levels of trainee performance throughout the learning trajectory of program (ACGME, 2020). Per ACGME requirements (2021b), residents and fellows must demonstrate mastery of these knowledge, skills, behaviors, and attitudes to be considered ready for autonomous practice. The four research questions guiding this investigation are derived, in part, from these ACGME core competencies. I used the additional frameworks of Bloom's and Miller to further define each competency as described in the following section.

Guiding Research Questions

Based on the problem statement, as well as the considerations explored in the Literature Review and Conceptual Frameworks sections, this capstone project seeks to answer the following guiding questions:

1. What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing knowledge?

    a. Here, knowledge is defined here as clinical knowledge acquisition and recall (ACGME, 2020; Bloom, 1956).

2. What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing clinical skills?

    a. In this context, clinical skills reflect how residents analyze and interpret that knowledge within the context of their practice (Miller, 1990; Bloom, 1956).

3. What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing behaviors?

    a. Behavior involves application of knowledge and/or skills as evidenced through direct patient interaction (Miller, 1990; Bloom, 1956).

4. What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing attitudes?

    a. Here the ACGME defines attitudes almost exclusively in terms of empathy (ACGME, 2021b)

The next section provides a detailed description of how the investigation was designed to answer each of these research questions.

Project Design

Programming for the Vanderbilt University Medical Center (VUMC) health equity orientation module consisted of a series of synchronous and asynchronous content spread over the course of four days: June 25 through June 28, 2021. The majority of the content was delivered via the video conferencing platform Zoom, both as a COVID-19 pandemic safety measure and to facilitate attendance by eliminating the need for participant travel time. The module was administered to all incoming VUMC residents (n=195).

Orientation Module Structure and Content

Following is a breakdown of the orientation module structure, including content, by day.

Day 1: Friday, June 25, 2021

The first portion of the health equity module was the only one to be delivered in person and consisted of four, one-hour presentations from 8:00 am to 12:00 pm, which were attended by all incoming residents. Presentations took place in a theater-style lecture hall on the VUMC

campus in downtown Nashville and speakers consisted of VUMC faculty and staff. Graduate medical education (GME) leadership chose to deliver the initial content in person, versus virtually, to better foster a sense of welcoming and community among the new resident physicians.

The first hour of content was led by Dr. Terhune, and served, in part, as a welcome to the organization and community. The second hour consisted of a 45-minute presentation on the history of race and racism in Nashville and VUMC, delivered by Dr. André Churchwell, former Chief Diversity Officer and Senior Associate Dean for Diversity Affairs. Dr. Churchwell's presentation was followed by a brief, 15-minute break. The third hour included a presentation on prioritizing racial equality and anti-racism in patient care, given by Dr. Consuelo Wilkins, Vice President and Associate Dean for Health Equity. The Friday session culminated with a presentation titled "Seeds of Equity," delivered by Elisa Friedman, Assistant Vice President for Community & Population Health Improvement, and Carly Frazier, Community Health Coordinator.

Days 2-3: Saturday, June 26, 2021, and Sunday, June 27, 2021

The second portion of the content consisted of an approximately 45-minute pre-recorded video that was delivered asynchronously via Zoom. All residents were required to view the video, but could do so at any point over the 48-hour period. Content was spaced out in this manner to avoid taxing cognitive load, as noted in a previous section. Per Carpenter et al. (2012), performance (in this case retention) is often improved for items that are spaced versus those that are massed.

In terms of content, the video explored the neighborhoods of Nashville, including information relating to several of the social determinants of health listed above (e.g., race,

socioeconomic status, etc.). The video, presented by Community Navigator and Vanderbilt Instructor Tiffany Israel, was intended to serve as a more in-depth introduction to the communities served by VUMC in contrast to the broad overview delivered by Dr. Terhune on Day 1.

Day 4: Monday, June 28, 2021

The final segment of the VUMC health equity orientation module was delivered via Zoom and consisted of three, consecutive sessions totaling 90 minutes. While all residents were exposed to the same content, they were split into two relatively equal-sized groups with one receiving the content in the morning (10:30 am to 12:00 pm) and the other receiving the content in the afternoon (1:00 pm to 2:30 pm). This was done to accommodate required electronic medical record training, with the vendor dictating the date and size of the training classes.

The first 20 minutes of the segment consisted of an introduction to the structure and content of the module, presented by VUMC faculty Drs. Sophia Kostelanetz and Eleanor Weaver. They began with a brief (approximately 10 minutes) review of social determinants of health followed by an overview (approximately 15 minutes) of an internal resource titled, "Housestaff [sic] Guide to Addressing Patient Social Determinants of Health" (the term "house staff" is commonly used to refer to resident physicians). The resource guide was created using Google Docs and accessible to residents with a quick-response or "QR" code, which was included on the slide. The guide is a curation of resources compiled by VUMC medical students, physicians, residents, and social workers, with input from community organization leadership, and aims to assist residents in caring for patients with unique psychosocial needs (VUMC, 2021). Guide topics include instructions on how to access VUMC interpreters as well as contact information for internal and external resources devoted to immigration, housing instability,

underinsurance, domestic partner violence, etc. (VUMC, 2021). The resource guide overview was followed by a brief (again, approximately 5 minutes) introduction to the next session: virtual site visits.

During the virtual site visits, residents were randomly assigned to one of six breakout rooms using Zoom functionality. Each of the breakout rooms contained approximately 20 residents and a representative from one of six community resource groups devoted to serving the needs of minoritized patients. Each representative gave a 25-minute "tour" of their organization, which was followed by a 5-minute question-and-answer period. Two of the resource groups were internal to VUMC: the Clinic for Transgender Health and the addiction "bridge clinic," which was established as a conduit through which patients presenting with active opioid addictions can enter a three-month outpatient treatment program (Farmer, 2019). The remainder of the organizations were external or quasi-external to VUMC. Shade Tree Clinic provides free health care and education to Nashville's uninsured population and is staffed by VUMC medical students. Open Table Nashville and Second Harvest Food Bank of Middle Tennessee are both dedicated to individuals experiencing food insecurity. The final, and largest organization by far, was the Tennessee Department of Health, a state-level agency responsible for overseeing public health. During the virtual site visits, one resident was asked to volunteer as a "scribe," who would document key information on their assigned organization and provide a "teach back," or brief (approximately 1-minute) recap to the large group once the breakout sessions had concluded. These teach backs served as one opportunity for residents to receive immediate feedback (e.g., clarification, identification of knowledge gaps, etc.) from facilitators, which has shown to aide in information retention (Agarwal, et al., 2012).

The final segment of the orientation module consisted of case discussions—three

hypothetical patient scenarios that were accompanied by one to three questions (see Figure 4 for

example).

Case 2:

This is a 45 yo man with a history of type 2 diabetes and opiate use disorder who presents with fever and a left great toe wound with foul smelling discharge.
He is prescribed insulin and metformin for his diabetes. His A1C results at 11.3.
Imaging shows osteomyelitis. He is started on IV antibiotics. Infectious disease and podiatry are consulted. He undergoes partial amputation of the left great toe- pathology shows residual infection at the margin and infectious disease recommends a total of 6 weeks of IV antibiotics. He will need close follow up with podiatry to monitor the wound and to evaluate if he will need further amputation or debridement.

The case management team begins preparing him for discharge on IV antibiotics. He discloses to them that he is currently homeless and has significant difficulty with food insecurity as well. Due to food insecurity, he has been hesitant to take his insulin out of fear of hypoglycemia

Questions:
What questions do you have before you make decisions about his discharge plan?
Where will you plan to discharge him to?
What do you want to arrange for him when he does discharge?

Figure 4: Case Discussion from Health Equity Module (Weaver & Kostelanetz, 2021)

During this exercise, a facilitator read the case aloud to the large group and asked residents to

respond to the questions either verbally or by using Zoom's chat functionality. Residents were

asked to volunteer responses using information presented during the module (e.g., the house staff

resource guide, community resource organizations, etc.). During case discussions, residents

received feedback from the facilitators as well as an expert panel comprised of VUMC staff,

including social workers, pharmacists, and behavioral health advocates. As with the teach back

activity, case-based discussions including feedback have been shown to improve retention (Turk,

et al., 2019).

Assessment of the orientation health equity curriculum was embedded into the module's structure and will be discussed in further detail below.

Data Collection

In terms of assessment, I developed pre- and post-module surveys with input from GOL^{2}D faculty to explore what residents' understandings of social determinants of health suggest about their developing knowledge, skills, behaviors, and attitudes. As with the module objectives, the surveys were adapted from content from the existing social medicine rotation. Despite limitations in survey design related to areas of interest in this investigation, we selected this approach for multiple reasons. First, surveys are often utilized for exploratory purposes and are particularly useful in measuring attitudes in a population (Babbie, 2017). In that way, we envisioned this data collection and analysis as an initial exploration into the phenomenon of interest. Additionally, survey administration proved to be the most convenient and effective means through which to collect data given the population and constraints faced by the organization. As noted above, residents were provided with protected time during which to complete the pre- and post-module surveys, which the group felt may help to reinforce compliance.

Survey Setting

Both surveys were administered to all incoming VUMC residents (n=195). The pre-module survey was administered on Day 1 of orientation following Dr. Terhune's welcome presentation to the residents, prior to delivery of any health equity content. This timing was selected for two reasons. First, it allowed Dr. Terhune to introduce the module and provide context for the survey. Second, it provided residents with 10-15 minutes of protected time during which to complete the survey to encourage completion compliance. The post survey was

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administered immediately following the conclusion of the case discussion exercise and wrap-up on Day 4. Both surveys were made available to residents via a QR code and URL, which were displayed on one of the presentation slides. This provided them with the convenience to complete the survey using their device of choice (e.g., laptop, tablet, or personal mobile device).

While the sample size is quite small in comparison to the population (i.e., 195 incoming residents at one institution versus all incoming residents at all institutions), the results will nevertheless prove useful to others in medical education interested in similar questions. First, the results can inform the second iteration of the health equity orientation curriculum at VUMC, as well as the first iteration at the University of Mississippi Medical Center (UMMC). If the curriculum is found to have a positive impact on VUMC residents' knowledge, skills, behaviors, and attitudes as they relate to social determinants of health, it may be shared across institutions, significantly increasing the sample size for future research. VUMC findings will be discussed at length in a later section.

Survey Instrument

The survey was created using REDCap, an online survey building and management tool developed at Vanderbilt in 2004. Dr. Terhune requested the use of REDCap, with the rationale that it is commonly used for survey creation and distribution within VUMC graduate medical education. Utilizing the same platform would therefore make it easier, in terms of formatting, to compare our data with any related existing and/or future data. The complete pre- and post-module survey instruments can be found in Appendices A and B, respectively.

Both pre- and post-module surveys included demographic questions, with the same questions presented in the same order in each. Demographic data categories included level of training (i.e., year post-medical school graduation), medical specialty, and underrepresented in

medicine (URiM) status. Originally adopted in 2003, the concept of "underrepresented in medicine" was amended by the Association of American Medical Colleges (AAMC) in response to the Supreme Court's ruling in *Grutter v. Bollinger* (2003). In this case, the court found that the University of Michigan Law School's acceptance policy did not violate the Fourteenth Amendment by giving special consideration to Native American, African American, and Hispanic candidates in an effort to diversify its student body (*Grutter v. Bollinger*, 2003). While the AAMC (2021) adheres to a similar definition of URiM, we expanded this definition to include members of the LGBT community based on the literature review.

Reasons behind collecting these data were two-fold. First, the group felt that it would be interesting to explore survey responses by demographic group. For example, do residents who identify as URiM report markedly different knowledge, skills, behaviors, and attitudes than those who do not identify as URiM? Second, many Accreditation Council for Graduate Medical Education (ACGME) sponsoring institutions track these data routinely to assess the diversity of their resident body in accordance with AAMC and ACGME diversity standards.

In addition to demographic data, the survey also captured information relating to the type and duration of residents' previous experience with social determinants of health and/or health equity. As with the demographic data, the group felt it would be illuminating to analyze the response data by this variable. For example, do residents with high levels of previous exposure report less intense changes in knowledge, skills, behaviors, and attitudes than those with less exposure?

Qualitative data were captured via six narrative response questions that were only included in the post-module survey. The first of those questions asked residents to indicate one way in which they intend to change their future practice as a result of the module content. This

question was meant to solicit responses that speak to the conceptual frameworks described above. The five remaining questions were included at the request of the organization to obtain feedback from resident participants regarding the structure and content of the module (e.g., "What was the most valuable feature of this course?").

Based on discussion with the partner organization, responses to all questions included in the pre- and post-module survey were optional and anonymous. Meaning, residents could elect not to respond, and, for those who did respond, individual responses could not be identified by the researchers (Babbie, 2017). Residents were informed of these conditions via survey instructions (refer to Appendices A and B). The organizations felt that making responses optional and anonymizing the data would embolden residents to respond honestly. These decisions significantly limited the analysis, which will be discussed at length in the Data Analysis and Recommendations sections.

Conceptual Frameworks. For both pre- and post-module surveys, the demographic and prior experience questions were followed by 10 statements designed to collectively answer the four guiding research questions driving this investigation using the conceptual frameworks. Residents were asked to respond to the statements using a six-point Likert-style answer format that ranged from "Strongly disagree" to "Strongly agree" and included a "Not applicable" option. Below is a concept map depicting how the statements were crafted to address the research questions within the context of the conceptual frameworks.
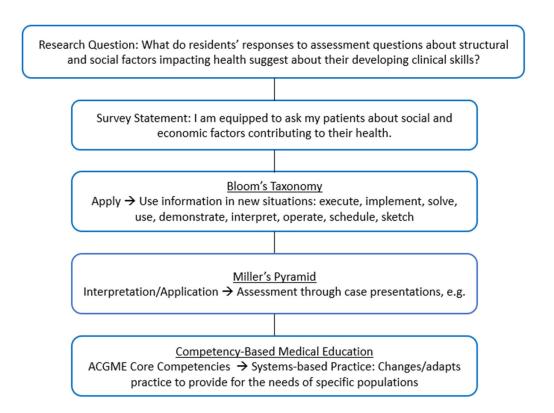
Figure 5: Concept Map

Reliability and Validity. As noted by Babbie (2017), one of the strengths of using a Likert-style answer format is the "unambiguous ordinality," or specificity of the response categories (p. 182). This specificity increases the likelihood of reliability (achieving the same result after repeated attempts) and accuracy, though individual subjectivity must always be taken into consideration (Babbie, 2017). I argue that the same assumption of reliability and accuracy can be applied to the demographic questions, given the specificity of their wording and the fact that respondents were required to select one option per question.

As noted, medical education has only recently begun to prioritize health equity training despite physician awareness that disparities exist among minoritized communities (IOM, 2001; Maldonato, et al., 2014). As such, neither I nor my partner organization colleagues were able to find an existing validated tool; that is, one with formally established, consensus agreement regarding concepts (Babbie, 2017). For example, in the session objectives noted above, do all

residents conceptualize "levers of change" in the same way? To increase face validity, or the likelihood that our instrument measured what it was intended to measure (Babbie, 2017), the 10 Likert-scale response statements were adapted from an existing VUMC social medicine elective survey that had yielded promising results. I updated the statements to make them reflective of the orientation module content and then made modifications to align them with the conceptual frameworks (e.g., making them competency-based, measurable according to Bloom, etc.). The statements were then distributed to staff and faculty involved in the orientation module curricular design for their input with the aim of making the statements as objective as possible. External validity, or the ability to replicate the same results in other settings (Babbie, 2017), remains to be seen. However, sharing the tool across sponsoring institutions should aid the group in assessing its generalizability.

The next section is devoted to a description of the methods used to analyze the survey data.

Data Analysis

Following conclusion of the module, I exported all survey data (closed-ended and narrative response) from REDCap to Microsoft Excel for initial review. Having limited experience using REDCap, I anticipated the need to assess and clean up (e.g., reformat, etc.) the data prior to conducting an in-depth analysis. In doing so, several issues immediately became apparent to me. Foremost was the magnitude of the limitations resulting from the decision to make responses optional and anonymize the data. I chose not to include incomplete data in the analysis. Per Babbie (2017), excluding all occurrences where data are missing could bias findings. However, assigning scores to the missing data points also has the potential to alter findings (Babbie, 2017). Given the subjective nature of the survey content, particularly the

competency-based questions, I did not feel comfortable assigning scores to the missing data and chose to exclude them. Omitting these data made it virtually impossible to calculate overall pre- and post-module survey response rates. Instead, reliable response rates could only be determined on a question-by-question basis once the missing data were accounted for. While considering the overall pre- and post-module response rates, a second issue presented itself. As noted above, the incoming resident sample size was 195; however, the pre-module survey resulted in 267 distinct records. Meaning, the number of respondents for the pre-module survey exceeded the number of incoming residents. Based on information I received from the GOL^2D grant manager, who was physically in attendance during administration of the pre-survey, I believe that a handful of faculty and staff also completed the survey. This will be discussed further in the sections on limitations and recommendations.

Following my preliminary review of the data, I calculated the percent of respondents who identified as URiM (26.4%), as well as those who reported prior experience (see Figure 6). To answer the four guiding research questions, I categorized the ten, competency-based statements into four groups—knowledge, skills, behaviors, and attitudes—based on the conceptual frameworks (see Table 2). I then calculated the difference between strongly agree and agree responses, which were combined into one category, from pre- to post-survey. I chose to focus on strongly agree and agree for two reasons. First, those two response options saw the biggest change from pre- to post-survey. Second, it still allowed for inference of the strongly disagree, disagree, and n/a options.

In addition to analyzing the data myself, I also worked with Dr. Mario Davidson, Assistant Professor of Biostatistics at Vanderbilt University. Dr. Davidson is a frequent collaborator with the Office of Graduate Medical Education at VUMC, so I reached out to him at

the suggestion of Dr. Terhune. He provided me with a brief report of his analysis, and revisions were made based on his feedback.

Due to time limitations, I was not able to formally review and code the qualitative response data from the post-module survey. However, I did review responses to the questions relating to the most valuable and least valuable aspects of the module and manually group them together by theme for my presentation to the organization. I did so by using inductive reasoning, during which I developed general categories based on observation of the data (Babbie, 2017). These categories will be described in the next section on findings. The raw qualitative post-survey response data were also shared with the organization and will be used to improve the second iteration of the module and to develop a comparable module at UMMC for June 2022.

Findings

The following summarizes findings by survey content area as described above. Note that all findings are evidence of correlation rather than causation due to statistical analysis limitations, which will be described in a later section.

Demographic Data

As noted above, the survey utilized the Association of American Medical Colleges' (AAMC) definition of populations identified as underrepresented in medicine (URiM), including Black/African American, Hispanic/Latinx, and Indigenous American. This definition was expanded to include an LGBTQI and "Other" option, based on the literature review and curriculum content. Data analysis revealed that 26.4% of incoming Vanderbilt University Medical Center (VUMC) residents identified as URiM based on the categories presented, while 73.6% did not.

Prior Experience

Prior experience data by type can be seen below in Figure 6. Residents were instructed to select all response categories that applied.
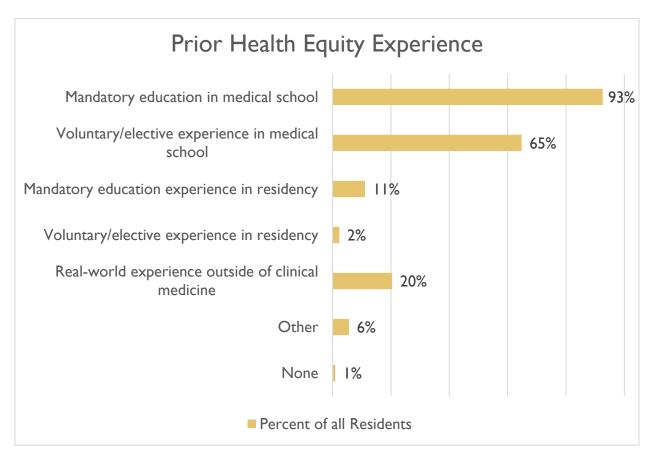
Prior Health Equity Experience

Category	Percent of all Residents
Mandatory education in medical school	93%
Voluntary/elective experience in medical school	65%
Mandatory education experience in residency	11%
Voluntary/elective experience in residency	2%
Real-world experience outside of clinical medicine	20%
Other	6%
None	1%

Figure 6: Incoming Resident Prior Health Equity Experience Type

Of note, 93% of all incoming residents indicated that they had received some form of mandatory health equity education in medical school. An additional 65% also reported completing a voluntary and/or elective health equity experience in medical school. A small percentage of respondents (11% and 2%, respectively) indicated similar experience within the context of residency. One-fifth, or 20% of incoming residents indicated real-world experience with health equity content outside the context of clinical medicine. An additional 6% reported some other type of exposure, and only 1% indicated that they had no prior health equity experience.

Competency-Based Statements

Table 2 depicts the difference in agree and strongly agree responses across the ten, competency-based survey statements. As noted above, the statements were categorized as pertaining to knowledge, skills, behaviors, or attitudes. The number of questions in each group is indicated.

Research Question	Findings: Agree + Strongly Agree		
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **knowledge**? (n=2)	Pre-Module Survey	Post-Module Survey	Difference
	93%	98%	↑5%
	54%	96%	↑42%
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **clinical skills**? (n=5)	Pre-Module Survey	Post-Module Survey	Difference
	92%	97%	↑5%
	91%	97%	↑6%
	86%	96%	↑10%
	37%	92%	↑55%
	36%	91%	↑55%
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **behaviors**? (n=1)	Pre-Module Survey	Post-Module Survey	Difference
	74%	96%	↑21%
What do residents' responses to assessment questions about structural and social factors impacting health suggest about their developing **attitudes**? (n=2)	Pre-Module Survey	Post-Module Survey	Difference
	97%	98%	↑1%
	98%	99%	↑1%

Table 2: Pre- and Post-Survey Difference in Strongly Agree and Agree by Research Question

Guiding Question #1

Findings revealed an overall increase in residents' self-perceived *knowledge* of structural and social factors impacting health based on their responses to the following two statements:

- I can describe social determinants of health common to the general population.

- I can describe social determinants of health common to the Vanderbilt University Medical Center patient population.

For the first statement, agree and strongly agree responses increased by 5 percentage points between the pre- and post-module surveys. As seen in Table 2, 93% of residents strongly agreed or agreed with this statement in the pre-test. One may deduce that this correlates with the high

percentage (99) of residents who reported having prior health equity experience and explain the relatively small increase of only 5 percentage points.

For the second statement relating to social determinants of health specific to VUMC's patient population, strongly agree and agree responses increased by 42 percentage points from pre- to post-module survey. This may be reflective of the hyper-localized curriculum content (e.g., neighborhoods of Nashville video, virtual site visits, etc.).

Guiding Question #2

Findings also revealed an overall change in residents' self-perceived *clinical skills* relating to structural and social factors impacting health based on their responses to the following five statements:

- I can identify potential barriers to addressing social determinants of health.

- I recognize how my own privilege and power affect my clinical practice.

- I recognize the importance of considering insurance status and other financial/resource constraints when developing a plan of care.

- I can describe programs and services for addressing social determinants of health, such as access to addiction and mental health care, at Vanderbilt University Medical Center (e.g., Addiction Psychiatry, Bridge Clinic, etc.).

- I can describe programs and services for addressing social determinants of health, such as food stability, trans health, and access to affordable, quality care, for external community resources (e.g., Shade Tree Clinic, Clinic for Transgender Health, etc.).

As with the first guiding question, the statements relating to generalized clinical skills saw smaller increases (5, 6, and 10 percentage points, respectively) in agree and strongly agree compared to the two VUMC-specific statements. The latter saw the largest increases (55

percentage points) in strongly agree and agree from pre- to post-module survey across all statements. For the statement relating to internal VUMC resources, this represented a 167% increase (27% to 72%), while the statement relating to external VUMC resources increased by 169% (26% to 70%).

Guiding Question #3

Residents' self-perceived *behaviors* also changed from pre- to post-module survey based on the following statement:

- I am equipped to ask my patients about social and economic factors contributing to their health.

Agree and strongly agree responses rose by 21 percentage points from 74% to 96%, which was the largest increase in regard to the generalized (i.e., non-VUMC contextualized) statements. In terms of corollary interpretation, could this reflect a potential gap in some medical school curricula as it pertains to application of these concepts to practice? Nearly all residents reported having some prior required health equity education, yet approximately one-fifth indicated a change in behavior following participation in the orientation module.

Guiding Question #4

Finally, findings indicated a relatively small change in residents' perceived *attitudes* as they relate to structural and social factors impacting health based on their responses to the following two statements:

- All patients deserve the same level of care regardless of their illness.
- Large institutions, such as hospital systems, have a duty to evaluate the ways in which their practices may lead to health inequities.

Each statement saw only a 1 percentage point increase. However, 97% and 98% of residents indicated strong agreement or agreement with these statements in the pre-module survey, leaving little room for change.

Competency-Based Statements by URiM Status

Included in the statistician's report are stacked bar plots (see Figure 7) depicting the proportions of pre- and post-module agreement levels by URiM status (i.e., underrepresented minority status versus non-underrepresented minority status). This data visual was completed for only seven of the ten competency-based statements due to time limitations. As with the overall findings, the proportion of agree and strongly agree responses increased from pre- to post-module for both groups (URiM versus non-URiM) for all seven statements.
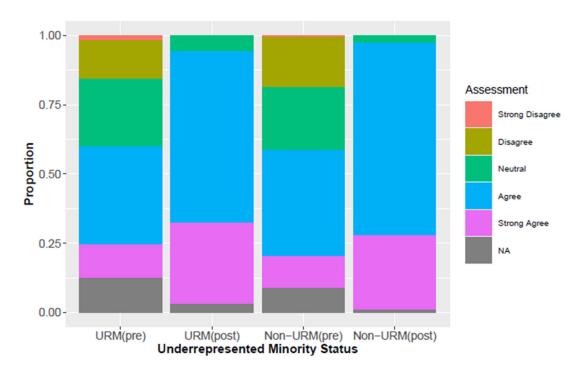
Figure 7: Ability to Describe Social Determinants of Health of VUMC Patients by URiM Status

Limitations

In terms of survey design, the chief limitation of this investigation is that it is self-assessing in nature, which limits results to residents' perceived knowledge, skills, behaviors, and attitudes. Meaning, I was not able to assess actual change in residents' practice and/or demonstration of knowledge, just their perception of it. This in turn limits the organization's ability to measure the effectiveness of the instruction as it pertains to these competencies.

In terms of survey configuration, the greatest limitation was the fact that the anonymity settings in REDCap limited the analysis to descriptive statistics. Because the responses were truly anonymized, I was unable to perform hypothetical statistics, such as the within-subjects related sample t-test, which measures the same participants twice. In regard to survey administration, a second limitation of the findings is that the number of respondents for the pre-module survey exceeded the number of incoming residents. Based on information I received from the GOL^{2}D grant manager, who was in attendance during the pre-survey, I believe that a handful of faculty and staff also completed the survey.

Recommendations

The following five recommendations were developed as a result of the investigation.

Recommendation #1: Update Survey Configuration in REDCap

The first recommendation is to update the anonymity settings in REDCap to allow for broader statistical analysis, such as the within-subjects related sample t-test. There exists in REDCap a mechanism that allows responses to remain anonymous, but still trackable. Respondents are issued a unique ID linking their individual responses, but still remain anonymous to the researchers. As noted above, the organizations felt that making responses optional and anonymizing the data would embolden residents to respond honestly. In utilizing

the unique ID to link participants' pre- and post-module responses, the organizations can assure residents in good faith, verbally and/or via survey instruction, that the data are anonymous. These settings should be applied to both the second iteration of the Vanderbilt University Medical Center (VUMC) module, as well as the inaugural orientation module at the University of Mississippi Medical Center (UMMC).

In addition to these configuration changes, survey administration recommendations are warranted based on the discrepancy in the number of pre-module survey respondents and the number of incoming residents. In future iterations of the module, it needs to be made clear that only residents are to complete the pre- and post-surveys. This could easily be addressed via verbal instruction and a call out on the slide containing the QR code and URL at the time of survey administration.

Recommendation #2: Incorporate Objective Assessment Methods into the GOL²D Curriculum

As noted, the self-assessing nature of the surveys limited findings to residents' perceived (versus actual) changes in knowledge, skills, behaviors, and attitudes. The second recommendation is to incorporate more objective assessment methods into the GOL²D curriculum, beginning with the first tier. One example of an assessment method that doesn't rely on resident self-perception is to track the number of referrals to VUMC and/or community resource organizations by residents who have completed the module (controlling for other statistical variables). This could also be implemented at UMMC within the context of their unique organizational and community resources.

In terms of the second tier of the GOL²D curriculum, individualized rotations, the organizations could analyze targeted patient-of-resident evaluations, which are already required

by ACGME. For example, the evaluations could ask the patient whether the resident inquired about their insurance status and/or other resource constraints. This is supported by Miller's Pyramid of Competency (Corbetta, et al., 2019), which recommends using workplace-based assessments to evaluate changes in behavior.

The third tier of the curriculum, workshops, could incorporate case presentations with direct feedback—another assessment method supported by Miller (Corbetta, et al., 2019) and Bloom (1956). The fourth tier of the curriculum is comprised of an individualized capstone-level project. The flexibility associated with this project should allow for any number of objective assessment measures.

Recommendation #3: Use Prior Experience Data to Identify Gaps, Learning Opportunities

The basis for the third recommendation came from one of the VUMC GOL^{2}D teaching faculty during my presentation of findings to the organization. Given the high percentage of residents reporting prior health equity education, the faculty member suggested that the group consider whether trainees are coming in with more experience than VUMC can currently offer them. I will expand on this to recommend that the organizations use future versions of the post-module survey to identify health equity experience gaps and potential learning opportunities. For example, in addition to asking about the type of prior experience (e.g., mandatory educational experience in medical school), the survey should ask residents to indicate specific topics. This could be done using either a pre-determined multi-select list of options, or by allowing residents to enter short text narrative descriptions. I also recommend adding a question to the prior experience section of the survey asking residents to share health equity-related topics that they are interested in, but have not had exposure to. Results should help to highlight content gaps and opportunities for both the baseline module and additional curriculum tiers.

Recommendation #4: Consider Module Format for Future Iterations

The fourth recommendation also resulted from discussion with GOL^{2}D faculty during my presentation to the organization. In reviewing the post-survey feedback data, I highlighted for the group that a small number (approximately 4% of residents) identified the sessions' mostly virtual format as the least valuable aspect of the module. This led the group to wonder how Zoom may have affected the outcomes. While it is clear that a confluence of events, including the global COVID pandemic, led to new, virtual opportunities, it is not clear if the same format is appropriate moving forward. For example, while several residents called out the Zoom format as a limitation of the module, completion compliance for the pre-survey was considerably higher than the post-survey; could the fact that the pre-survey was administered in-person have produced these results? Based on these outcomes, I believe this issue warrants careful consideration and recommend that the group assess pros and cons of virtual formatting for both the UMMC inaugural health equity module and the second iteration of the VUMC module.

Recommendation #5: Increase Sample Size by Scaling Outward

My fifth and final recommendation is to increase the sample size of the investigation as it pertains to the baseline module by scaling the project out to other organizations. There are over 800 ACGME-sponsoring institutions in the U.S. (ACGME, 2021a). Scaling out coupled with the updated anonymity settings noted above will result in a larger sample size, and allow for broader analysis. However, in doing so, I would caution the organizations involved to carefully consider their module content given how hyper-localized it was for the VUMC residents. Specifically, they should consider if and how their own local context may affect results. It would undoubtedly affect the wording of the survey, given that internal and external community resources will vary from institution to institution.

In addition to increasing sample size, scaling out would provide additional information on whether implementation is feasible in other settings (i.e., generalization). For example, VUMC and UMMC are medium-to-large sponsoring institutions located in relatively dense urban areas. Scaling out could shed light on the feasibility of implementation and effectiveness in institutions located in rural and/or remote areas. This is an important consideration given that the social determinants of health described herein are not isolated to any one particular geographic area.

Conclusion

The purpose of this investigation was to develop a research-informed approach to assessing resident learning outcomes of the novel GOL^2D baseline health equity module to determine its effectiveness. In doing so, the overarching aim of the partner organizations was to prepare Vanderbilt University Medical Center and University of Mississippi Medical Center residents for practice in today's diverse and complex health systems.

Findings revealed that residents perceived a change in their knowledge, skills, behaviors, and attitudes relating to structural and social factors impacting health following participation in the module. However, the self-assessing nature of the survey tool used did not allow for assessment of actual change in those competencies. The findings also identified issues with the survey configuration—namely that anonymity settings limited the analysis to descriptive statistics. To address these issues, recommendations included implementation of objective, rather than self-assessing, outcome measures for future iterations of the module, and updating of the survey configuration to allow for within subjects related sample t-testing.

I believe that future investigation is warranted given the potentially devastating adverse effects of health outcomes disparity. Examples include higher mortality rates for certain

minoritized groups (Melillo, 2020; HHS, 2020), a decrease in life expectancy for those in the bottom of the income distribution (Price, et al., 2018), and lack of access to care for trans and other sexual minorities (Safer, et al., 2016; Sanchez, et al., 2009). Physician trainees have what Rich (1986, as cited by da Silva Iddings & Leander, 2017) referred to as "…the power to name and to socially construct reality…" In doing so, they must acknowledge the disparities that exist to effectively and, more importantly, equitably, care for their patients.

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Appendix A

VUMC Orientation Health Equity Pre-Survey

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Please complete the survey below.

Thank you!

The first section of this survey will collect demographic information. This information is optional, will not be used to identify any individual, and will only be used in aggregate once a sufficient number of surveys are obtained. Your answers are anonymous.

1) **Please select your training level as of July 1, 2021:**
   * must provide value

   ○ PGY-1
   ○ PGY-2
   ○ Other

2) **If you selected "Other," please specify:**
   [   ]

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3) Please select your residency specialty:

* must provide value

- ○ Anesthesiology
- ○ Child Neurology
- ○ Emergency Medicine
- ○ General Surgery
- ○ Internal Medicine
- ○ Internal Medicine/Pediatrics
- ○ Neurological Surgery
- ○ Neurology
- ○ Obstetrics and Gynecology
- ○ Oral and Maxillofacial Surgery
- ○ Orthopaedic Surgery
- ○ Otolaryngology
- ○ Pathology
- ○ Pediatrics
- ○ Physical Medicine and Rehabilitation
- ○ Plastic Surgery - Integrated
- ○ Psychiatry
- ○ Therapeutic Radiological Medical Physics
- ○ Urology
- ○ Other

4) If you selected "Other," please specify:

[   ]

5) **Do you identify as someone from a group traditionally underrepresented in medicine (e.g., Black/African-American, Hispanic/Latinx, Indigenous American, LGBTQI, etc.)?**
* must provide value

○ Yes
○ No

This section of the survey will collect information about your individual experience as it relates to social determinants of health and health equity.

6) **Please indicate any formal education you received on the topics of social determinants of health and health equity prior to these sessions (select all that apply):**
* must provide value

☐ Mandatory educational experience in medical school
☐ Voluntary/elective experience in medical school
☐ Mandatory educational experience in residency
☐ Voluntary/elective experience in residency
☐ Real-world experience in a career outside of
☐ Other
☐ None

7) **If you selected "Other," please specify:**

[   ]

8) **If you have had previous instruction, how long did this instruction last? Select all that apply.**

   must provide value

   ☐ 1-2 lectures/brief experiences
   ☐ Several lectures/experiences over 6-12 months
   ☐ Intermittent longitudinal instruction lasting >12 months
   ☐ Immersive experience
   ☐ Other
   ☐ N/A

9) **If you selected "Other," please specify:**

   [   ]

Based on your experience in the health equity elective sessions, please answer the following questions regarding your knowledge, skills, intended behaviors, and beliefs. Your answers are anonymous.

	Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10) **I can describe social determinants of health common to the general population.**	☐	☐	☐	☐	☐	☐
11) **I can describe social determinants of health common to the Vanderbilt University Medical Center patient population.**	☐	☐	☐	☐	☐	☐
12) **I can identify potential barriers to addressing social determinants of health.**	☐	☐	☐	☐	☐	☐
13) **I recognize how my own privilege and power affect my clinical practice.**	☐	☐	☐	☐	☐	☐

14)	I recognize the importance of considering insurance status and other financial/resource constraints when developing a plan of care.	☐	☐	☐	☐	☐	☐
15)	I am equipped to ask my patients about social and economic factors contributing to their health.	☐	☐	☐	☐	☐	☐
16)	I can describe programs and services for addressing social determinants of health, such as access to addiction and mental health care at Vanderbilt University Medical Center (e.g., Addiction Psychiatry, Bridge Clinic, etc.).	☐	☐	☐	☐	☐	☐
17)	I can describe programs and services for addressing social determinants of health, such as food stability, trans health, and access to affordable, quality care, for external community resources (e.g., Shade Tree Clinic, Clinic for Transgender Health, etc.).	☐	☐	☐	☐	☐	☐
18)	All patients deserve the same level of care regardless of their illness.	☐	☐	☐	☐	☐	☐
19)	Large institutions, such as hospital systems, have a duty to evaluate the ways in which their practices may lead to health inequities.	☐	☐	☐	☐	☐	☐

Submit

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Appendix B

Vanderbilt University Medical Center Health Equity Post-Module Survey

VUMC Orientation Health Equity Post-Survey

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Please complete the survey below.

Thank you!

The first section of this survey will collect demographic information. This information will not be used to identify any individual, and will only be used in aggregate once a sufficient number of surveys are obtained. Your answers are anonymous.

1) **Please select your training level as of July 1, 2021:**
   * must provide value

   ○ PGY-1
   ○ PGY-2
   ○ Other

2) **If you selected "Other," please specify:**

3) Please select your residency specialty:

* must provide value

- ○ Anesthesiology
- ○ Child Neurology
- ○ Emergency Medicine
- ○ General Surgery
- ○ Internal Medicine
- ○ Internal Medicine/Pediatrics
- ○ Neurological Surgery
- ○ Neurology
- ○ Obstetrics and Gynecology
- ○ Oral and Maxillofacial Surgery
- ○ Orthopaedic Surgery
- ○ Otolaryngology
- ○ Pathology
- ○ Pediatrics
- ○ Physical Medicine and Rehabilitation
- ○ Plastic Surgery - Integrated
- ○ Psychiatry
- ○ Therapeutic Radiological Medical Physics
- ○ Urology
- ○ Other

4) If you selected "Other," please specify:

5) **Do you identify as someone from a group traditionally underrepresented in medicine (e.g., Black/African-American, Hispanic/Latinx, Indigenous American, LGBTQI, etc.)?**

    * must provide value

  ○ Yes
  ○ No

This section of the survey will collect information about your individual experience as it relates to social determinants of health and health equity.

6) **Please indicate any formal education you received on the topics of social determinants of health and health equity prior to these sessions (select all that apply):**

    * must provide value

  ☐ Mandatory educational experience in medical school
  ☐ Voluntary/elective experience in medical school
  ☐ Mandatory educational experience in residency
  ☐ Voluntary/elective experience in residency
  ☐ Real-world experience in a career outside of clinical medicine
  ☐ Other
  ☐ None

---

7) **If you selected "Other," please specify:**

  [   ]

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8) If you have had previous instruction, how long did this instruction last? Select all that apply.
* must provide value

☐ 1-2 lectures/brief experiences

☐ Several lectures/experiences over 6-12 months

☐ Intermittent longitudinal instruction lasting >12 months

☐ Immersive experience

☐ Other

☐ N/A

9) If you selected "Other," please specify:

[   ]

Based on your experience in the health equity sessions, please answer the following questions regarding your knowledge, skills, intended behaviors, and beliefs. Your answers are anonymous.

	Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10) I can describe social determinants of health common to the general population. * must provide value	☐	☐	☐	☐	☐	☐
11) I can describe social determinants of health common to the Vanderbilt University Medical Center patient population. * must provide value	☐	☐	☐	☐	☐	☐
12) I can identify potential barriers to addressing social determinants of health. * must provide value	☐	☐	☐	☐	☐	☐
13) I recognize how my own privilege and power affect my clinical practice. * must provide value	☐	☐	☐	☐	☐	☐

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14)	I recognize the importance of considering insurance status and other financial/resource constraints when developing a plan of care. *** must provide value**	☐	☐	☐	☐	☐	☐
15)	I am equipped to ask my patients about social and economic factors contributing to their health. *** must provide value**	☐	☐	☐	☐	☐	☐
16)	I can describe programs and services for addressing social determinants of health, such as access to addiction and mental health care, at Vanderbilt University Medical Center (e.g., Addiction Psychiatry, Bridge Clinic, etc.). *** must provide value**	☐	☐	☐	☐	☐	☐
17)	I can describe programs and services for addressing social determinants of health, such as food stability, trans health, and access to affordable, quality care, for external community resources (e.g., Shade Tree Clinic, Clinic for Transgender Health, etc.). *** must provide value**	☐	☐	☐	☐	☐	☐
18)	All patients deserve the same level of care regardless of their illness. *** must provide value**	☐	☐	☐	☐	☐	☐
19)	Large institutions, such as hospital systems, have a duty to evaluate the ways in which their practices may lead to health inequities. *** must provide value**	☐	☐	☐	☐	☐	☐

Information from the following will be used to improve the experience for other residents. Your answers are anonymous.

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20) **Please indicate at least one way you will change your clinical practice because of these health equity session:**

* must provide value

Please indicate the extent to which you agree with the following statements:

		Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
21)	**Information and concepts were presented clearly.** * must provide value	☐	☐	☐	☐	☐	☐
22)	**Content was presented in an organized manner.** * must provide value	☐	☐	☐	☐	☐	☐

23) **What was the most valuable feature of this course?**

* must provide value

24) **What was the least valuable feature of this course?**

* must provide value

25) **What specific suggestions do you have for changes to these sessions in the future?**

* must provide value

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26) **What further training in health equity topics are you interested in receiving during your residency training?**

27) **Please provide us with any additional feedback you wish to share:**

Submit

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