

REVIEW

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# Implicit bias assessment by career stage in medical education training: a narrative review

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## Abstract

Implicit biases involve associations outside conscious awareness that lead to a negative evaluation of a person based on individual characteristics. Early evaluation of implicit bias in medical training can prevent long-term adverse health outcomes related to racial bias. However, to our knowledge, no present studies examine the sequential assessment of implicit bias through the different stages of medical training. The objective of this narrative review is to examine the breadth of existing publications that assess implicit bias at the current levels of medical training, pre-medical, graduate, and postgraduate. Protocol for this study was drafted using the Scale for the Assessment of Narrative Reviews (SANRA). Keyword literature search on peer-reviewed databases Google Scholar, PubMed, Ebsco, ScienceDirect, and MedEd Portal from January 1, 2017, to March 1, 2022, was used to identify applicable research articles. The online database search identified 1,512 articles. Full screening resulted in 75 papers meeting the inclusion criteria. Over 50% of extracted papers (74%) were published between 2019 and 2021 and investigated implicit bias at the post-graduate level (43%), followed by the graduate level (34%), and pre-medical level (9.4%). Fourteen percent were classified as mixed. Studies at the medical and medical graduate level identified an implicit preference towards white, male, non-LGBTQIA+, thin, patients. Study findings highlight notable gaps within the sequential assessment of implicit bias, specifically at the pre-medical training level. Longitudinal epidemiological research is needed to examine the long-term effect of implicit biases on existing healthcare disparities.

**Keywords** Implicit bias, Medical education, Pre-medical, Medical, Graduate

## Background

Implicit bias involves unconscious associations resulting in negative evaluations of a person based on individual characteristics such as race, gender, sexual orientation, and religion [1]. Several mechanisms contribute to the formation of harbored implicit biases. Current research

has identified two pathways involved in this action. Type 1 decision-making is fast, unconscious, intuitive, and involves "mental shortcuts or heuristics", while type 2 is a slower, 'analytical' process that requires higher cognitive ability [2, 3]. The resulting individual behavioral phenomena, a combination of type 1 and type 2 decision-making styles, can be affected by various experienced factors, such as implicit bias [4]. Through exposure to stereotypes and misinformation, implicit bias can take root, impacting personal and professional interactions. Unlike explicit biases, which involve attitudes and assumptions that we acknowledge, implicit bias can surreptitiously influence judgment through the lack of individual intent: a person can display a dissociation between explicit attitudes and implicit associations [5]. Without proper mitigation, over time, these unacknowledged biases can result in

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microaggressions, prejudice, and the further marginalization of communities.

The cause of implicit bias is among the many contributing factors that lead to health inequity and has resulted in a remarkable effect on clinician diagnoses, bedside treatment, and patient consultations [6]. Results of a 2015 systematic review showed that most healthcare clinicians have an implicit bias against people of color, including Black, Hispanic/Latine and dark-skinned individuals [7]. The result of discriminatory behavior within healthcare has led to poor patient outcomes such as reduced medication adherence, and a discontinuity of care, specifically among marginalized racial groups [8, 9].

Racial bias within healthcare is merely one example of implicit assumptions held within the field. Weight bias has also demonstrated similar findings, with many healthcare clinicians harboring strong negative attitudes and stereotypes toward obese or overweight patients [10, 11]. Gender blindness and preconceived stereotypes about men and women are contributing factors to gender-specific biases [12]. These distortions are dramatized for specific health conditions, like myocardial infarction in which women often present with 'atypical' chest pain such as nausea, vomiting, and palpitations [4, 13]. Furthermore, while race, weight, and gender are the most researched types of implicit bias, several others exist, such as sexual orientation and religious preferences.

The multifactorial nature of implicit bias presents ongoing challenges and has resulted in limited detection methods in public health and clinical settings [14]. The Harvard Implicit Assessment test (IAT) is the most commonly used method to identify implicit bias [15, 16]. Although this test is widely used in current literature, opponents of the IAT have highlighted several limitations such as a lack of measurement accuracy and poor differentiation between association and automatically activated responses [17]. Out of this uncertainty, many other methods have emerged such as focus groups, and the establishment of academic curricula. However, such biases exist within larger economic and social structure perpetuated by systemic prejudice. As a result of this complexity hidden within the intrinsic nature of implicit biases, research on this topic has been limited.

### **Implicit bias in medical education training**

The prevalence of implicit bias among clinicians can be partly attributed to unaddressed discriminatory experiences throughout life and the perpetuation of these experiences within medical education settings [5, 18]. A 2015 longitudinal study reported that 48.7% of U.S. medical students were exposed to negative comments about

Black patients by attending or resident physicians [5]. As a result, these students experienced significantly greater implicit racial bias in year 4 compared to year 1 [5]. Based on these results, and many supporting others, the impact of implicit bias and adverse health outcomes at the level of physician can be mitigated by experiences during medical education [19–22]. However, there is sparse knowledge about the implementation of implicit bias training programs within the medical education path. Furthermore, no present study to our current knowledge has examined the sequential assessment of implicit bias through the different stages of medical training, beginning at the pre-medical level. To address this gap, the objective of the current study is to perform a narrative review to evaluate the breadth of existing publications that assess implicit bias at the different levels of medical training, pre-medical, graduate, and post-graduate.

### **Methods**

A narrative review approach was used to assess implicit bias training throughout medical education. In theory, narrative reviews can be useful in identifying research gaps and critical areas where stronger policy and practice is necessary. The narrative review was guided by the research criterion: 1) The stage of medical education at which implicit bias was assessed [pre-medical, graduate, medical graduate], and 2) the specific methods used to measure implicit bias at each educational level.

### **Literature search**

To maintain the efficacy and systematic nature of our study, two reviewers (A.C., and M.S.) generated a search string of terms associated with implicit bias and medical education. Search terms were identified as descriptive of implicit bias and related to required medical education [pre-medical, medical, and medical graduate].

The initial search was conducted on February 26, 2022, on six selected research databases: Google Scholar, PubMed, Ebsco, MedPortal, Scopus, and ScienceDirect. Databases were selected broadly to cover the breadth of implicit bias interpretations and information on medical educational training. No study design restrictions were applied. The total number of collected studies from each search engine was validated to ensure the full scope of available articles was collected. All articles collected during the literature search were imported into Zotero, a standardized reference management software. The search was completed on March 14, 2022, and updated on March 27, 2022, to include any additional newly published articles since the completion date.

### Inclusion criteria

Two reviewers independently screened and applied inclusion criteria to the collected articles gathered from the literature search (A.C. and M.S.). To examine the published articles before and during the impact of COVID-19, the years 2017–2022 were included in the study. Collected articles from the initial search were halved and inclusion criteria were applied between two reviewers (A.C. and M.S.). Titles and abstracts were initially screened for the scope and relevance of the research aim. All discrepancies were resolved from team consensus.

Studies were identified as those at the pre-medical level if they included a population of students at the undergraduate level with an intended focus on medical school attendance after graduation. Those studies at the medical and graduate level included students currently enrolled in medical school and at the level of resident, respectively. Since not all medical students enroll in clinical fellowships, publications including this subgroup were not included in the article search as these articles were not within the scope of the proposed study's research question. Assessment of implicit bias at individual levels of medical education was identified as having examined the presence of implicit bias by Implicit Association Tests, social focus groups, and other assessment methods described elsewhere [23].

Studies were included if they assessed implicit bias at any level of medical education within the study's research aim. Additional inclusion criteria included: 1) Full text was provided, 2) Published between 2017–2022, 3) Conducted in the United States, 4) English, 5) involved qualitative, quantitative, or mixed methods study design, and 6) within the scope of implicit bias and medical educational training.

### Data extraction, quality assessment, and analysis

Data was extracted using a standardized protocol in Microsoft Excel. Extracted data included authors, year, medical training level, implicit bias assessment method, category of implicit bias explored (i.e. race, gender, socioeconomic status, etc.), study results, and conclusion. Articles extracted among one reviewer (A.C. or M.S.) were reviewed by the other reviewer for verified accuracy and completeness. Methodological quality was assessed using the Assessment of Scale for the Assessment of Narrative Reviews [24]. The Assessment of Scale for the Assessment of Narrative Reviews (SANRA) is a methodological tool used to evaluate the quality of narrative review articles, by assessing things like research aims, study methodology and presentation of evidence [24]. Discrepancies in manuscript assessment were resolved

through discussion and consensus between the two reviewers (A.C. and M.S.).

### Results

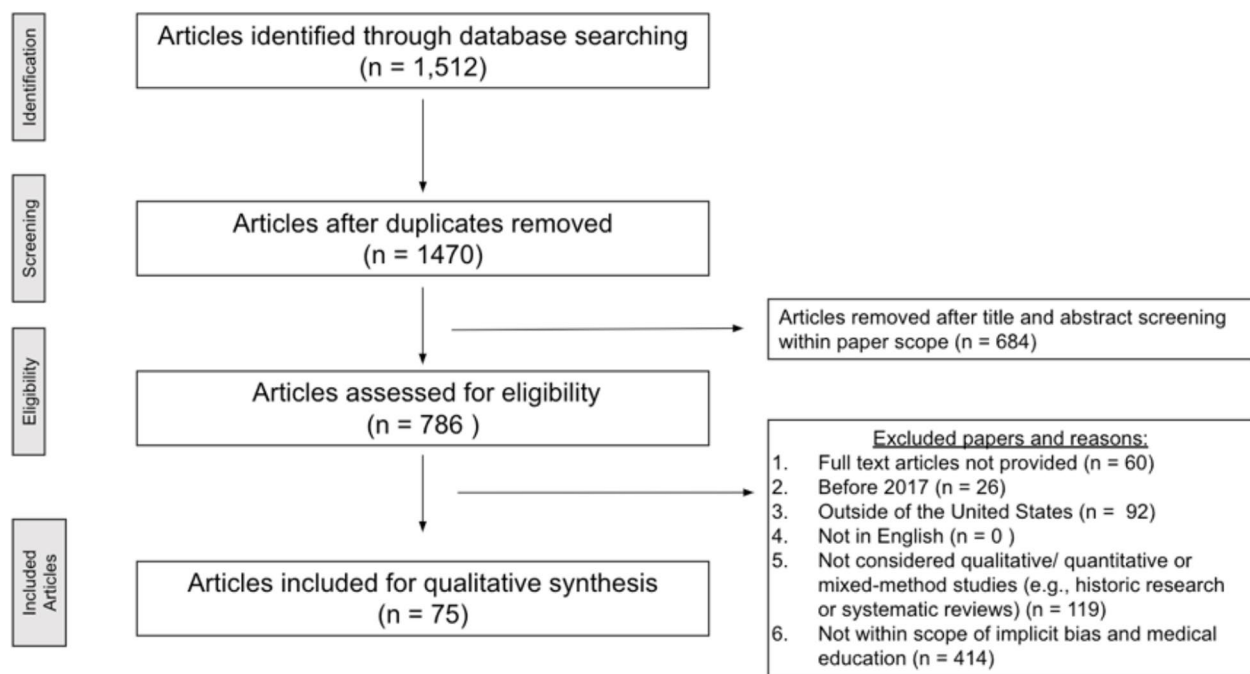
Figure 1 demonstrates the flowchart for article eligibility. A total of 1,512 articles were identified through database searching, with 42 duplicates removed; 1,470 articles were then screened based on the title, abstract, and relevance to the study objective. Five literature review articles were included due to their breadth of implicit bias training methods and discussion. The screening step resulted in 786 articles being assessed for eligibility. Of those 786 articles, 711 were excluded, leaving 75 articles included in the qualitative synthesis.

Table 1 lists the included studies that met study eligibility criteria. Over 50% of articles were published between 2019–2021. In 2022, only two published articles targeted implicit bias within medical education, a decrease potentially explained by our data extraction timeline and not a lack of topic significance during this period. Implicit bias was least assessed at the pre-medical education level, with approximately 50% of the total articles focusing on implicit bias as a general concept (non-specific to any form of bias). Four articles explored intersectional forms of implicit bias, such as the combined effects of socioeconomic and occupational status.

Figure 2 demonstrates the annual number of published articles at each level of medical education from 2017 – 2022. From 2017–2018, the number of published articles remained nearly constant from the previous year among all levels of medical education. However, between 2018 and 2019, the number of published articles assessing implicit bias increased at the medical graduate, mixed, and pre-medical levels. Findings remained constant in the previous year among current medical students. In the years 2019–2020, published articles on the pre-medical and medical student educational level increased while mixed and medical graduate, remained constant and decreased, respectively. From 2020–2021, published articles on the study's objective decreased among the pre-medical, mixed, and medical graduate educational levels. This pattern continued for the mixed category, while pre-medical remained constant. Published papers were not available in the 2022 data extraction for the medical graduate and medical student education levels.

### Definition of implicit bias

The definition of implicit bias was relatively consistent across all included articles. Most articles defined implicit bias as an unrecognized negative attitude towards a specific patient population (such as weight, race, gender, or



**Fig. 1** Article screening and eligibility flowchart

sexual orientation) unless discussed in a general context. As an introduction to the concept, implicit bias was contrasted with explicit behavior to highlight the impact within healthcare and the need for deeper research on the topic.

### Implicit bias assessment method

All studies identified implicit bias as a concern along the continuum of medical education in the United States. Using a sample of 2nd-year medical students, a study conducted by Leslie et. al using the IAT identified LGBTQIA+, race, and weight-associated implicit biases pre-curriculum intervention [38]. Observed biases persisted even after curriculum intervention; however, minor improvements were seen. Assessment methods varied by study; however, most studies identified the IAT as a foundational tool for implicit bias assessment used frequently in studies exploring the topic. Some studies used a mixed intervention design, including two or more implicit bias assessment measures (most frequently employing a qualitative and quantitative assessment), suggesting possible insufficiency of using IAT alone as the primary assessment tool.

Figure 3 highlights the most common assessment methods mentioned among the extracted articles of the study. Surveys and curriculum-based approaches were the most common assessment tools, representing 21.3% and 14.7% of the published literature, respectively. IAT was used in less than 10% of articles. Thirteen studies

used mixed methods such as IAT and focus groups/curriculum-based tools.

### Common forms of implicit bias

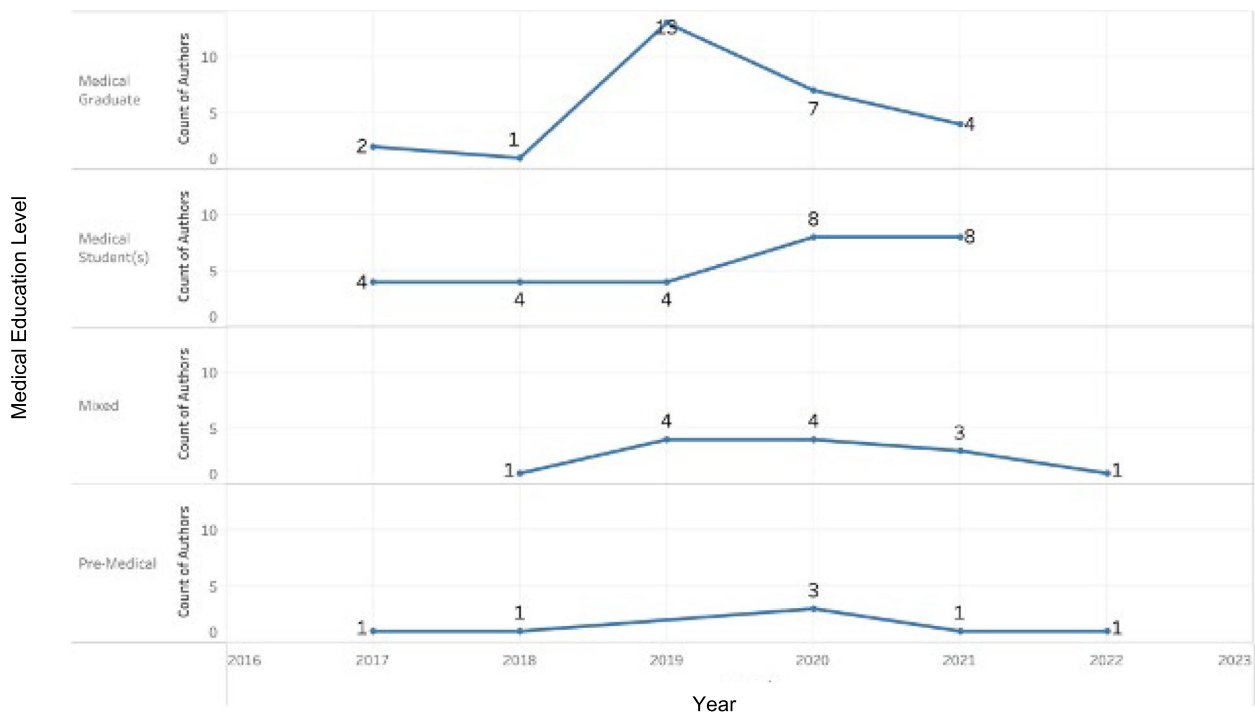
Research from 2017 to 2022 consistently revealed prevalent implicit biases in medical education, particularly regarding race, sexual orientation, gender, and weight. Overall, results at the medical student and medical graduate level suggest an implicit preference towards a male, non-LGBTQIA+, white, thin patients [10, 22, 25, 34, 99]. Hemphill et al. [100] recognized the persistence of unconscious or unintentional gender biases in medical education, and suggested that evidence-based guidelines tailored for graduate medical education are necessary to mitigate such occurrences [100]. This acknowledgment of pro-bias behavior aligns with prior research among medical students, which found that approximately 50% of students reported having negative attitudes towards lesbian and gay people, while about 80% harbored implicit biases [62, 99]. Expanding on these findings, a study conducted by Sabin et. al examined implicit and explicit racial attitudes among physicians and found that most physicians across all racial and ethnic groups demonstrated implicit bias favoring White Americans relative to Black Americans, among various specialties [22]. Furthermore, the study also revealed that female physicians and Black physicians, on average, exhibited lower levels of implicit racial bias compared to their male and

**Table 1** List of all manuscripts that met eligibility criterion

Authors	Year	Training Level	Implicit Bias Assessment Method	Type of Implicit Bias Explored
Minturn et al. [25]	2021	Pre-Medical	10-h LGBTQ health curriculum	LGBTQIA +
Petty et al. [26]	2017	Pre-Medical	Structural Foundations of Health Survey	Race
Metzl et al. [27]	2018	Pre-Medical	Structural Foundations of Health Survey	Race
Goyal et al. [28]	2020	Pre-Medical	Structured in-depth interviews	Cultural/Social
Munk et al. [29]	2020	Pre-Medical	Survey Design	Gender
Copeland et al. [30]	2020	Pre-Medical	Pre/Post Questionnaire	Socioeconomic Status
Martinez et al. [31]	2022	Pre-Medical	Skills and Knowledge based interventions	Attitude / Reflection
Gonzalez et al. [20]	2021	Medical Student	1-h, multimedia, interactive lecture to all first-year medical students	General
Baker et al. [32]	2017	Medical Student	Implicit Relational Assessment Procedure	Weight
Pettit et al. [33]	2017	Medical Student	high-fidelity simulation of acute coronary syndrome	Socioeconomic Status
Phelan et al. [34]	2017	Medical Student	Web-based survey	LGBTQIA +
Sawning et al. [35]	2017	Medical Student	pretest-post-test design	LGBTQIA +
Geller et al. [36]	2018	Medical Student	Ethics Education (Survey + Education course + IAT)	Weight
Lawrence et al. [37]	2018	Medical Student	NA (literature review of hidden curriculum)	General
Leslie et al. [38]	2018	Medical Student	Health Equity Curriculum Intervention	Race, Weight, LGBTQIA +
Marion et al. [39]	2018	Medical Student	Seminars + Patient Assessments	General
Gonzalez et al. [40]	2019	Medical Student	Focus Groups	General
Horst et al. [41]	2019	Medical Students	Selecting and Performing Service prompts aimed at self-examination, bias mitigation, and compassionate behavior	General
Motzkus et al. [42]	2019	Medical Student	IAT + Determinants of Health Course	General
Phelan et al. [43]	2019	Medical Student	Survey	Race
Acholonu et al. [44]	2020	Medical Student	Academic Workshop	General
Benoit et al. [45]	2020	Medical Student	A student-led initiative (Curriculum + Guidelines + Existing learning environment)	General
Gonzalez et al. [46]	2020	Medical Student	Course intervention + Program evaluation	General
Morris et al. [47]	2020	Medical Student	Survey	Socioeconomic Status, LGBTQIA + , Occupation
Ona et al. [48]	2020	Medical Student	Antiracism Curriculum	Race
Rivlin et al. [49]	2020	Medical Student	Open-ended written questionnaire	Medical Decisions (abortion)
Ruben et al. [50]	2020	Medical Student	Three-Part Implicit Bias Training Program	Skin Tone
Fitterman et al. [51]	2021	Medical Student	Curriculum-based intervention	Weight
Gonzalez et al. [52]	2021	Medical Student	One 90-min session on implicit bias	General
Gonzalez et al. [53]	2021	Medical Student	Skills-Based Curriculum	General
Nestorowicz et al. [54]	2021	Medical Student	Beliefs About Obese Persons Scale, Attitudes Toward Obese Persons Scale, Fat Phobia Scale, and the Harvard Implicit Association Test (IAT) and researcher-generated questions, measured levels of bias before and after study activities	Weight
Phelan et al. [55]	2021	Medical Student	Survey + Patient Care Scenario	Weight
Van Winkle et al. [56]	2021	Medical Student	Medical Humanities Course	General
Matsumoto et al. [57]	2020	Medical Student	Survey	Gender
Chen et al. [58]	2021	Medical Students	Evaluations	Gender

**Table 1** (continued)

Authors	Year	Training Level	Implicit Bias Assessment Method	Type of Implicit Bias Explored
Gopal et al. [59]	2021	Mixed	Mixed (literature review)	General
Fassioto et al. [60]	2018	Mixed (residents and fellows)	Evaluations	Gender
Halvorson et al. [61]	2019	Mixed (pediatric hospitalists, residents, and acute care nurses)	- Semi-structured Interviews, - IAT (implicit) and - Crandall's Anti-Fat Attitudes Questionnaire (explicit)	Weight
Morris et al. [62]	2019	Mixed (medical, dental and nursing students)	Mixed (literature review) - including programs, experimental interventions, etc	LGBTQIA +
Brottman et al. [63]	2020	Mixed (medical students and professional)	Educational strategies, Academic curriculum	General
Mastrocola et al. [64]	2020	Mixed (residents and fellows)	Obesity education programs	Weight
Teherani et al. [65]	2020	Mixed (Medical Students and Residents)	Semi structured interviews	General
Tobon et al. [66]	2021	Mixed (Medical students and psychiatric physicians)	IAT	Race
Ogunyemi et al. [67]	2021	Mixed (Medical students, residents and faculty)	Structured, Interactive Workshop	Mixed (Gender, race, appearance (tattoos))
Xiong et al. [68]	2022	Mixed (faculty, fellows, residents, and medical students)	Survey (Likert-scale)	Gender
Bartlett et al. [69]	2019	Medical Graduate (Medical Trainees)	Workshop	General
Kallianos et al. [70]	2019	Mixed (Faculty and Trainees)	IAT and Survey	General
Sherman et al. [71]	2019	Mixed (Faculty and Trainees)	Trainings and Focus Groups	General
Herr et al. [72]	2020	Mixed (Medical students and post medical trainees)	N/A (Literature Review)	General
Perdomo et al. [73]	2019	Medical Graduate (Residents)	Health Equity Rounds Curriculum	General
Barnes et al. [74]	2019	Medical Graduate (Surgical Trainees)	Focus Groups	Gender
Johnson et al. [75]	2017	Medical Graduate (Residents)	Implicit Association Tests (IATs)	Race
Kulayat et al. [76]	2017	Medical Graduate (Trainees)	Small group discussions/ Focus groups	General
Chapman et al. [77]	2018	Medical Graduate (Medical Trainees)	Intervention focus Groups	Race/ Ethnicity
Bucknor et al. [78]	2019	Medical Graduate (Medical Trainees)	Verbal Responses	Weight
Dyrbye et al. [79]	2019	Medical Graduate (Medical Trainees)	Questionnaire	Race
Gerull et al. [80]	2019	Medical Graduate (Surgical Trainees)	Written Evaluations	Gender
Hansen et al. [81]	2019	Medical Graduate (Resident Physicians)	Survey	Gender
Khatri et al. [82]	2019	Medical Graduate (Medical Trainees)	IAT and Facilitated Discussion	General
Klein et al. [83]	2019	Medical Graduate (Medical Trainees)	N/A (Literature Review)	Gender
Lukela et al. [84]	2019	Medical Graduate (Medical Trainees)	Cross-Sectional Survey	Gender
McKinley et al. [85]	2019	Medical Graduate (Medical Trainees)	Survey	Gender
Wittlin et al. [86]	2019	Medical Graduate (Medical Trainees)	Survey	LGBTQIA +
Zeidan et al. [87]	2019	Medical Graduate (Medical Trainees)	IAT and Curriculum Intervention	General
Kassam et al. [88]	2020	Medical Graduate (Medical Trainees)	Resident Applications	General
Klein et al. [89]	2020	Medical Graduate (Medical Trainees)	Intervention and Cross-Sectional Surveys	Gender
Kuo et al. [90]	2020	Medical Graduate (Surgical Trainees)	Templated Spreadsheet	Gender
Sabin et al. [91]	2020	Medical Graduate (Medical Trainees)	IAT + Intervention	General
Thomas et al. [92]	2020	Medical Graduate (Medical Trainees)	Curriculum Changes	Race and General
Barber et al. [93]	2020	Medical Graduate (Medical Trainees)	Cross-Sectional Survey	General
Chatterjee et al. [94]	2020	Medical Graduate (Medical Trainees)	Gender Bias Curriculum	Gender
Dill-Macky et al. [95]	2021	Medical Graduate (Surgical Trainees)	Evaluations	General
Kramer et al. [96]	2021	Medical Graduate (Medical Trainees)	Implicit Assessment Test (IAT)	Gender
Ouyang et al. [97]	2021	Medical Graduate (Surgical Trainees)	Interview Survey	Gender
Roth et al. [98]	2021	Medical Graduate (Medical Trainees)	Questioning Health Curriculum	LGBTQIA +



**Fig. 2** Graph by year and number of published articles at the different levels of medical education

non-Black counterparts, respectively [22]. In a separate longitudinal study of 4,732 participants, Phelan et al. [10] further demonstrated persistent anti-fat bias among first year medical students [10]. Collectively, these findings underscore the pervasive nature of implicit bias in medical education and the challenges in addressing it effectively. Notably, cultural bias was the least assessed form of implicit bias in our study, suggesting a potential area for future research.

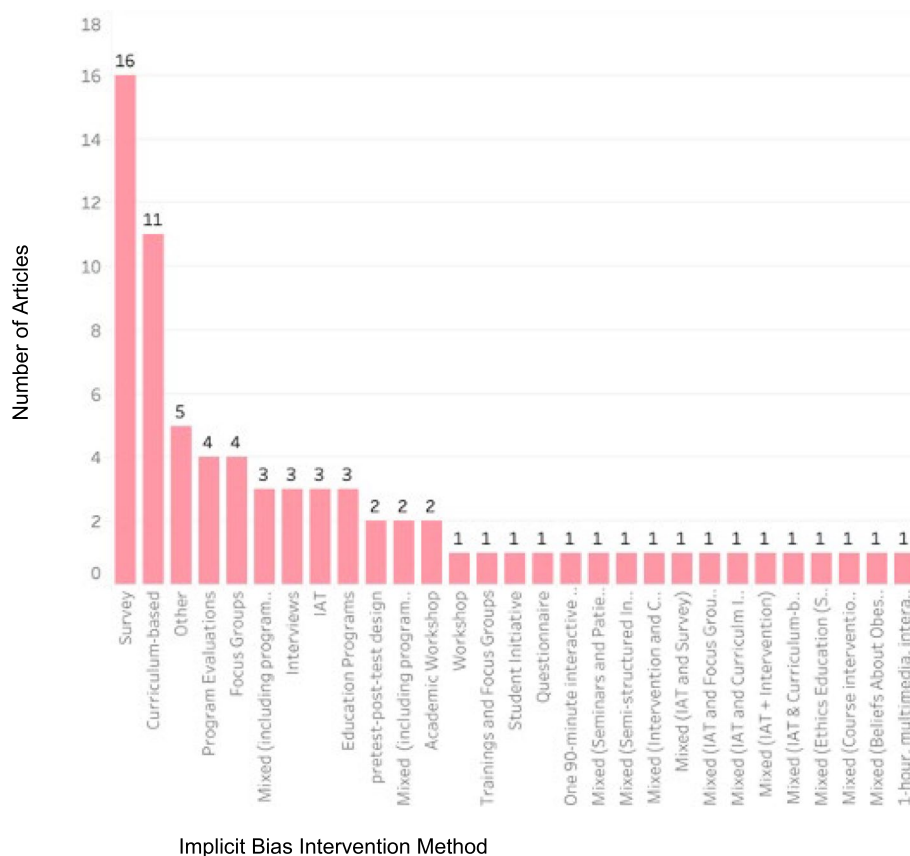
### Potential solutions to implicit bias in medical training

Several studies discussed potential solutions to implicit bias throughout medical educational training. Solutions for implicit bias in medical training ranged broadly depending on the discussed bias, with many focusing on role-playing, reading, and reflection to demonstrate patient perspectives and highlight necessary skills to address bias in a clinical setting [101]. Reflective activities combined with discussions fostered a deeper understanding of information and allowed for the assessment of students' understanding and awareness [25]. Role-playing exercises such as scripted interview exercises and training in sexual history taking have been instrumental in enhancing students' comfort and confidence in working with LGBTQ patients [34, 102].

Collaborative approaches including educational training courses were also suggested as effective methods to reduce implicit bias. For biases associated with sexual orientation, specifically, the implementation of discussion-based courses was a helpful mechanism to increase knowledge about specific patient populations, such as the LGBT community [38]. Courses that incorporated discussions about the IAT and workshops on the social psychology of implicit bias have also been shown to reduce an implicit preference towards straight individuals [98]. Additionally, interactive presentations focusing on unconscious bias, discussions on intersectionality (i.e., the interconnectedness of social categorizations like race and gender), and visual demonstrations significantly raised perception and understanding of these biases and encouraged clinicians to ask sensitive history-related questions [63, 103]. In the classroom setting, assigned readings on cultural issues in healthcare further contributed to reducing students' implicit bias by increasing awareness of interpersonal discriminator behaviors [25, 104].

### Discussion

Based on our findings, implicit bias was least studied among pre-medical students. Furthermore, articles that assessed implicit bias at the medical student and graduate levels suggest a preference for male, non-LGBTQIA+,



**Fig. 3** Graph by number of articles and assessment method

white, thin patients. Inequality in patient preference further indicates that current implicit bias mitigation tools for current medical professionals are inadequate and may contribute to long-term health disparities. For example, unresolved implicit bias can in turn lead to confirmation or anchoring biases that cause a physician to prioritize their own inherent beliefs rather than alternative evidence and diagnoses. As a result, the misapplication of inherently well-intentioned practical theories, such as the social determinants, is used as justification for inequities in patient care, and increased prevalence of additional biases [104, 105].

The current study is novel in its inclusion of implicit bias throughout the process of medical education, a process often spanning well over a decade. By examining the topic across multiple educational levels, we offer a holistic perspective on the role of implicit bias along the student-to-clinician continuum. Limited research at the pre-medical level points to an opportunity for early intervention with implicit bias training that may impact medical professionals throughout their education and

career. Simultaneously, documented persistence following standard training raises doubts about whether curriculum content adequately addresses the multifaceted biases spanning gender, racial, ageist, weight-based, and socioeconomic realms.

The current study has certain limitations. First, the exclusion of literature outside of the study period (2017–2022) results in a reduced perspective of implicit bias assessment and medical education. Second, as this study is primarily an assessment of the current literature, causality cannot be determined to examine how reduced assessment of implicit bias in medical education influences patient health outcomes. Third, the current study is restricted to published literature and does not include articles from other sources (i.e., grey literature); therefore, we cannot exclude the possibility of publication bias. Fourth, how prior studies have measured implicit bias may likely influence previous study findings and subsequent interpretations. Despite the limitations, the current study offers initial and impactful evidence on the assessment of implicit bias in the stages of medical education.



## Conclusion

The results of this review suggest that implicit bias is not assessed early in the medical education curriculum. Furthermore, these results highlight the need for a comprehensive and longitudinal approach to mitigating implicit bias in healthcare education. Future directions should be expanded to include examining implicit bias longitudinally across the span of medical education into later career medical training stages (i.e., attending physician status). The longitudinal examination of implicit bias would enable a holistic evaluation and provide clarity on where to apply targeted anti-bias interventions along each transitional milestone, a necessary objective to mitigate long-term health inequities.

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## Informed consent

Not applicable.

## Authors' contributions

A.C.: Project Administration. A.C., M.S., and S.A.: Wrote the manuscript text. E.A.: Prepared Figs. 1–3. S.J.: Advisory Support. All authors reviewed the manuscript.

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## Data availability

No datasets were generated or analysed during the current study.

## Declarations

### Ethics approval and consent to participate

The current study was deemed exempt by institutional policy, as all data used in this narrative review is publicly available and does not contain identifiable human information. Additionally, a clinical trial number is not applicable for this study type.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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