Audit of Sex and Gender Medicine Topics in Preclinical School of Medicine Curriculum

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ABSTRACT

Introduction: The importance of the inclusion of sex and gender medicine (SGM) in medical education has been recognized formally by both the American Association of Medical Colleges and the Department of Health and Human Services since 1995. Yet, few medical schools, including the Medical College of Wisconsin, have a standard SGM curriculum. This work mapped the SGM health topics taught in the Medical College of Wisconsin preclinical curriculum.

Methods: Seven medical students audited 16 basic science preclinical courses in 2020-2021. SGM characterizations, including epidemiology, diagnosis, presentation, treatment, prognosis, pharmacology, and disparity, were captured by an online survey tool. Comparisons were made to 38 high-yield topics presented in the textbook "How Sex and Gender Impact Clinical Practice: An Evidence-Based Guide to Patient Care."

Results: Of the 604 preclinical sessions audited, 54% contained some SGM content. Epidemiology was the most common characterization (23% of total). Thirty-four of the 38 high-yield clinical SGM topics received mention in the basic science sessions. Breast cancer, stroke, osteoporosis, sex and gender considerations in therapeutic response, and systemic lupus erythematosus had the most frequent SGM-specific coverage (representation in at least 4 of the 16 preclinical courses).

Conclusions: Utilizing a medical student cohort to thoroughly audit courses was an effective way to document that Medical College of Wisconsin preclinical curriculum introduces many clinically relevant SGM topics. However, the audit also discovered varying levels of detail among the high-yield topics with concern that students may not be adequately prepared to treat all patients. These results establish the groundwork for a more formalized and integrated approach to include SGM in preclinical curriculum.

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INTRODUCTION

Recognition and teaching of sex and gender diversity is an essential component of medical education and critical to providing high-quality medical care to all people.[1,2] Sex as a biological variable affects anatomy, physiology, and pathophysiology. The term gender is considered a social construct and encompasses behaviors individuals use to present themselves in society.[3] Sex and gender both influence aspects of health including, but not limited to, clinical presentation, diagnosis, treatment, and access to health care. For example, cardiovascular conditions are well-studied instances of how sex and gender affect medicine. The anatomy of a female heart has coronary vessels with more branching than those of a male heart, which leads to different patterns of blockage and, thus, different symptoms related to myocardial ischemia.[4] Additionally, the traditional gender role of women as primary caretakers can result in women delaying prevention and treatment of chronic conditions like heart disease.[5,6]

Despite the importance of understanding the differences in sex and gender terminology, there is a concern that undergraduate medical education lacks adequate training of learners in sex and gender medicine (SGM).[7-9] While a national survey[10] indicated that 85.5% of medical students were aware of SGM differences and 94.4% believed that medical education should include teaching about SGM, it is not easily apparent which medical schools (allopathic and osteopathic) have a standard SGM curriculum.

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The textbook *How Sex and Gender Impact Clinical Practice: An Evidence-Based Guide to Patient Care* by Jenkins and Newman listed 8 US academic institutions that have educational resources on sex and gender health.[11] Furthermore, the survey reported that 97.9% of faculty and 89.0% of students answered "no" or "not sure," to the question "Does your institution have an identified sex and gender-based medicine curriculum?"[10]

An internal survey of Medical College of Wisconsin (MCW) students and faculty supported the results of the national survey.[12] Of the 210 students (M1-M4 years) surveyed, 84% said their education should include SGM education and that knowledge would improve patient care. Faculty surveyed indicated that they felt strongly that MCW medical education should include the teaching of sex and gender medicine differences (96%), while only 20% said that their own training had prepared them to teach it to medical learners. More importantly, both national and MCW institutional survey data reported that over 50% of students indicated that their curriculum did not prepare them to clinically manage SGM differences.[10,12] This training deficit needs to be addressed in a more systematic manner.

There are some published results of curricular audits of SGM topics taught in either undergraduate or graduate medical education and in learning materials for licensing board examinations.[7,13-15] In general, these studies found content focused more on anatomical and physiological sex differences, with less details on incidence, treatments, and outcomes that are sex- and gender-based. The Sex and Gender Medical Education (SGME) Summits played a major role in raising awareness of teaching SGM in all health professions.[16,17] These summits provided key connections to validate and implement the integration of SGM into education and laid groundwork for content standardization.[3]

The goal of this work was to perform a directed audit to identify and document SGM topics in MCW medical curriculum with intent to inform future curriculum content. The MCW Institutional Review Board deemed this work exempt from review.

METHODS

Organization

MCW enrolls approximately 1000 medical students across 3 campuses, with an approximate distribution of 56% female and 44% male. MCW teaches basic or foundational (preclinical) science over 2 years using mainly didactic lectures and clinical case correlations. M1 courses are Clinical Human Anatomy I and II, Molecules to Cells, Physiology, Infectious Agents and Host Immunity, Principles of Drug Action, Medical Neuroscience, and Foundations of Human Behavior. M2 courses are arranged by organ system units and include Foundations of Pathological Processes and Musculoskeletal Skin, Cardiovascular, Renal-Respiratory, Heme-Lymph, Gastrointestinal-Nutritional, Endocrinology-Reproduction, Neurology-Psychiatry, and Symptoms.

Curriculum Review

The MCW Curriculum and Evaluation Committee (CEC) is charged with oversight of the undergraduate medical curriculum. In 2019, the CEC discussed a curricular thread review of sex and gender topics in current courses and clerkships. To meet its goal, the CEC funded this work through a learning resource grant to engage students in identifying sex and gender topics in the MCW curriculum. Details of methodology are included below.

Recruitment of Student Auditors and Training

Student auditors were recruited to provide real-time assessment of the preclinical lecture content. Open positions were advertised during orientation for M1 and M2 students during the start of the 2020-2021 academic year. Ultimately, 7 student auditors were recruited to the project: 6 women and 1 man. Each student auditor received a stipend for their work and met with the faculty leader to review the project's objective, time commitment, and design. Additionally, they were provided with asynchronous training on SGM resources pertaining to the historical context of SGM, recent studies on sex and gender in medical education, and correct use of SGM terminology. A Microsoft Teams page was used for further communication and sharing content. The faculty leader (SP) did monthly face-to-face check-ins with students to get updates and address concerns.

Survey Development and Real-Time Audit

The Qualtrics survey platform was used to capture these data: course, session title, SGM terminology, SGM coverage, and comments. When it was noted that terms relating to sex (male or female) and/or gender (man/boy or woman/girl) were used in a lecture, the survey expanded to capture additional details of how SGM topics were characterized using the following categories: pharmacology, prognosis, treatment, disparity, diagnosis, presentation, and epidemiology. Additionally, training emphasized that student auditors include more distinct facts about a lecture in the comments section.

Data collection began in October of the 2020 fall semester and continued through the end of the 2021 spring semester. M1 and M2 students audited their respective enrolled courses. Only large group didactic lectures were audited given the variability inherently present in small group, clinical skills, and laboratory-based sessions. Due to the COVID-19 pandemic, all students were limited in their ability to attend class in-person. Because the large group sessions were recorded, student auditors had the option to either attend class in person when appropriate according to institutional policies, stream the lecture in real time, or watch recorded lectures later. The recorded lectures and slide decks were reviewed to retrospectively evaluate those lectures from August to October that took place before the real-time audit began. All student auditors were expected to complete a survey after every lecture. There were multiple auditors for each

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session to decrease any auditor bias. M1 lectures had up to 3 different student entries, and M2 lectures had up to 4 different student entries. Additional details recorded as comments were specific to each student. To avoid the observer effect, faculty lecturers were unaware of the project.

Data Analysis

Data analysis was carried out during the summer following the 2020-2021 academic year. All survey data were combined into a final dataset, with 1 entry per lecture session. Any discrepancies between auditors were resolved by group consensus using survey comments, lecture slides, and lecture recordings. Most of the inter-auditor variance was attributed to the use of sex and/or gender terminology in clinical case examples without adequate context of sex and/or gender in lecture material (eg, "a 62-year-old female presents to the emergency department"). Auditors agreed that SGM was not covered if the lecture session only used sex and/or gender terminology in clinical case examples but did not discuss SGM topics in the lecture. Session presentation of SGM content focused on the categorical characterizations of pharmacology, prognosis, treatment, disparity, diagnosis, presentation, and epidemiology. Curriculum characterization content was then mapped to current practices in medicine for comparison.

A variety of sources exist to identify and map sex and gender topics to include in medical education curriculum.[18] With input from faculty, the students chose the textbook *How Sex and Gender Impact Clinical Practice: An Evidence-Based Guide to Patient Care,*[11] which was highlighted in presentations and workshops at the most recent Sex and Gender Education Summit (2021) to provide an authoritative source for use in the education of learners about sex and gender differences.

Using section 2 in the textbook, "Sex and Gender Evidence in Health and Disease," a comprehensive template was created to include 38 SGM topics (Table 1). Approximately 74% of lecture sessions included additional student comments, which were used to compare the depth of topic coverage by scoring for several distinct facts. This process was verified by a second rater for randomly selected topics at each coverage level. Table 2 shows an example of comment scoring.

Table 1 . Topics Selected From *How Sex and Gender Impact Clinical Practice: An Evidence-Based Guide to Patient Care*

Topic	M1	M2
Access to care	—	En-Rep
Acute ischemic syndrome	—	CV
Alcohol use disorder	PDA	GI-N, Sym
Alzheimer's dementia	Phys	Sym
Ankylosing spondylitis	—	FPP-MSS, CV
Anterior cruciate ligament injuries	—	—
Asthma		R-R, Sym
Breast cancer	PDA, CHA, MTC	En-Rep, FPP-MSS, GI-N, CV
Chronic obstructive pulmonary disease	—	R-R, Sym
Colorectal cancer	—	GI-N
Diabetes	Phys	GI-N, En-Rep
Dyslipidemia	—	CV, En-Rep
Effect of sex and gender in disease states on drug therapy outcomes	—	CV
Gastroesophageal reflux disease and Barrett's esophagus	—	—
Generalized anxiety disorder	—	Neu-Psy
Heart failure	—	CV
History of sex/gender in drug therapy	PDA	—
Importance of sex/gender in pharmacologic research	PDA	CV
Inflammatory bowel disease	—	—
Intimate partner violence	CHA	En-Rep, Neu-Psy
Liver lesions	—	GI-N
Lung cancer	PDA	R-R
Major depressive disorder	M-Neu	Neu-Psy
Migraine	M-Neu	Neu-Psy, Sym
Myocardial infarction from obstructive coronary artery disease	FHB	CV, Sym
Nonobstructive ischemic heart disease	—	CV
Obesity	—	CV, GI-N
Opioid use disorder	PDA	—
Osteoarthritis	CHA	FPP-MSS
Osteoporosis	Phys, PDA	FPP-MSS, En-Rep
Rheumatoid arthritis	—	FPP-MSS, CV
Sex/gender considerations in therapeutic response	PDA	CV, GI-N, En-Rep
Schizophrenia	M-Neu	Neu-Psy
Sleep apnea	—	—
Stroke	Phys, PDA	CV, Neu-Psy, Sym
Systemic lupus erythematosus	—	FPP-MSS, CV, R-R, Sym
Tobacco use and nicotine addiction	—	CV
Vaccination	IAHI	GI-N

Abbreviations: MTC, molecules to cells; Phys, physiology; CHA, clinical human anatomy; IAHI, infectious agents and host immunity; FHB, foundations of human behavior; PDA, principles of drug action; M-Neu, medical neuroscience; FPP-MSS, foundations of pathological processes and musculoskeletal skin; CV, cardiovascular; R-R, renal-respiratory; H-L, Heme-Lymph; GI-N, gastrointestinal-nutrition; En-Rep, Endocrine-Reproduction; Neu-Psy, neurology-psychology; Sym, symptoms.

RESULTS

Session Presentation of SGM Content

All 604 basic science sessions delivered in large group didactic lectures were audited across the M1 and M2 preclinical years. Fifty-four percent (330/604) of sessions contained SGM characterization content, which further divided into 45% (132/294) of M1 sessions and 64% (198/310) of M2 sessions. Of the sessions covering SGM content, 60% (198/330) were from the M2 year. The breakdown of topics by sex and gender across the 7 characterizations is shown in Figure 1. Coverage of 6 out of 7 characterizations was greater in M2 courses compared to M1 courses. Only pharmacology had less coverage in M2 courses compared to M1 courses. Epidemiology and disparity characterizations were used most often in the presentation of SGM topics in M2 and M1 courses, respectively.

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Curriculum Content Comparison

When the preclinical course characterization content was compared to the 38 SGM topics from the Jenkins and Newman textbook, 34 topics were covered (Table 1). The M1 curriculum covered 18 of 38 (47%) topics, while the M2 curriculum covered 32 topics (84%). The 4 topics not covered from SGM perspective included inflammatory bowel disease, sleep apnea, anterior cruciate ligament injuries, and gastroesophageal reflux disease/Barrett's esophagus. Regarding the depth of coverage (Table 3), 14 topics were covered briefly with 1 to 2 distinct facts, 11 were covered moderately with 3 to 5 distinct facts, and 9 were covered in-depth with 6 or more facts. The median SGM topic coverage was 3 facts (Table 3). Topics receiving the most SGM-specific coverage were breast cancer (3 M1courses, 4 M2 courses), stroke (2 M1 courses, 3 M2 courses), osteoporosis (2 M1 courses, 2 M2 courses), sex and gender considerations in therapeutic response (1 M1 course, 3 M2 courses), and systemic lupus erythematosus (4 M2 courses) (Figure 2). Ten topics were mentioned in only 1 course across both preclinical years (Table 1).

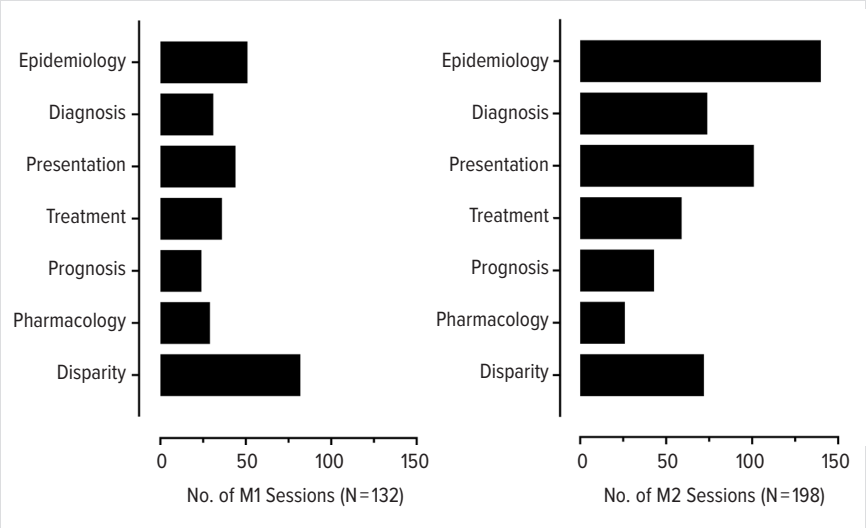
Overlap across the 2 preclinical years was noted. While 2 topics were covered only in the M1 year, most topics covered in the M1 year were repeated in the M2 year (16/18). Although M2 courses are organ systems based, SGM topics from other organ systems had overlapping coverage among courses. For example, the M2 cardiovascular unit covered 15 topics, ranging from addiction and autoimmune to metabolic and neurological (Table 1). Only 5 topics are primarily cardiovascular-specific (acute ischemic syndrome, myocardial infarction from obstructive coronary artery disease, nonobstructive ischemic heart disease, heart failure, dyslipidemia).

Table 2. Example of Student Comments Matched to Sex and Gender Medicine (SGM) Topics

Coverage Level	SGM Topic	Student Survey Comments
Brief (1-2)	Rheumatoid arthritis	Rheumatoid arthritis is more common in women than men, approximately 2.5:1
Moderate (3-5)	Major depression disorder (MDD)	Women more likely than men to have a diagnosis of depression depression after an ischemic event Discussed prevalence of depression in males vs females Women are 70% more likely than men to experience depression Men are less likely to seek help for MDD
In depth (6+)	Myocardial infarction from obstructive coronary arrtery disease	Women have a harder time quitting smoking and increased cardiovascular risk due to sex- and gender-based differences There are traditional and nontraditional atherosclerotic cardiovascular disease risk factors in women Session included difference in men (50%) vs women (15%) dying from ischemic heart disease related to hyperlipidemia type 2a. Session discussed aspirin originally being tested in men or cardiovascular disease secondary prevention and later tested (and comparable) in women Prevalence of coronary artery disease in "men and women" Also discussed the greater prevalence of autoimmune disorders in women, which increases the risk for atherosclerosis and heart disease

Student comments from the survey were mapped to the SGM topics. Each unique comment was added to score each topic and assign a coverage level. For example "brief" coverage included topics with 1-2 discrete comments.

Figure 1. Breakdown of Sex and Gender Medicine Characterizations by M1 and M2 Year



The number of times each characterization was used in a lecture is plotted, along with the total number of M1 and M2 sessions containing SGM content.

DISCUSSION

Learning sex- and gender-based medicine during the preclinical years sets a foundation for young clinicians to "improve diagnosis, disease management, and health outcomes"[11] for all. It was notable that the SGM content in MCW curriculum expanded on sex-based anatomical and/or physiological differences and made connections to clinical evidence of sex- and gender-based differences. In contrast, a report from the Texas Tech Health University Health Sciences Center School of Medicine found that most SGM content was focused on anatomical and physiological sex differences, while incidence, prevalence, treatments, and outcomes that

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Table 3. Summary of Number of Distinct Facts Matched to Sex and Gender Medicine Topic List

	No Coverage (0)	Minimal Coverage (1-2)	Moderate Coverage (3-5)	In-Depth Coverage (6+)
Topics	Gastroesophageal reflux disease and Barrett's esophagus Inflammatory bowel disease Anterior cruciate ligament injuries Sleep apnea	Opioid use disorder Rheumatoid arthritis Ankylosing spondylitis Colorectal cancer Heart failure The effect of sex and gender in disease states on drug therapy outcomes Tobacco use and nicotine addiction Nonobstructive ischemic heart disease Generalized anxiety disorder Dyslipidemia Obesity Osteoarthritis Alzheimer's dementia The history of sex and gender in drug therapy	Systemic lupus erythematosus Liver lesions The importance of sex and gender in pharmacologic research Vaccination Asthma Major depressive disorder Schizophrenia Access to care Alcohol use disorder Diabetes Stroke	Acute ischemic syndrome Myocardial infarction from obstructive coronary artery disease Osteoporosis Chronic obstructive pulmonary disease Breast cancer Migraine Lung cancer Intimate partner violence Sex and gender considerations in therapeutic response
TOTAL	4	14	11	9

Student comments indicated more distinct details about sex and gender medicine topics (Table 2). The number of distinct facts were summated across both the M1 and M2 curriculum as no coverage, minimal coverage (1-2), moderate coverage (3-5) and in-depth coverage (6+).

were more clinically sex- and or gender-based were obscure.[7] The dual approach used by the current study of first identifying session presentation of SGM terms linked to characterizations and then doing a more in-depth comparison to relevant SGM clinical content was key to gaining more insight into strengths and gaps in curriculum content.

While SGM characterizations were covered in the M1 and M2 curriculum, it was clear that many were taught in an inconsistent manner. Sessions described only minimal epidemiological differences between sex and gender. It is speculated that faculty lecturers relied more heavily on incidence and prevalence to demonstrate a sex and/or gender-based difference because these are well known and widely reported. The apparent lack of SGM characterization related to pharmacology is also a concern, given the known differences in pharmacology between the sexes, but not necessarily unexpected, as a similar finding was reported by Miller et al[19] in a case study of SGM at Mayo Medical School. Reasons for pharmacology deficits are varied, but one possibility is the continued lack of inclusion of women in clinical drug trials. The work also showed that most clinical content topics from the Jenkins and Newman textbook were covered, and this is acknowledged as an asset to the preclinical MCW medical education. It will be an important framework on which to continue to build a more robust clinically relevant SGM curriculum. It is notable that of the 38 topics used to index the sex and gender clinical content in the M1 and M2 courses, only 4 topics were not covered from SGM perspective. It is predicted that fewer SGM topics will be missed, as research and clinical studies continue to include and report on sex as a biological variable and/or gender identity in health conditions.[8] A challenge remains how to keep faculty knowledgeable and how to easily incorporate new information into existing lectures.

The overlap of SGM topic coverage across the 2 preclinical years and between individual courses also demonstrates the achievability of further integration. This is important because it means no additional lecture time needs to be pulled from other foundational topics to make room for SGM. Instead, our data support the conclusion that coverage needs to be formalized, intentional, and presented at a greater depth. A necessary next step of current work is to develop ways to engage faculty to integrate SGM more completely into future curriculum. Most recently, a set of 4 sex and gender health educational tenets were developed by an interprofessional group of educators based on work of the 2020 Sex and Gender Health Education Summit.[3] Adaptation of these tenets by curriculum leaders will ensure that educational materials are continually updated as the knowledge base of sex and gender medicine continues to expand.

Study Limitations

This study had some limitations. One was a lack of common language across faculty lecturers to define and discuss sex and gender. While this added to the complexity of describing and analyzing SGM topics within the curriculum, it also demonstrates additional need to educate faculty lecturers on both

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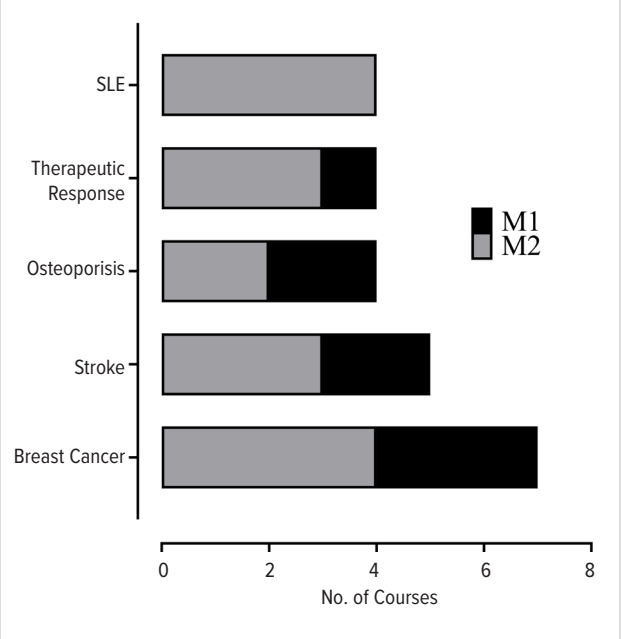
importance of these discussions and the use of clear and appropriate terminology.

Not auditing small groups and clinical skills sessions is another limitation of this work, particularly as many in medical education work to transition away from large lecture formats toward smaller group sessions. In the future, such small groups could be audited for SGM topic coverage using a similar method with more auditors or with more qualitative methods, such as focus groups or interviews.

Additionally, utilizing a single textbook to define the SGM topics for analysis could potentially limit what SGM topics were deemed important. However, as accomplished leaders in both the practice of SGM and education of medical students, Jenkins and Newman took a comprehensive and foundational approach to sex and gender health and disease. The outline of the book was systems-based and correlates well with the course structure of many medical schools, including the current MCW curriculum.

Another limitation was the qualitative approach to analyze the curriculum content as it was based on the feedback provided in the survey's optional comments section. However, because sessions were viewed by multiple students, the comments—while completed to varying degrees by individual students—allowed compilation from all the student observations.

Figure 2. Topics Receiving the Most Sex and Gender Medicine Coverage



Bar graph shows topics that had most coverage across the M1 and M2 courses compiled from Table 1. Therapeutic response = sex and gender considerations of therapeutic response. Systemic lupus rrythematous (SLE) from a sex and gender medicine perspective was not taught in the M1 year.

Study Strengths

Strengths of the study include the real-time audit approach being time efficient and comprehensive. The survey audit form was completed shortly after the lecture session, took a few minutes to complete, and considered both written and spoken content contained in the lecture. Additionally, using medical student auditors authentically captured the student perspective on the discussion of SGM topics in the curriculum.

Like other SGM curriculum audits, our work provides a meaningful baseline of SGM teaching. The MCW CEC encouraged and supported this work with the additional caveat that the results be used to inform current and future curriculum changes. These methods also could be adapted to audit other elements of the curriculum, such as race, ethnicity, mental health, substance use, and social determinants of health, to ensure their inclusion in appropriate contexts. While it is inherent that this study was performed on a single medical school's curriculum, it joins a growing number of such audits that could, and should, be used in the future to begin to examine on national and international levels how SGM is taught in medical education. This is important, particularly when considering curriculum redesign and integration of SGM.

CONCLUSIONS

Previous survey data from both national and local levels reported that medical students recognize the importance of SGM while acknowledging a lack of preparedness, demonstrating the need for institutions to approach SGM integration into the curriculum in a formalized and consistent way. The defined dual approach of this study to identify SGM characterization content in lectures and compare it to topics presented in an evidence-based book on SGM is novel and can be a model for other medical schools.

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