BEME Scoping Review Study Protocol

1. Cover Sheet

Contribution of basic science to the professional identity development of medical learners: A BEME scoping review protocol (Reg. No. 0152)

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Sources of Support

None

2. Glossary of Terms:

Basic science: the biological sciences traditionally taught in medical school, including anatomy, physiology, pathology, biochemistry, histology, embryology, pharmacology, cell biology, molecular biology, genetics, immunology, microbiology, and neuroscience.

Professional Identity Formation (PIF) and Professional Identity Development (PID): The process through which a medical learner transforms into thinking, acting, and feeling like a physician. Professional Identity Formation is the term most commonly used in the medical literature. Professional Identity Development better captures the continual process of growth and becoming that ideally occurs throughout one's career.

Landscapes of practice: A sociocultural learning theory that explains the identity formation of learners and practitioners as a journey through a landscape of many different communities of practice. This theory was developed by Wenger-Trayner and colleagues[1], and more recently has been applied to physician PIF and medical education[2].

Knowledgeability: It relates to the 'complex relationships people establish with respect to the landscape of practice, which make them recognisable as reliable sources of information or legitimate providers of service."[1] It involves appropriate use of knowledge in relevant situations.

Narrative/discussion/view/position/literary conversation: A written account or discussion about (in our context) basic science in the education, transformation and development of a physician or medical doctor.

3. Abstract:

The objective of this scoping review is to systematically map the literature related to the role of basic science in the process of physician professional identity development, with the goal of identifying key concepts and gaps in the literature. For the past century the undergraduate medical curriculum has typically included a significant basic science component, with the assumption that basic science underpins the study and practice of medicine. As the identified content, values and skills required for physicians continue to swell, many medical schools are re-evaluating the roles, timing and amount of basic science required to educate their students. If one views medicine as a vast landscape of knowledge and practice, learners traverse this landscape, engaging to varying extents with scientists, clinicians, and other academics as part of their developmental journeys. Since a major role of the medical education continuum, from undergraduate medical education through graduate and continuing medical education, is to support and promote physician professional identity development, this scoping review aims to summarize the literary discussions and findings related to how basic science contributes to this process. These findings should help in the design of future medical curricula as well as identifying new research questions.

Included sources will all be related to the impact of basic science on learners' thinking, feeling, or acting like a physician, or their medical specialty choice. The complete search will include PubMed, ERIC, PsychInfo, Scopus, Web of Science, Cochrane and Embase databases as well as websites from several professional organizations. The search will be limited to January 1988-October 2021, and English and Spanish languages. The identified sources with be systematically charted, and the extracted data will be mapped, and thematic categories will be identified. The conceptual framework that will be used to interpret data is the 'landscapes of practice' sociocultural learning theory[1, 2]. The final step before writing the review will be consultation of several experts in the field to share, validate and build on preliminary findings.

4. Background:

Since the publication of the Flexner Report[3] on medical education in the United States (US), the undergraduate medical education (UME) curriculum has typically included a significant basic science component, with the assumption that basic science underpins the study and practice of medicine[4, 5]. In this review, we define 'basic science' as the biological sciences traditionally taught to medical students (e.g., anatomy, physiology, pathology, biochemistry, histology, embryology, pharmacology, cell biology, molecular biology, genetics, immunology, microbiology, and neuroscience). In depth study of the basic science has been proposed as a key differentiator between physician training and that of other healthcare providers[4, 6]. Throughout the past century, formal medical curricula have primarily contained the basic science early during UME, even though Flexner argued that rigorous, academic science was important broadly as a tool to advance medical practice and for the professionalization of medicine[3, 7].

The combination of expanding amounts of medically relevant knowledge in basic science, together with the appreciation that medical students also need time to develop skills and adopt the values inherent in social sciences, health systems, and medical ethics, arts and humanities, is causing many medical schools to re-evaluate what essential roles basic science plays in educating physicians[8]. This re-analysis is acutely critical in the US due to the change in the USMLE Step 1 licensing exam reporting from a 3-digit score to Pass/Fail, beginning in January 2022, which removes a significant external motivation for teaching detailed and extensive basic science content[9]. Therefore, from a practical perspective, this proposed scoping review aims to provide a broad and comprehensive analysis of the indexed, peer-reviewed literature, the grey literature (e.g., theses, professional organization websites), and expert opinion to help pre-medical, medical, and residency programs best design their future curricula.

In 2010 a Carnegie Foundation report proposed reforming medical education to include a greater focus on the 'progressive formation of [the physician's] professional identity'[10]. In the subsequent decade, many medical educators have elaborated on this proposal and contributed to our understanding of physician professional identity formation (PIF)[6, 11-16]. These studies and analyses of the components of medical education that help students and residents "think, act, and feel like a physician" include references to clinical role models, humanities-based reflective practices, ethics training and health systems quality improvement projects, but rarely mention an explicit role for basic science[17-21]. A search of PubMed, Cochrane and Embase databases on September 16, 2021 for Professional Identity Formation and Medical Learners revealed 15 systematic reviews. Only one of these reviews considers the role of basic science, and it completely focuses on professionalism within the cadaver lab[22]. The involvement of basic

science may be implied within the general idea of achieving clinical competence for PIF[23], but is not otherwise articulated in these reviews.

We specifically chose a systematic scoping review for this project because there has not yet been a comprehensive exploration of the potential ways, both positive and negative, that study of and participation within basic science impacts the development of physicians. Physician PIF is a relatively new perspective for considering medical education and we will read all of the literature discussions since 1988 regarding the roles of basic science through this lens. Therefore, a scoping study is the most appropriate approach[24, 25].

This scoping review is designed to fill this gap by systematically exploring the literature to identify themes and theories for how basic science contributes to (or inhibits) development of physician identities. No similar scoping or systematic reviews or review protocols were found by searching the following databases: BEME, Prospero registry, Cochrane Database of Systematic Reviews, PubMed, and ERIC.

Professional Identity Formation (PIF) is the term most commonly used in the medical literature. However, we think that Professional Identity Development (PID) better captures the continual process of growth and becoming that occurs throughout a physician's career trajectory. We therefore use both terms to acknowledge the majority of prior scholarship and the goals of this scoping review.

This scoping review will include sources that describe the impact of the basic science on learners' professional identity formation (PIF)/development (PID) across the medical education continuum from pre-medical (as appropriate) through medical school (undergraduate medical education) and residency training (graduate medical education), as well as during continuing medical education. Since the PIF/PID of learners is impacted by their socialization into a specific medical specialty[26], we include specialty choice within our selection criteria. We will specifically look for information regarding the impact of basic science on the PIF/PID of minoritized learners, including those identifying as women or transgender, racially minoritized and individuals with disabilities, as well as from lower socioeconomic status. The research team involved was specifically chosen to have broad medical education and clinical or scientific expertise, as well as a breadth of personal and social identities.

Cruess et al[12, 17] suggest the Communities of Practice learning theory for understanding and interpreting evidence regarding physician PIF. This constructivist social learning theory was first proposed in 1991 by Lave and Wenger[27] and its connection with identity formation was further elaborated by Wenger in 1998[28]. More recently, Wenger-Trayner and other sociocultural learning theorists have proposed the related Landscapes of Practice model for learner identity development[1]. This theory acknowledges the transformative journey that medical learners take through a landscape of *different* communities of practice during both their formal curricula and their careers[2]. Learners may either be sojourners who deeply engage with a specific community and develop 'knowledgeability' of the field or behave more like tourists who move quickly through a community without being significantly impacted[1]. Wenger-Trayner and colleagues define three modes of identification within a landscape: engagement, imagination, and alignment[1]. Engagement within the basic science community of practice might involve participation in a research project or co-creating an artifact for explaining a disease process to a patient. Imagination involves reflecting on our roles within a practice or how that practice will impact who we will become. Alignment involves coordinating our ways of thinking and acting with those of the community, for example applying the scientific method to solving a problem[1]. The landscapes of practice theoretical framework will be used as a lens for interpreting the data identified as part of this scoping review.

Ultimately, this proposed BEME scoping review will systematically identify, map, and summarize the literary discussions around impacts on medical learners made by basic science and the communities of basic scientists that they encounter during their journeys of becoming and developing as physicians . By clarifying what is known and what is hypothesized but remains untested in this area, medical educators will be better informed regarding the ultimate goals of the basic science components of the medical curriculum and what training faculty may need to achieve these goals. Identified gaps in current knowledge will also inform future medical education research questions.

5. Scoping review framework

The framework for this scoping review is based on that initially proposed by Arskey & O'Malley[24] with clarifications provided by Levac et al[29] and Peters et al[30].

Framework Stage 1: Identifying the research question and alignment of objectives with purpose of the review

The aim of this scoping review is to explore, document and summarize the conversations in published literature surrounding the contribution of studying basic science to the development of a physician's professional identity. As summarized above, this review will provide a new perspective on how basic science and basic scientists impact medical learners that will help medical education programs with their curriculum designs and reveal fertile ground for new research.

PICO framework for developing the research question:

- **Population:** Medical Learners
- **Intervention:** Basic science component of medical education
- **Comparison:** No comparison group. (Since education is a transformative process, the implied comparison group is the learners before they received the intervention.)
- **Outcome:** Professional identity development of physicians

Research question: **How does the basic science component of a medical curriculum contribute to the professional identity development of medical learners?**

Objectives:

1) Summarize, through rigorous methodology, the various views of how basic science impacts how learners think, feel and act like a physician, including medical specialty choice.
2) Provide an overview of the types of studies and levels of evidence that currently exist regarding impact of basic science on physician PIF/PID.
3) Describe implications of these findings for medical curriculum design and future research.

Key words: Basic science, medical education, professional identity formation, professional identity development, physician development, medical learners, landscapes of practice, community of practice

Framework Stage 2: Identifying relevant studies by an iterative process

For identification of relevant published literature to include in this scoping review, a library scientist (MH) was added to the team to support a comprehensive and systematic search of electronic databases and literature from relevant organizations. In addition, the library scientist

(MH) recommended an initial table of inclusion and exclusion criteria based on our research question to facilitate the identification of relevant sources. The systematic search strategy for our scoping review is based on terms used to identify the role of the basic science curriculum in the professional identity formation/development of medical learners. Furthermore, the scoping review team provided the library scientist (MH) with a developmental test-set of 12 published articles that are expected to be included in this scoping review[6, 31-41]. Keywords and subject headings were searched using 'OR', 'AND' and 'NOT' Boolean operators.

A pilot search was conducted by the library scientist (MH) on the PubMed database, where the search strategy initially yielded 2376 citations. These citations were imported into an EndNote X9 library and shared with the team. Upon careful review and further discussions on the refinement of the search strategy, a comprehensive set of keywords and controlled vocabulary were utilized that yielded 2205 references. This search yielded 10 of the 12 original test-set articles. Several attempts were made to alter the search strategy to try to include all 12 articles, but each of these attempts expanded the total number of citations identified by at least three-fold with primarily irrelevant articles. Therefore, after completing this iterative process, the research team decided to adhere to the search strategy that yielded 2205 references from PubMed and broaden the results by searching other databases and by hand searching; the search strategy used is provided in Appendix A.

Search method: Preliminary PubMed searches using keywords and subject headings revealed relevant papers from January 1988-October 2021. The year 1988 was chosen as the start date because it was when the World Conference on Medical Education was held, and the Edinburgh Declaration was formulated to mandate updates in medical education[42]. The search also restricted results to English and Spanish citations because of the language limitations of the research team members and the goal of ensuring that at least two team members could read each citation.

The full search strategy aims to identify further sources of information for both the conventional journal literature and grey literature in the following databases and professional organizations: PUBMED, ERIC, PsychINFO, Scopus, Web of Science, EMBASE, Cochrane, the International Association of Medical Science Educators (IAMSE), the Association for Medical Education Europe (AMEE), the Association for American Medical Colleges (AAMC), the Canadian Association for Medical Education (CAME), the Australian and New Zealand Association for

Health Professional Educators (ANZAPHE) and Advancing Scholarship in Medical Education (ASME).

In addition to these comprehensive searches, reference lists of key articles will be searched by hand. Citations will be managed, and duplicates removed, using EndNote X9 provided by Clarivate Analytics and then exported to RAYYAN.ai[43] for primary title and abstract screening and secondary full-text screening.

The full inclusion/exclusion criteria were applied to the first 50 articles from the preliminary search that yielded 2096 references. Two team members (SJ and JL) completed the primary (title and abstract) screening process, yielding 14 articles. The full-text secondary screening of these 14 articles by two team members (CC and JL) yielded 10 that match full criteria. Therefore, we estimate that approximately 20% of articles identified by our searches (500+) will be appropriate for including in our review.

Three of these papers that meet the inclusion criteria in full are:

- Aborajooh E, Al-Taher R, Tarboush NA, Al-Ani A, Qasem N, Ababneh S, Ababneh G, Al-Ahrash A, Al-Saeedi B, Al-Husaini S, Bucheeri A. A cross-sectional study of basic education influence on the clinical training: Attitudes and perception among Jordanian medical students. Ann Med Surg (Lond). 2020 Nov 15;60:456-461. doi: 10.1016/j.amsu.2020.11.022. PMID: 33294174; PMCID: PMC7688991.

- Abrams MP, Eckert T, Topping D, Daly KD. Reflective Writing on the Cadaveric Dissection Experience: An Effective Tool to Assess the Impact of Dissection on Learning of Anatomy, Humanism, Empathy, Well-Being, and Professional Identity Formation in Medical Students. Anat Sci Educ. 2020 Oct 13. doi: 10.1002/ase.2025. Epub ahead of print. PMID: 33052018.

- Abulaban AA, Obeid TH, Algahtani HA, Kojan SM, Al-Khathaami AM, Abulaban AA, Bokhari MF, Merdad AA, Radi SA. Neurophobia among medical students. Neurosciences (Riyadh). 2015 Jan;20(1):37-40. PMID: 25630779; PMCID: PMC4727603.

Search Limitations: The search strategy has been established to capture references relevant to medical education. It excludes literature focusing on other healthcare careers such as nursing, dentistry, pharmacy, and veterinary medicine. The authors purposely chose this limitation to help focus the review on the team's primary area of interest. A future study of the role of basic science on the identity formation/development of non-physician healthcare providers may be appropriate at a later date. Another limitation is the language restriction of English and Spanish. Furthermore, database citations indexed without an abstract may be missed.

Framework Stage 3: Study selection based on inclusion and exclusion criteria

The following inclusion and exclusion criteria (Table 1) were developed through an iterative process of multiple team members reviewing a set of 10 articles, voting on inclusion or exclusion, and justifying their vote based on the study objectives. These criteria may be further refined as the screening and selection process proceeds; significant updates will be documented and reported.

Table 1: Inclusion and Exclusion criteria

Criteria domain	**Inclusion parameter**	**Exclusion parameter**
Date	Reported during or after 1988	Reported before 1988
Geographic Location of study	All	None
Language	English and Spanish	All other languages
Participants/Population	Future physicians/medical doctors (pre-medical students, medical students) or current physicians/medical doctors [43]	Does not directly relate to current/future physician/medical doctor
Type of Literature- Peer Review and Grey	All types of peer reviewed literature (including editorials, perspectives, opinion pieces, and reviews); Grey literature:	Blogs, Twitter

	book chapters, books, conference papers, meeting abstracts, reports, theses/dissertations, white papers, DR-ED listserv	
Setting	All countries	None
Study design	All	None
Types of evidence	All	None
Overarching concept	Must include direct reference to basic science (foundational, biomedical) or one of the specific sciences mentioned earlier (anatomy, biochemistry, physiology, histology, etc.)	No direct reference in title or abstract to basic (foundational, biomedical) science or to one of the specific sciences mentioned. (e.g., Clinical study design, statistical methods, evidence-based medicine does not count unless basic science is mentioned)
Context	Must include impact on student/learner, including thinking, feeling, acting like a physician, or medical specialty choice	Only describes a program/course/curriculum and NOT effect on the learners or no direct connection to thinking, feeling, or acting like a physician or consistent with? medical specialty choice

Study Selection:

All review authors, excluding the library scientist (MH), will be involved in the primary screening of articles and other materials. Teams of two reviewers will independently conduct primary screening of a fraction of the total references by examining the titles and abstracts for those that

meet inclusion criteria. Disagreements will be resolved by discussion between the two reviewers, with a third reviewer from a separate team available to develop consensus. The included articles will undergo secondary screening by a separate team of two reviewers through full text review to identify reports that meet inclusion criteria and documenting reasons for those that are excluded. Again, any disagreements will be resolved through discussion with a third reviewer available to develop consensus. A flow diagram of article identification will be created (PRISMA-ScR)[44].

In order to engage in reflexivity and avoid making assumptions about the data, authors will do the following: (1) use established criteria for inclusion vs. exclusion to make decisions, (2) keep a written audit trail about what criteria they are using to establish whether each article should be included or excluded, and (3) meet with other authors to check for consensus on a regular basis (every other week or after every approximately 100 reviews).

Framework Stage 4: Procedure for extracting and charting the data

Data extraction: The data extraction process will begin with a test-set of 10 sources in order to develop a systematic approach. Once the data extraction process is refined, all review authors, excluding the library scientist (MH), will participate in data extraction of a fraction of the total references with two team members assigned to each reference. Following data extraction, each dyad of team members will review the extracted data, discuss any disagreements to achieve consensus and bring in a third member as needed to achieve agreement. Anticipated data to be extracted and charted is shown in Table 2. The data charting form will be loaded into Google forms to ease sharing of data among team members.

Table 2. Anticipated data charting fields

1. Article identifiers (authors, publication date)
2. Type of article (primary research study, opinion piece, review, guidelines, website)
3. Setting (Country)
4. Participants/Target Group (e.g., undergraduate, postgraduate, continuing professionaldevelopment/medical education, minoritized learners)
5. Discipline or Medical Specialty
6. Description of the study or discussion
    - Purpose
    - Methodology
    - Theoretical models or conceptual frameworks
7. Outcome measures (including Kirkpatrick Level)
8. Key results; Impact of basic science on learner related to PIF/PID; evidence that learner developed 'knowledgeability' related to learning basic science; evidence for engagement, imagination, or alignment with basic science practices.

Framework Stage 5: Collating and summarizing the data

The first step at this stage will be to synthesize the data into a series of maps and charts to help visualize the scope and frequency of information identified. Next, two team members will employ content analysis[45] to code the charted data and create a preliminary codebook. The other team members (excluding the library scientist, MH) will then analyze all records based on the identified codes, suggesting new codes as needed. Team members will use memo writing to document their coding process. Discrepancies will be resolved through discussion. Discussion will also be used to further refine and/or collapse codes as necessary and to organize codes into themes. These themes will be analyzed from the perspective of the landscapes of practice theory of identity development.

Framework Stage 6: Expert consultation and reporting the results

In order to gather some initial reactions to our identified themes and ideas about their implications for curriculum design and future research, subject to appropriate ethical approval, one of our team members (CC) will conduct structured interviews with 3-5 acknowledged experts in the international medical education field. Diversity of background and experience will play a major role in choosing the experts, in order to solicit varying perspectives.

Criteria for choosing experts will include:

- Has been teaching medical learners for at least 5 years
- Has established a research agenda in either:

- studying professional identity formation of medical students/trainees/physicians and/or guiding medical students/trainees/physicians in the development of professional identity, OR
- studying the impact of basic science curricula on medical learners

A written draft summary of our findings will be provided at least one week before the interview to allow participants time to consider potential implications of our findings for both curriculum design and medical education research. The interviews will be recorded and transcribed verbatim. The transcripts will be provided to all team members.

The review team will meet at least twice to discuss the findings and jointly agree on the overall outline of the written manuscript. Three team members (JL, EA and SJ) will draft the manuscript; all team members will revise the manuscript prior to submission.

6. Potential expected outcomes and implications for medical education

Many medical school programs are struggling with the significant challenges of competition for limited amounts of curricular time and securing adequate resources[8], including how and when to include basic science concepts in meaningful learning activities. Additionally, in some schools, finding the right balance and integration of basic and clinical sciences is often more influenced by internal political disputes than academic consensus. The overarching goal of this scoping review is to provide the analysis and summary of current evidence for what, if any, components of the basic science curriculum and basic science community of practice are essential to the transformation of one's sense of self during development into a competent physician. Based on our initial review of the literature[5, 6, 14, 40, 46-48] together with the shared expertise of the team members, we anticipate finding evidence for the following contributions of basic science to physician PIF/PID:

1. adopting and internalizing the beliefs, values and characteristics of medicine;
2. clinical competence, including diagnostic reasoning and preventing errors;
3. developing scientific values and habits of mind, including curiosity, inquiry, hypothesis generation and testing, motivated by ambiguity and uncertainty, skepticism, creativity, intellectual honesty, and openness to new ideas;
4. providing a common vocabulary to communicate with the medical community;
5. the ability to explain the biological basis of disease to a patient;

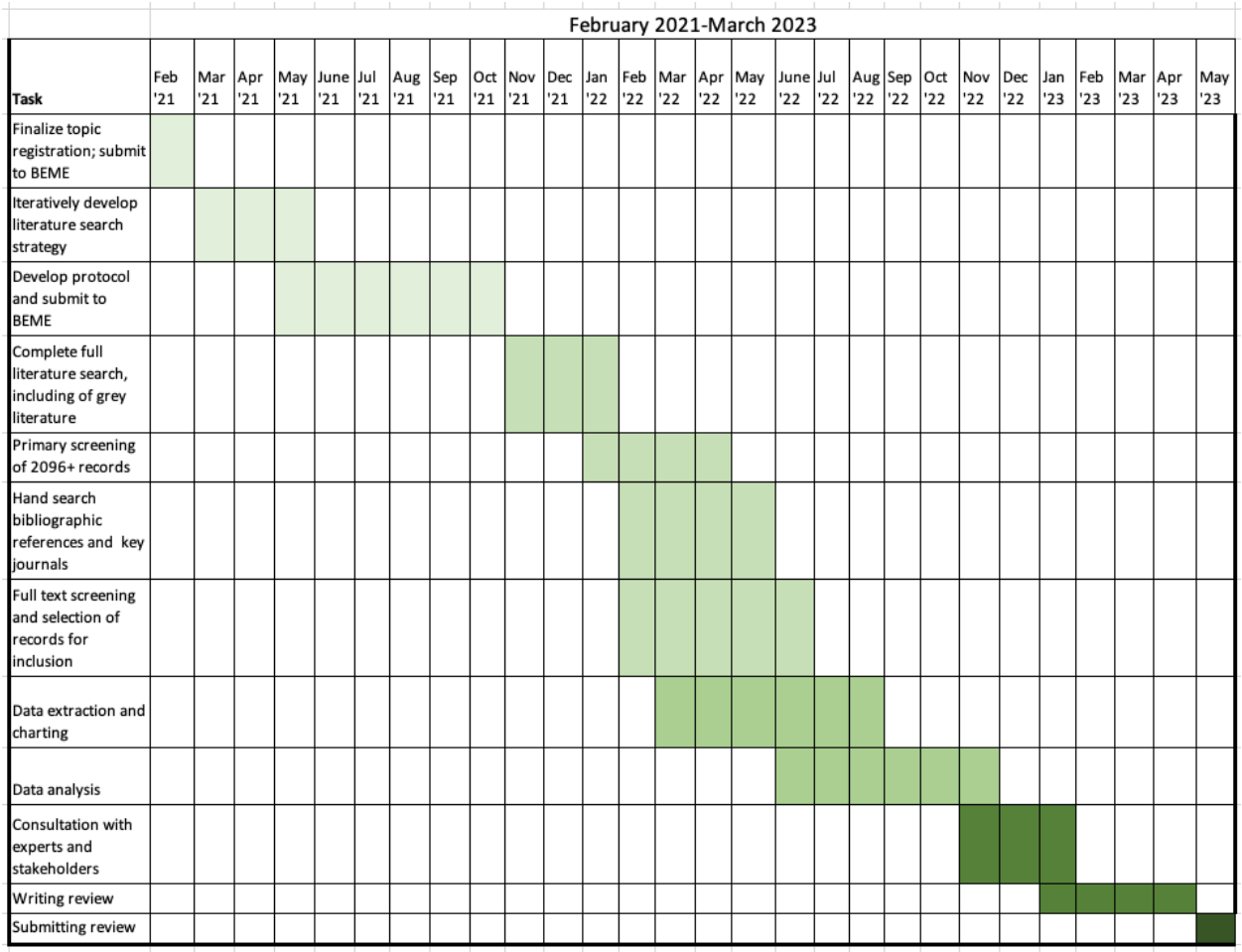
6. the development of clinician-scientists, who contribute to the body of medical knowledge through their research;
7. specialty career choice.

In order to focus the scope of this review, we will only be considering medical learners and not other healthcare professionals. Therefore, while we may identify evidence that basic science helps differentiate physicians, we will not be systematically comparing medical learners with other health science students. We will pay close attention to the impact of basic science on the evolution of professional identity formation/development along the educational continuum from undergraduate to post graduate. Special attention will also be paid to who is included and who is absent from these studies, including students of color, or those of specific gender, sexual identity, nationality and/or socio-economic background.

7. Contributions of this review to the field

By establishing the empirical base for the role of basic science curriculum and community of practice in physician PIF/PID, we will provide an evidence-based guide to use for the design of medical curricula and reallocation of resources. Performing this analysis through the lens of landscapes of practice will provide a new perspective and identity gaps in the evidence to inform future research. This BEME scoping review will bring basic science into the general discussion of physician professional identity development .

8. Project Timetable:



9. Conflicts of interest

All authors report no conflicts of interest, neither academic, institutional, political, financial, personal, nor other.

10. Changes to the protocol

The review team will follow the methodology outlined in this protocol with the caveat that the process of performing a scoping review is often iterative[29]. Minor changes to the protocol, including reasons and dates for any deviations, will be carefully documented. Any major changes will be submitted to BEME for approval.

11. Protocol checklist

The BEME Systematic Review Protocol Checklist was utilized to ensure that all essential components of a Scoping Review protocol are included. Due to the nature of scoping reviews, there will be no quality appraisal of studies[24, 25, 44].

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Appendix A: Initial PubMed search strategy that yielded 2096 references

(“basic science*”[tiab] OR science[tiab] OR "Science/education"[Mesh] OR anatomy[tiab] OR "Anatomy/education"[Mesh] OR “human body” [tiab] OR biochemistry[tiab] OR "Biochemistry/education"[Mesh] OR “biomedical science” [tiab] OR “biomedical knowledge” OR “cell biology” [tiab] OR "Cell Biology/education"[Mesh] OR genetics[tiab] OR "Genetics/education"[Mesh] OR histology[tiab] OR "Histology/education"[Mesh] OR immunology[tiab] OR "Allergy and Immunology/education"[Mesh] OR microbiology[tiab] OR "Microbiology/education"[Mesh] OR neuroscience[tiab] OR "Neurosciences"[Mesh] OR "Neurosciences/education"[Mesh] OR pathology[tiab]
OR pathophysiolog*[tiab] OR "Pathology/education"[Mesh] OR pharmacology[tiab] OR "Pharmacology/education"[Mesh] OR physiology[tiab] OR "Physiology/education"[Mesh] OR “scientific method”[tiab])

AND
(“undergraduate medical education”[tiab] OR “medical education” [tiab] OR “graduate medical education”[tiab] OR “medical student*”[tiab] OR “medical residency” [tiab] OR “medical resident*”[tiab] OR “medical residencies” [tiab] OR “medical internship*”[tiab] OR “medical fellow*”[tiab] OR “medical trainee*”[tiab] OR “foundation year” [tiab] OR “house staff” [tiab] OR “medical practitioner*”[tiab] OR “clinical medicine” [tiab] OR “clinical education”[tiab] OR “clinical clerkship*”[tiab] OR “clinical rotation*”[tiab] OR “medical curriculum” [tiab] OR “medical curricula”[tiab] OR "Curriculum"[Mesh] OR "medical learner*")

AND
(career[tiab] OR “clinical scientist*”[tiab] OR “physician-scientist*”[tiab] OR doctor[tiab] OR physician[tiab] OR “clinical competence” [tiab] OR “clinical competencies” [tiab] OR “clinical decision-making” [tiab] “clinical cognition” OR “clinical judgement” [tiab] OR “clinical expertise” [tiab] OR “clinical reasoning” [tiab] OR “lifelong learning” [tiab] OR “professional foundation*”[tiab] OR “professional competence” [tiab] OR “professional identity” [tiab] OR “professional self-identity” OR “professional identity development” [tiab] OR “professional

identity formation” [tiab] OR “ medical expertise” [tiab] OR researcher[tiab] OR investigator[tiab] OR “expert development” [tiab] OR “adaptive expertise” [tiab] OR perception*[tiab] OR “critical thinking”[tiab] OR "Thinking"[Mesh])

NOT

("Dentistry"[Mesh] OR dentistry OR dentist* OR dental OR "Nursing"[Mesh] OR nursing OR nurs* OR "Veterinarians"[Mesh] OR veterinarian* OR veterinary OR "Pharmacists"[Mesh] OR pharmacist* OR pharmacy)