Interventions to Teach Medical Students About Disability

A Systematic Search and Review

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Abstract: Historically, medical students have received little training about working with patients with disability, but there is now a greater recognition of the need to educate medical students in this domain. The aims of this review were to define the body of literature and to determine effective strategies for teaching medical students about disability. A systematic search protocol executed across six databases identified journal articles reporting interventions implemented to teach disability to medical students. Seventy-seven articles spanning 1960–2018 met inclusion criteria. Most articles reported objectives related to increasing knowledge and skills or changing attitudes. However, only half included evaluations for all of their stated objectives in those domains. In addition, few articles used longitudinal evaluations, resulting in most articles basing conclusions on immediate posttest evaluations. Overall, the reported interventions exhibit a high risk of potential bias, with only 10% of the articles receiving a global quality rating of "good." Thus, although several articles have reported educational interventions to teach medical students about disability, the high risk of bias, incomplete reporting, and limitations of the evaluations prevent evidence-based determinations of effective strategies for teaching medical students about disability. The findings highlight ways to improve future studies in this domain.

Key Words: Education, Medical, Clinical Competence, Attitude, Knowledge

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Disability has steadily increased in America for the past 30 years, with the number of adults reporting some type of functional limitation increasing from 53 million in 2013 to 61 million in 2016, which translates to 1 in 5 adults in 2013 and 1 in 4 adults in 2016.[1,2] In addition, the number of children with disability has also increased, and for the past 10–15 years, there has been a change in types of disability reported, with behavioral and cognitive disabilities now far exceeding physical disabilities.[3,4] Given that people with disability have higher usage of health care[5] and experience differences and disparities in receiving health care,[6] all physicians will likely provide health care services to this population. To do this effectively, physicians should have the knowledge and skills necessary to meet routine care needs and address the disability-specific conditions of the patients they serve.

Historically, most medical students in the United States have received little training on caring for people with disability.[7] In recognition of the need to provide better medical care for people with disability, the American Association of Medical Colleges and other professional and advocacy organizations are increasingly identifying the need for medical schools to provide their students with training related to disability.[8] Although this unified push to educate medical students about disability is a new development that may provide more substantive training opportunities, there is no clear consensus on the most effective ways to educate medical students about disability.[7]

This systematic search and review were undertaken to address the following questions about medical student education related to disability:

1. What is the breadth of published articles in the scientific literature reporting on interventions for teaching medical students about disability?
2. What are effective strategies for teaching medical students about disability based on the empirical evidence?
3. Do the evaluations reported in these articles provide insight into the interventions' effectiveness in increasing knowledge and skills and in changing attitudes?

See Table 1 for a breakdown of the population, interventions, comparators, outcomes, and study design (PICOS) elements that defined the focus of this review.

METHOD

Protocol

A systematic search and review of articles reporting interventions teaching medical students about disability were conducted following the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines (see Supplemental Materials – Appendix A for the Preferred Reporting Items for Systematic Reviews and Meta-analyses Checklist, Supplemental Digital Content 1, http://links.lww.com/PHM/A742).[9] Key terms and specific search phrases were determined

TABLE 1. Review focus population, interventions, comparators, outcomes, and study design elements (PICOS)

Population	Medical students
Interventions	Educational interventions focused on disability implemented at medical schools
Comparators	No comparators were specified because of the broad nature of the study question.
Outcomes	Any outcomes reported related to students' disability knowledge, skills, or attitudes.
Study designs	Any study designs used to evaluate outcomes of interventions that have been implemented with medical students.

before initiating the systematic search in consultation with a research librarian (Table 2). Six databases were queried (PubMed, Web of Science, Scopus, PsycINFO, HealthSTAR, CINAHL). All articles identified and deemed to meet the eligibility criteria were included in this review and coded to capture key information. This coding included identifying characteristics of the intervention and providing a risk of bias assessment for each article. Rigor in the process was maintained by using two independent reviewers (a combination of MI, RMF, JFL, with MI reviewing all articles) and a reconciliation process for all coded data. In the case of disagreements that could not be reconciled between the two reviewers, the senior author (MAT) served as an additional reviewer to negotiate a decision. The data analysis and risk of bias assessment focused on identifying commonalities among the included articles and providing an overall quality assessment of the state of current scientific literature reporting these interventions.

Eligibility Criteria

To be eligible for inclusion in this study, each article had to (*a*) be written in English, (*b*) be published in scientific journal, and (*c*) report being focused on teaching medical students about disability, either exclusively or as part of an interdisciplinary group of students. There were no publication date restrictions.

Articles that were not published in scientific journals were excluded. Commentaries were only included if they reported a specific intervention or curriculum change. Review articles were also excluded, but their references were evaluated as part of an ancestry review to capture potentially relevant articles.

Articles were also excluded if they did not report teaching medical students about disability. Therefore, articles were excluded if medical students were not among the students participating in the intervention or if the focus of the article was on teaching medical students about something other than disability. For the purpose of this review, disability included: physical, sensory, intellectual, and developmental disabilities. Articles that focused solely on providing geriatric care or exposing students to the field of Physical Medicine and Rehabilitation (i.e., disability was not explicitly addressed by any of the components of the educational intervention) were not considered to be disability focused and were excluded.

Information Sources and Search Strategy

Six databases were used in the systematic search: PubMed, Web of Science, Scopus, PsycINFO, HealthSTAR, and CINAHL. An initial search was conducted during July and August 2017. An updated search was also conducted to capture articles published January 2017 to June 2018.

Eight search phrases were used. Each search phrase combined one of the eight medical education-related terms (Table 2) with "*AND Disabilit**." When possible, searches were limited to only include journal articles published in English (see Supplemental Materials – Appendix B for detailed search strategies, Supplemental Digital Content 2, http://links.lww.com/PHM/A743). After articles were identified for inclusion, a data set was created combining results from each of the six databases and duplicates were removed. For each included article, an ancestry review of the reference section was conducted to identify other articles that could potentially meet the criteria for inclusion. The ancestry review process was repeated for each included article until saturation was achieved (i.e., no additional new articles were identified for potential inclusion; a total of 3 iterations).

Study Selection

All articles from the database search results were screened for inclusion by two reviewers (MI, RMF) based on the articles' title and abstract. The two reviewers then reconciled their findings. If consensus could not be reached, the article was kept for full-text review. All articles that remained after the initial screening were assessed by full-text review. Again, the authors reconciled their decisions (MI, RMF); however, at this stage, if consensus was not reached, the senior reviewer was available to resolve the dispute (MAT). For each ancestry review, the reference sections of all included articles were examined by both reviewers. If the title of an article indicated that it might fit within the scope of the review, the full-text article was obtained and evaluated. Again, the senior reviewer (MAT) was available to resolve disagreements if consensus was not reached.

Data Collection Process

A data extraction sheet specific to this review was established and refined through pilot testing 15 articles (20%). Each article was coded independently by two reviewers (a combination of MI, RMF, JFL, with MI reviewing all articles). The results of the independent evaluations were reconciled. If the pairs of reviewers could not reach consensus, the senior reviewer (MAT) was available to resolve disagreements.

TABLE 2. Search phrases

1. "Medical Education" AND Disabilit*
2. "Medical Curriculum" AND Disabilit*
3. "Medical School" AND Disabilit*
4. "Medical Student" AND Disabilit*
5. "Medical Undergraduate" AND Disabilit*
6. "Clerkship" AND Disabilit*
7. "Clinical Competence" AND Disabilit*
8. "Attitude Change" AND Disabilit*

Data Items

The content of each article was coded to capture five different aspects of the educational intervention, noted hereinafter (see Supplemental Materials – Appendix C for details related to general intervention implementation attributes and used instructional methods, Supplemental Digital Content 3, http://links.lww.com/PHM/A744). Each data point was determined by two independent reviewers (a combination of MI, RMF, and JFL, with MI reviewing all articles). Any differences in the data recorded by the two reviewers were discussed until consensus was reached. If the two reviewers could not reach consensus on their own, then the senior reviewer (MAT) was available to arbitrate the discussion until all three reviewers reached consensus.

Article Type

Each article was categorized as either an empirical article or a commentary based on the format of the reporting article. Empirical articles were presented in a traditional research report format with introduction, methods, results, and discussion sections or that presented all of the information needed for an article with that format. Commentary articles were narrative reports and editorials that presented information about a specific educational intervention but that did not have all of the methods or results information necessary to be considered an empirical research report.

Setting and Sample Characteristics

Each article was coded to determine the country of origin, sample size (for all medical students participating in the intervention), year in medical school, and whether the target group of the educational intervention was solely composed of medical students. Year in medical school included seven categories (i.e., MS 1, MS 2, MS 3, MS 4, MS ≥4, mixed group, multiple years for cohort). MS 1–MS 4 designations were given when the medical students who participated in the intervention were all in only one specific year in medical school. "> MS 4" was used to identify educational interventions administered to medical students who were in years beyond MS 4 (these interventions were implemented with students in countries other than the United States). The "mixed group" designation was used when the medical students who participated in the intervention were from multiple medical school classes, and the "multiple years for cohort" designation was used when the students in the same cohort experienced parts of the intervention during multiple years of their medical school training. Interventions were not categorized as "only medical students" if there were other types of health professions students who also participated in the intervention (e.g., physical therapy, nursing, social work).

Objectives

Each article was evaluated to identify the explicitly stated objectives that fell into one of the following three categories: attitude change, increased skills, and increased knowledge. Attitude change objectives included language indicating a desire to change opinions about or feelings toward people with disability and/or the way people with disability are seen. Increasing skill objectives focused on increasing the students' ability to perform an action related to disability, whereas knowledge objectives focused on increasing what students know about people with disability and/or their health issues.

Evaluation Domains

Each article was coded to capture the utilization of intervention outcome evaluations that fell into the following four different domains: (*a*) attitudes: evaluations that captured thoughts and opinions about or feelings toward people with disability; (*b*) skills: evaluations that assessed how well students could execute skills related to disability. This included objective structured clinical examinations (OSCEs); (*c*) knowledge: evaluations that assessed whether students had learned disability-related information; and (*d*) general feedback: any form of evaluation or reported feedback related to students' perceptions of the educational intervention and/or what they reported they took away from the experience.

Evaluation Timing

Each article that had an evaluation was also assessed to determine the timing of the evaluation. Articles were coded as having a longitudinal follow-up evaluation if they reported a follow-up that was 2 or more days after the educational intervention.

Risk of Bias in Individual Studies

The articles in this review used a wide variety of intervention and evaluation methods and reporting formats. To provide a consistent risk of bias rating that took into consideration the unique attributes of each specific study, a global risk of bias assessment tool was used. Specifically, the National Institutes of Health National Heart, Lung, and Blood Institute provides several global quality assessment tools that are tailored to specific study designs (https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools). The quality assessment tool used for each individual article was selected based on the study design that would have provided the strongest evidence of effectiveness given the implementation of the intervention. The default quality assessment tool used to evaluate each article was the Quality Assessment Tool for Before-After (Pre-Post) Studies With No Control Group (see Supplemental Materials – Appendix D, Supplemental Digital Content 4, http://links.lww.com/PHM/A745) because it was anticipated that most articles would report an educational intervention that was administered to a group of students, without having a control group. The Quality Assessment of Controlled Intervention Studies (see Supplemental Materials – Appendix E, Supplemental Digital Content 5, http://links.lww.com/PHM/A746) was used to evaluate articles that reported a control group. Two reviewers (a combination of MI, RMF, and JFL, with MI reviewing all articles) independently evaluated each article using the quality assessment tool criteria to provide a global quality rating (i.e., good, fair, poor). Any differences between the two reviewers in the global ratings for each article were discussed until consensus was reached. If the two reviewers could not reach consensus on their own, then the senior reviewer was available to arbitrate the discussion until all reviewers reached consensus.

Given the wide range of reporting formats and conventions, the Strengthening the Reporting of Observational Studies in
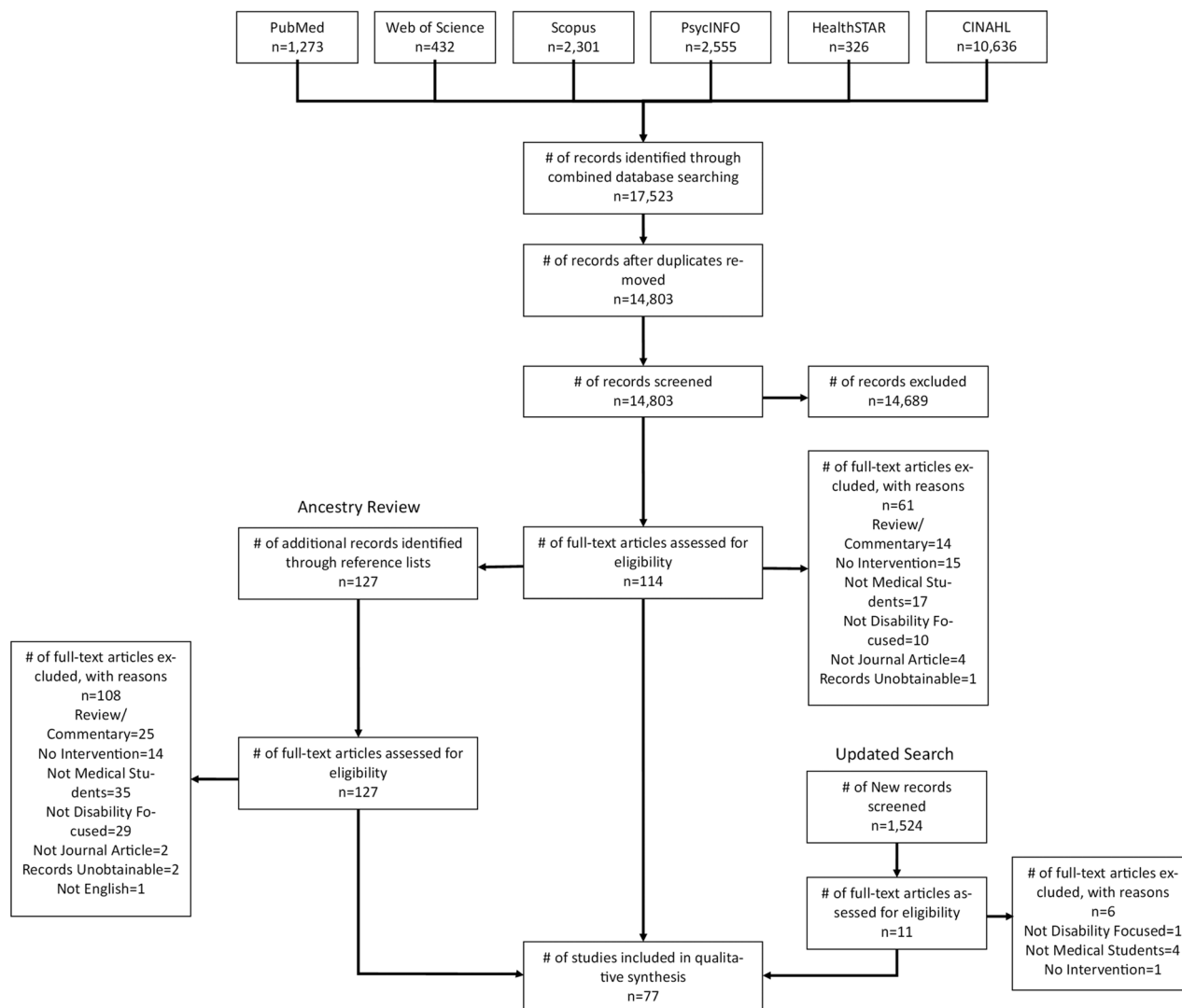
FIGURE 1. Flow chart of study selection.

Epidemiology (STROBE) Statement Checklist was used to provide insight into the completeness of the information presented in the articles. Although this checklist does not provide an assessment of risk of bias, it does help put the global risk of bias assessment in context. It is likely that an article will have a high risk of bias if key methodological information is not reported. In this application, the STROBE Statement Checklist was used to identify the presence of reported elements, including methodological details.[10,11] This checklist contains 22 different items outlining the essential components of research articles reporting observational studies. Two reviewers (a combination of MI, RMF, and JFL, with MI reviewing all articles) independently scored each article using the recommendations on the STROBE Statement Checklist as criteria. One point was given for each component that the reviewer determined the article to have included (1 = present, 0 = absent), with a possible score for each article ranging from 0 (no recommended components present)—22 (all recommended components present) points. A component was marked present if any aspect of the component was present. Differences in the scores for each item

between the two reviewers were discussed until consensus was reached. If the two reviewers could not reach consensus on their own, then the senior reviewer was available to arbitrate the discussion until all three reviewers reached consensus. This STROBE-based evaluation process was in line with that used in similar review studies.[12,13] The result of this evaluation is only a quantitative indicator of whether each article contains the information necessary to fully report an intervention and evaluation. The presence/absence evaluation does not provide an assessment of the risk of bias of the article. However, the STROBE score does provide an indication of the completeness of the information that was used to make a global evaluation of risk of bias.

RESULTS

Study Selection

A total of 17,523 records from six databases were screened for inclusion in this review during the initial search.
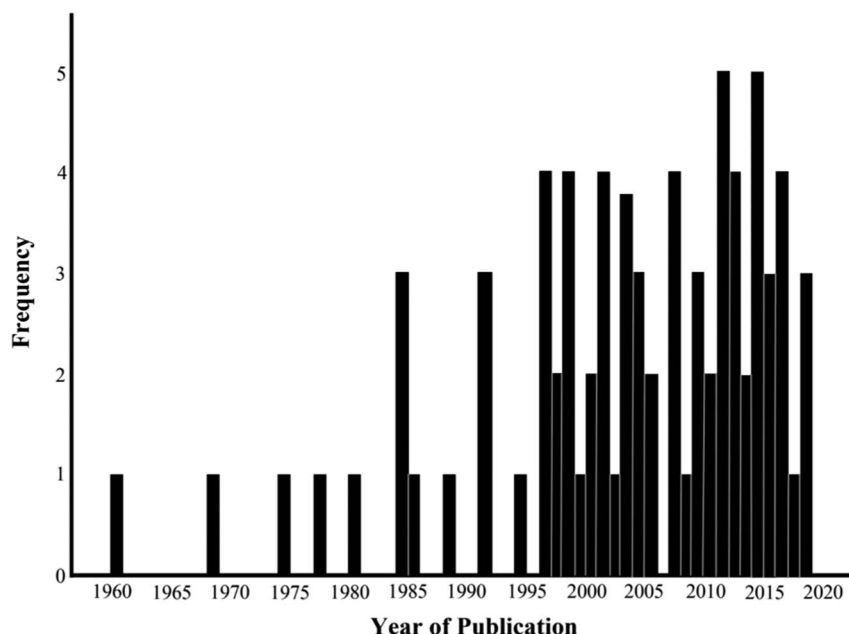
FIGURE 2. Number of articles reporting a disability intervention targeted to medical students by publication year.

After this initial screening process, the ancestry reviews, and the search update, a total of 77 articles spanning 58 yrs (1960–2018) met the criteria to be included and evaluated as part of this review. See Figure 1 for the search flow diagram. Nearly 82% ($n = 63$) of the articles included in this review were published after 1995 (see Fig. 2 for a histogram representing the distribution of articles by publication year).

Included Article Characteristics

Of the 77 articles included in this review, 23% reported interventions in the form of commentaries ($n = 18$). In addition, the greatest proportion of articles (47%, $n = 36$) reported interventions that were conducted in the United States (United Kingdom = 25%, Canada = 8%, Australia = 9%) (Table 3). The sample size for the interventions ranged from 2 to 488 (see Fig. 3 for a distribution of articles by sample size), with 22% ($n = 17$) of the articles not reporting a sample size. Most interventions (61%, $n = 47$) (Table 3) were targeted to students in a specific year in medical school, with 41% of all interventions being targeted to either only MS 3 ($n = 16$) or MS 4 ($n = 15$) students. See Table 4 for the specific article characteristics for each of the included articles. Appendix C reports the instructional methods used, with lectures being the most common ($n = 36$, 47%), followed by reflection ($n = 25$, 38%) and small group discussions ($n = 25$, 32%).

Objectives and Evaluations

Objectives related to changing attitudes (45%, $n = 34$), increasing skills (36%, $n = 28$), and/or increasing knowledge (45%, $n = 34$) were stated in 76% ($n = 58$) of the included articles. Across the included articles, 94% ($n = 72$) provided evaluation information related to one of the four captured evaluation domains, with general satisfaction with the educational experience and feedback being the most common

(78%, $n = 60$), followed by attitudes (42%, $n = 32$), knowledge (27%, $n = 21$), and skills (17%, $n = 13$). However, 47% ($n = 27$) of articles with stated attitudes, knowledge, and/or skills objectives did not provide evaluation information related to all of their objectives. In addition, only 8% ($n = 6$) of all of the articles provided longitudinal follow-up evaluation information. See Table 4 for objective and evaluation information for each of the included

TABLE 3. Summary table for target group and location of intervention

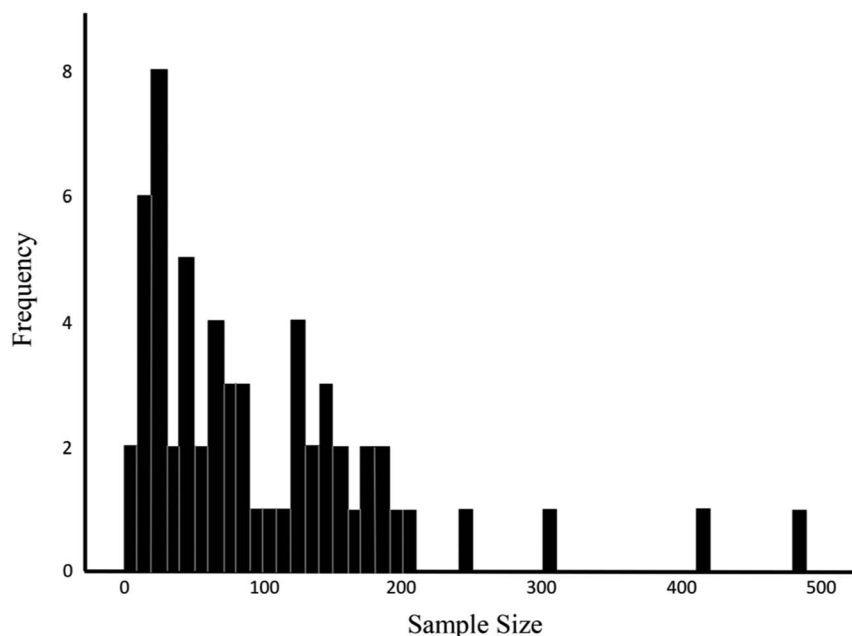|	*n*	*%*
Target group		
MS 1	8	11
MS 2	4	5
MS 3	16	21
MS 4	15	20
MS >4	4	5
Mixed	15	19
Multiple	8	11
Not reported	7	9
Location of intervention		
United States	36	47
United Kingdom	19	25
Canada	6	8
Australia	7	9
Brazil	1	1
Nigeria	1	1
Pakistan	1	1
South Africa	2	3
Croatia	1	1
Ireland	1	1
Israel	1	1
New Zealand	1	1

FIGURE 3. Number of articles reporting a disability intervention targeted to medical students by sample Size.

articles (see Supplemental Materials – Appendix F for additional evaluation details, Supplemental Digital Content 6, http://links. lww.com/PHM/A747).

Risk of Bias in Individual Studies

Only 10% ($n = 8$) of all of the included articles received global quality ratings of "good" (poor = 61%, $n = 47$; fair = 29%, $n = 22$), suggesting most articles have a relatively high potential risk of bias. Only two of the eight articles receiving a "good" rating used a control group design (see articles with good ratings using the controlled intervention Quality Rubric in Table 4). In addition, only 35% ($n = 27$) of the articles included in this review reported enough information about the intervention to minimally meet 19 or more of the STROBE's 22 components. See Table 4 for STROBE scores and global quality ratings for each of the included articles. The most common components reported were the presentation of key study design elements (100%), background information (96%), how participants were recruited/selected to engage in the intervention (96%), and a description detailing the exposure/intervention (94%). The most common components not reported were descriptions of how quantitative variables were handled in analyses (31%), funding sources (40%), steps taken to address potential bias (40%), descriptive data about participants (43%), and main statistical results for study outcomes (43%). Overall, the articles rated as "poor" had the lowest average STROBE scores (M = 13.2, SD = 4.4, median = 13), followed by the articles rated as "fair" (M = 18.6, SD = 2.3, median = 19), with the articles having "good" ratings having the highest average scores (M = 19.8, SD = 2.1, median = 20.5). The eight articles receiving a "good" rating typically reported 19 or more elements; however, one outlier noted only 15 elements. This suggests missing components from the STROBE Statement Checklist is associated with articles having a high risk of bias (i.e., having a "poor" global quality rating).[14-90]

DISCUSSION

The goal of this systematic search and review was to determine the range of articles discussing disability education and to identify effective strategies for teaching medical students about disability. There were 77 articles captured, spanning 58 yrs. A variety of intervention and evaluation methods were used, which made comparisons difficult and did not allow meta-analysis. Often satisfaction and feedback ratings were used to determine change in attributes, especially attitudes. In addition, no one intervention method could be confirmed as most effective because of the poorly structured reporting, high risk of bias ratings, and limited evaluations, especially lack of longitudinal measurement. Therefore, this review did recognize the breadth of literature related to teaching medical students about disability. However, this study importantly identified the need for meaningful, evidence-based designs and methods in future studies to distinguish effective interventions related to educating medical students about disability.

With respect to the scientific quality of the articles, only eight received global risk of bias ratings of "good." In addition, approximately two thirds were missing more than three pieces of information necessary for full reporting of an observational study. It is possible that for some articles, a global risk of bias rating of "poor" was related more to poor reporting than to poor design or methods. The paucity of quality of the reported scientific evidence makes it impossible to draw conclusions about the effectiveness of specific interventions or elucidate the key components. To put this into perspective, there is little research that defines best medical education practices for instructional strategies using adult education theory in general.[91-93]

Review of Disability Interventions

Overall, the evaluations reported in the articles were insufficient. Only 53% of the articles that stated objectives related to changing attitudes, increasing skills, and/or increasing knowledge evaluated whether all stated objectives were achieved. In addition, only six articles provided follow-up evaluation information that could illuminate the lasting impact of the intervention, and of those, none achieved a global quality rating of "good." Thus, even the best quality articles captured in this review failed to implement evaluations that could provide insight into the long-term impact of the educational interventions.

Another key problem with this body of work is that most articles that included evaluations other than general feedback focused on reporting changes in attitudes. Previous research with medical students has shown that changes in attitudes are both difficult to achieve and do not necessarily last over time, whereas changes in knowledge and skills are more enduring.[94,95] Given that knowledge and skills were only evaluated in a few studies, little is known about the impact of disability interventions on these more durable outcomes.

Many of the articles reported that the interventions were well received by medical students, that students found them to be meaningful experiences, and/or that they resulted in the desired changes. However, given the low quality of the empirical evidence that was provided, much of what is claimed is based on conjecture and interpretation of general feedback and satisfaction with the experience. Although lecture was the most commonly reported instructional method used, evaluation data do not support this, or any other method, as the best means of instruction. General feedback (often from self-selected groups of students) was the most common type of evaluation. For the studies that did measure attitudes, knowledge, and/or skills, these evaluations were most commonly captured immediately after the conclusion of the intervention (again, usually from a self-selected group of students). Thus, none of this information provides insight into the long-term impact of these interventions on the students, or, more importantly, the quality of care received by people with disability. Research using rigorous evaluation, including the use of longitudinal evaluations, is needed to more effectively determine the best approaches to teaching medical students about disability and to determine whether this training has downstream effects on patient care.

Strengths and Limitations

This systematic search and review has several strengths. This study's systematic search protocol facilitated an extensive capture of the scientific literature. This included using eight different search phrases across six databases and processing through approximately 17,500 articles during the initial phase of the search. Ancestry reviews were also conducted with the included articles until a point of saturation had been reached, and an updated search was run to account for articles published between January 2017 and June 2018 to ensure that this work is up-to-date. Each step of this process was crafted specifically to facilitate the most extensive capture of potentially relevant articles as possible. In addition, this systematic search and review followed a rigorous data collection protocol that enhanced the accuracy and reliability of the data. For each individual data point, at least two reviewers independently made coding

decisions and then completed a reconciliation process requiring consensus agreement. Procedures were in place to handle disagreements and to ensure that consensus was eventually reached. In addition, the coding schemes were pilot tested to calibrate responses and ensure consistency among the coders.

However, this study is not without limitations. One goal of this review was to focus on identifying effective strategies to teach medical students about disability. This is a potential limitation because educators for other health professions (i.e., nursing, dental, physical therapy) have also reported interventions aimed toward teaching their students about disability. Thus, because of the restricted scope of this study, these interventions are not captured. However, the focus on interventions implemented with medical students was intentional. Given the leadership role physicians play in the healthcare system, and the amount of influence they have over the care of their patients, it is crucial to understand what is being done to teach future physicians about disability and what types of interventions have been effective. This review provides a foundation for beginning to understand that.

Another potential limitation is that only published journal articles were captured and reviewed as part of this study. Interventions for medical students have been reported in other formats (e.g., white papers, books, instructor toolkits). This gray literature is not included in this review. However, restricting the scope to published journal articles allows for this study to focus on evaluating the quality of evidence reported in the scientific literature related to the effectiveness of the interventions. Interventions reported in other formats were not anticipated to be reported with enough rigor or detail to allow for these evaluations to be made.

Both a strength and limitation of this study is that this search and review methodology systematically and objectively evaluated information by imposing uniform criteria on quantifiable components of scientific articles. Given the variable nature of scientific articles published across time and disciplines, this inherently means that choices are made that may hold published work to standards its authors were not intending to meet. For example, in this review, the exclusively qualitative research[31,38,51,56,58,75,86] did not easily lend itself to the assessment tools defining quality in terms of objectively derived information because many of these studies' outcomes were based on response to questions soliciting general feedback and feelings of satisfaction with the intervention, rather than rigorous qualitative methodologies. However, this review used a global risk of bias evaluation strategy. This approach allowed for the diverse set of studies captured in this review to be consistently evaluated based on their individual methodological merit, rather than having to meet an inflexible set of criteria.

Finally, as with all other work related to disability, the way disability was defined in this study is a potential limitation. This study captured articles reporting interventions explicitly focused on disability (i.e., physical disability, sensory disability, intellectual disability, developmental disability, disability in general). This focus on physical, sensory, intellectual, and developmental disability is common and is consistent with other work in this area.[52,96,97] However, restricting the definition of disability to these domains resulted in the exclusion of interventions focused exclusively on mental health or gerontology. This choice was made for this review because, although

TABLE 4. Overview of included articles

Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Objectives Attitude Change	Increase Skills	Increase Knowledge
2018	Castro[14]	Brazil	Empirical	—	12		X	X
2018	Coret[15]	Canada	Empirical	MS 1	27	X	X	
2018	Leppert[16]	United States	Empirical	Mixed Group	4			X
2017	Sheppard[17]	United States	Empirical	MS 2	118			X
2016	Bu[18]	United States	Empirical	MS 3	488	X		
2016	Sarmiento[19]	United States	Empirical	Mixed Group	301			X
2016	Thompson[20]	United Kingdom	Empirical	Mixed Group	16	X		
2016	Watkins[21]	United Kingdom	Empirical	MS 3	68	X		
2015	Ajuwon[22]	Nigeria	Empirical	> MS 4	184	X		
2015	Rogers[23]	United States	Commentary	MS 1	—	X		
2015	Whitehall[24]	Australia	Empirical	MS 4	129			X
2014	Harwood[25]	United Kingdom	Empirical	MS 4	69	X	X	X

	Evaluation Domains				Risk of Bias			
Attitude	Skills	Knowledge	General Feedback	Follow-up Evaluation	STROBE Total	Quality Rubric	Quality Evaluation	Intervention Description
X	X	X	X		17	PP	Poor	A mixed group of medical and health professions students completed a 30-hr elective course on disability that included lectures, discussions, people with disability as speakers, and disability simulation activities.
X	X		X		21	CI	Good	Students were randomly assigned to complete one of two interventions. The first was simply a lecture on health care for people with intellectual/developmental disabilities. The second was the same lecture with a reflective discussion based on videos of people with intellectual/developmental disabilities sharing their experiences.
		X			19	PP	Fair	Students completed three online modules presenting information related to neonatal care and disability.
		X			21	PP	Fair	Students completed an educational online module on legal issues related to children with disability, participated in an online discussion, and attended a panel discussion with parents of children with disability.
X			X	X	20	CI	Poor	Students were given a lecture on the ADA and barriers to care for PWD during MS 1, and then learned about communicating with PWD and engaged in a discussion with a PWD panel during MS 3.
		X			17	PP	Poor	Two 2-hr sessions related to disability are incorporated into a course spanning MS 1 and MS 2. The MS 1 session provides opportunities for reflection and discussion of disability. The MS 2 session includes a person with disability and his family talking about their experiences and further discussions.
X			X		20	PP	Fair	Students spend 5–7 days at sea sailing with a group and partnered with a person with disability. Students are provided with disability training before departure, and during the voyage students reflect on their experience.
X	X	X	X		17	PP	Poor	Students complete an educational program led by people with disability who lead activities and speak about their experiences. They also have an opportunity to practice skills in simulated patient interactions with a person with intellectual disability as the simulated patient.
X					22	PP	Fair	Educational modules using lectures, field visits, and interactions with PWD and their families were integrated into the medical school curriculum for upper-level medical students.
			X		11	PP	Poor	Five sessions related to disability are integrated across the genetics course and public health course for MS 1 students. These sessions include speakers with disability, small group discussions with community members, lectures, and panel discussions with people with disability.
		X		X	14	PP	Fair	During their pediatric rotation, students spent 2 wks at a local school for children with disability. As part of this experience, students attend lectures and conduct an interview with the parents of child with disability.
X		X	X		15	PP	Poor	Students are provided with a 75-min lecture on intellectual disability and are provided with access to a self-directed learning module on intellectual disability, featuring PWD.

(Continued on next page)

TABLE 4. *(Continued)*

Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Attitude Change	Increase Skills	Increase Knowledge
							Objectives	
2014	Shuja[26]	Pakistan	Empirical	MS 4	15			
2014	Symons[27]	United States	Empirical	Multiple Years for Cohort	129	X	X	X
2014	Thomas[28]	United Kingdom	Empirical	MS 4	47		X	
2014	Watmough[29]	United Kingdom	Empirical	MS 3	42		X	X
2013	Jain[30]	United States	Empirical	Mixed Group	44			
2013	Karl[31]	United States	Empirical	MS 3	144	X	X	X
2012	Kinnair[32]	United Kingdom	Empirical	Mixed Group	89			
2012	Medina-Walpole[33]	United States	Empirical	MS 1	194	X		
2012	Spitalnik[34]	United States	Commentary	MS 3	—			

Evaluation Domains					Risk of Bias			
Attitude	Skills	Knowledge	General Feedback	Follow-up Evaluation	STROBE Total	Quality Rubric	Quality Evaluation	Intervention Description
			X		14	PP	Poor	Students were provided with training related to communication skills and caring for people with disability, and then, they conducted several home visits with people with disability and their families.
X					21	PP	Fair	Training related to disability is integrated across the 4-yr curriculum. MS 1: Lectures and small group interactions with people with disability and their families. A summer elective focused on caring for people with disability is offered. MS 2: Lectures and an objective structured patient encounter (OSCE) with people with disability as standardized patients. MS 3: Lectures and clinical experiences during the family medicine and internal medicine rotations. MS 4: A 4-wk elective is offered on primary care for patients with disability.
	X		X		21	PP	Fair	MS 4 students completing their neuroscience block have a 3-hr lecture on intellectual disability, clinical placements with a community service provider serving people with ID, and a communication training session. Students interact with people with intellectual disability and are provided with feedback on their interactions.
			X		19	PP	Poor	A course was offered to MS 3 students including 6 d of training session, 5 d of placement in primary care settings, communication skills training, and visits to community service providers.
			X		15	PP	Poor	During the family medicine rotation, students participated in a 1-hr session on communication and disability etiquette led by PWD.
			X		18	PP	Fair	Training related to disability is integrated across the 4-yr curriculum. MS 1: Lectures and small group interactions with people with disability and their families. MS 2: Lectures and an objective structured patient encounter with people with disability as standardized patients. MS 3: Lectures and clinical experiences during the family medicine and internal medicine rotations. MS 4: A 4-wk elective is offered on primary care for patients with disability.
		X	X		18	PP	Fair	Medical students worked in small interprofessional groups to interview patients with mental health and the professionals caring for them. They then analyzed the current care plan and proposed way to enhance it as part of a presentation to care professionals, including feedback and discussion.
X			X		20	PP	Good	MS 1 students completed a 10-wk course providing content and clinical experiences related to providing care for patients with varied abilities across the life span.
			X		8	PP	Poor	MS 3 students participate in a seminar as part of their pediatrics rotation, including discussions, a lecture, reflection, and a home visit with a child with disability and his/her family.

(Continued on next page)

TABLE 4. *(Continued)*

Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Objectives		
						Attitude Change	Increase Skills	Increase Knowledge
2012	Woodard[35]	United States	Empirical	MS 3	245	X		X
2011	Anderson[36]	United Kingdom	Empirical	Mixed Group	109		X	
2011	Galletly[37]	Australia	Empirical	MS 4	87	X		
2011	George[38]	United States	Empirical	MS 4	15	X		
2011	Kirby[39]	Canada	Empirical	Mixed Group	26	X	X	X
2011	Shapiro[40]	United States	Commentary	MS 1	—			
2010	Anderson[41]	United Kingdom	Empirical	Mixed Group	150			X
2010	Brown[42]	United States	Empirical	MS 3	146		X	X
2009	Bunn[43]	United States	Empirical	MS 3	150			
2009	Duggan[44]	United States	Empirical	Mixed Group	138			
2009	Graham[45]	United States	Empirical	MS 3	92	X	X	X

Evaluation Domains					Risk of Bias			Intervention Description
Attitude	Skills	Knowledge	General Feedback	Follow-up Evaluation	STROBE Total	Quality Rubric	Quality Evaluation	
X		X	X		15	PP	Good	During their ambulatory care clerkship, MS 3 students complete a 6-wk module on caring for PWD. This module includes the following: a video with PWD discussing access to care, visits with community service providers, home visits, service learning experiences, communication training, online educational content, interactions with model patients who have a disability, panel presentations by advocates and family members of PWD, a disability role-play activity, and interprofessional training activities with physical therapy students.
		X	X		20	PP	Good	Medical students participate in an interprofessional workshop focused on communicating with people with disability. This workshop includes the following: practice having a conversation with people with disability, discussions, and reflection.
X			X		19	PP	Good	Some MS 4 students completing their psychiatry rotation participated in a workshop including a video of a college student with schizophrenia describing his experiences and then an auditory hallucination simulation and discussion.
X			X		18	PP	Fair	MS 4 students participate in an elective course with a service learning project focused on facilitating a story telling activity with people with disability in a retirement community. The course also included training on how to interact with the patients and deal with emergencies and a reflection at the end of the course.
X	X	X	X	X	21	CI	Fair	Medical students in the intervention condition completed a 4-hr workshop including a lecture, wheelchair skill training, playing the role of wheelchair user in the community, a reflective discussion, and provision of self-study materials.
			X		9	PP	Poor	A 2-hr session is provided to MS 1 students based on viewing video clips of a dance performance by a PWD and then having a facilitated discussion with a disability-rights advocate or physician with experience working with people with disability.
X		X	X		21	PP	Poor	Medical and social work students spent 4 wks working together in a community hospital talking with people with disability and learning about the interdisciplinary care strategies used to meet their needs.
	X	X			21	CI	Poor	Family medicine clerkship students were exposed to didactic sessions focused on disability, led by a PWD and parent of a PWD. Performance on OSCEs was compared for students interacting with standardized patients who either were PWD or were not PWD.
					21	PP	Good	During their psychiatry rotation, MS 3 students participate in an auditory hallucination disability simulation activity.
			X		20	PP	Fair	During their family medicine clerkship, students were invited to participate in a standardized patient interaction with a person with disability and receive feedback and a recording of their interaction.
X		X			16	PP	Fair	MS 3 students completing their family medicine rotation complete a 90-min session discussing caring for people with mobility and cognitive impairments, partially led by a PWD and parent of a PWD.

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TABLE 4. *(Continued)*

Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Objectives Attitude Change	Objectives Increase Skills	Objectives Increase Knowledge
2008	Tracy[46]	Australia	Empirical	MS 4	185	X		
2007	Eagles[47]	United Kingdom	Commentary	Mixed Group	—			
2007	Jones[48]	Australia	Empirical	MS 4	26			X
2007	Street[49]	United Kingdom	Empirical	MS 4	160			X
2007	Thacker[50]	United Kingdom	Empirical	Multiple Years for Cohort	40	X	X	
2005	Amosun[51]	South Africa	Empirical	Mixed Group	2	X		X
2005	Eddey[52]	United States	Commentary	MS 3	—	X		
2004	Minihan[53]	United States	Commentary	Mixed Group	175	X	X	X
2004	Saketkoo[54]	United States	Empirical	MS 4	77	X	X	X
2004	Vlak[55]	Croatia	Empirical	> MS 4	89	X	X	X
2003	Lock[56]	Canada	Empirical	Mixed Group	70		X	X
2003	Sabharwal[57]	United States	Empirical	Mixed Group	206	X		X
2003	Thistlewaite[58]	United Kingdom	Empirical	Multiple Years for Cohort	—	X		X

Evaluation Domains					Risk of Bias			
Attitude	Skills	Knowledge	General Feedback	Follow-up Evaluation	STROBE Total	Quality Rubric	Quality Evaluation	Intervention Description
X			X		20	PP	Fair	MS 4 students completed a 3-hr communication training session including a lecture on developmental disabilities and communication, interactions with instructors with intellectual disabilities, group discussions, and a disability role-playing activity.
			X		9	PP	Poor	During their psychiatry rotation, students practice interviewing actors who present as patients with various mental health issues.
			X		16	CI	Poor	An elective course in pediatrics and child health provided students with an opportunity to complete an 8-wk placement at a rural school specializing in meeting the needs of children with intellectual disability, physical disability, and autism.
X			X		21	CI	Good	MS 4 students and pediatric nursing students worked together to conduct home and school visits with a child with disability.
X	X		X		12	CI	Poor	Students complete disability communication training during their MS 2 year and then work with standardized patients with intellectual disability during their later clinical years.
X					16	PP	Poor	Medical students individually completed an elective module where they pretended to be a wheelchair user for a week and reflected upon their experiences.
			X		11	PP	Poor	During a clinical rotation, MS 3 students are provided with opportunities to work with standardized patients who have a disability and they are provided with communication training.
			X		11	PP	Poor	During their family medicine clerkship, students spend a half day working with standardized patients who have a disability and discussing the outcome of these interactions with the PWD. A large group reflection discussion concludes the session.
X	X	X	X		20	PP	Poor	MS 4 students participate in a 3-hr workshop that includes an overview of the ADA, panel presentations by people with disability and family members, a demonstration of hearing assistance devices and appropriate assistance, a visual impairment simulation, communication training, and module led by an occupational therapist focused on caring for people with physical and neurological disabilities.
X			X		14	PP	Poor	Students had lectures, clinical experiences, and skills training related to disability during a 10-d physical medicine and rehabilitation course.
			X		15	PP	Poor	Students completed a 3-hr workshop including lectures, discussions, and case-based simulated patient interactions. Some of the sessions were led by deaf people or people with hearing impairments.
X		X	X		21	PP	Good	MS 1 and MS 2 students participated in 6 1-hr lunch sessions over the span of the curricular year interacting with people with spinal cord injury. These sessions included information on the PWD's experience with the healthcare system, their lifestyle, as well as their abilities and challenges. Students also participated in a workshop on appropriate and inappropriate interactions with the PWD and spent time in a wheelchair.
			X		12	PP	Poor	Disability-related content is integrated into the professional development course for students across the first 3 yrs. The activities include the following: lectures, small group discussions, communication training, and a role-playing activity led by actors who are people with learning disabilities.

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TABLE 4. *(Continued)*

Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Attitude Change	Increase Skills	Increase Knowledge
						Objectives		
2002	Wells[59]	United Kingdom	Commentary	—	—	X		
2001	Coodin[60]	Canada	Empirical	MS 4	34			
2001	Okamoto[61]	United States	Commentary	Multiple Years for Cohort	—			
2001	Parkin[62]	United States	Empirical	MS 1	—	X	X	X
2001	Sabharwal[63]	United States	Commentary	—	—		X	
2000	Crotty[64]	Australia	Empirical	MS 2	146	X	X	X
2000	Sabharwal[65]	United States	Empirical	MS 3	129		X	
1999	Henley[66]	South Africa	Empirical	> MS 4	177			
1998	Andrew[67]	United States	Empirical	MS 3	125			
1998	Conill[68]	United States	Commentary	Mixed Group	14			
1998	Eddey[69]	United States	Empirical	MS 3	66		X	
1998	O'Carroll[70]	Ireland	Empirical	> MS 4	56			
1997	Jacobson[71]	United States	Empirical	—	44			X

Evaluation Domains				Follow-up Evaluation	Risk of Bias			Intervention Description
Attitude	Skills	Knowledge	General Feedback		STROBE Total	Quality Rubric	Quality Evaluation	
			X		8	PP	Poor	Medical students participate in small workshops led by people with disability, and students talk about disability and learn communication strategies.
X					20	CI	Poor	During their psychiatry rotation, MS 4 students attend a 90-min seminar on schizophrenia that included a lecture and a presentation by a person with schizophrenia who discussed his/her experiences and life.
					8	PP	Poor	Training related to childhood disability was provided for all 4 yrs of medical school. MS 1: students interact with a child with disability once a week for a year. MS 1/MS 2: Clinical cases include issues related to disability. MS 3: Students work with an early intervention program during their pediatrics rotation. MS 4: Students can take a pediatric elective that allows for emersion in schools and early intervention programs.
			X		7	PP	Poor	MS 1 students learn communication skills and role play having a disability.
					7	PP	Poor	Medical students complete several OSCE stations that focus on teaching disability etiquette and receive feedback on their performance.
	X	X	X		17	PP	Fair	For 4 wks, MS 2 students complete 4 activities: (*a*) attend multidisciplinary team meetings and therapy sessions in an inpatient rehabilitation setting, (*b*) two PWD home visits, (*c*) visit a community organization that supports PWD, and (*d*) spend half a day role-playing having a disability.
	X		X	X	14	CI	Fair	During the internal medicine clerkship, MS 3 students completed a 90-min training session on positioning and movement of a PWD in a bed or wheelchair.
			X		16	PP	Fair	During the pediatric and child health rotation, students complete at least 1 home visit with a child with disability and his/her family, with coaching from the program coordinator, and then present a summary of the findings of their visit.
X		X	X		17	PP	Poor	During their pediatric rotation, MS 3 students participate in an educational session related to disability and complete a home visit with a child with disability and his/her family.
			X		9	PP	Poor	A small pilot group of medical students spent 24-hr paired-up playing the role of either a person with disability or a caregiver. At the end of the role-playing exercise, they participated in a debriefing discussion.
	X		X		20	PP	Fair	MS 3 students are given lectures on mental, physical, and intellectual disability, they are taught communication strategies, and they complete a clinical interaction simulation with a PWD, which is also facilitated by a PWD.
X					17	PP	Fair	Group of 10–18 students completed a two-session disability awareness module led by a medical provider with a physical disability. The first session involved playing the role of a person with disability for 6 hrs with a partner. The second session focused on debriefing and reflection.
		X	X		9	PP	Poor	Standardized-patient instructors with disability were incorporated in the internal medicine OSCE. Medical students received instruction about disability following the OSCE.

TABLE 4. *(Continued)*

Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Attitude Change	Increase Skills	Increase Knowledge
1997	Sidebotham[72]	United Kingdom	Empirical	MS 3	21		X	X
1996	Galil[73]	Israel	Commentary	MS 1	—			
1996	Hall[74]	United Kingdom	Empirical	—	28			
1996	Susa[75]	United States	Commentary	Multiple Years for Cohort	—			
1996	Tracy[76]	Australia	Empirical	MS 1	25	X		
1994	May[77]	United Kingdom	Empirical	MS 2	23	X		
1991	May[78]	United Kingdom	Empirical	MS 2	26	X		
1991	McCreary[79]	Canada	Empirical	MS 3	75		X	X
1991	Smith[80]	United Kingdom	Empirical	MS 4	415		X	X
1988	Laking[81]	United Kingdom	Empirical	MS 4	58	X		
1985	Blackman[82]	United States	Empirical	MS 3	135		X	X
1984	Cohen[83]	United States	Commentary	Multiple Years for Cohort	—	X	X	X

			Evaluation Domains		Risk of Bias			
Attitude	Skills	Knowledge	General Feedback	Follow-up Evaluation	STROBE Total	Quality Rubric	Quality Evaluation	Intervention Description
	X	X	X		16	PP	Poor	MS 3 students completed an elective module focused on child development and disability that included visits to community service providers, interactions with providers who care for PWD, disability focused case-based learning, and a home visit with a child with disability and his/her family.
			X		10	PP	Poor	MS 1 students completed a 1-wk course focused on 1 of 4 disability groups (blind, deaf, intellectual, physical). The disability-specific programs included group discussions, lectures, interactions with PWD, reflections, visits to service providers, role-playing disability, and discussions with family members.
X			X		13	PP	Poor	Medical students participate in a 2-hr workshop led by actors with a learning disability, learning ice-breaker games, and mimes.
			X		9	PP	Poor	An affinity group is offered to give students an opportunity to learn about children with disability and their families. Activities include discussions, lectures, and building a longitudinal relationship with a child with disability and his/her family.
X			X		15	PP	Poor	MS 1 students spent 24 hrs for 12 wks engaging in disability-related learning experiences including: visits to community service providers, discussions, interactions with family members of people with disability, and a role-play activity.
X			X		17	PP	Fair	MS 2 students participate in a seminar including a one-on-one social interaction with a person with a learning disability, lectures, a placement at a center serving people with a learning disability, and a team project.
X			X		16	PP	Poor	MS 2 students are allocated to a seminar on mental disability including home visits with people with disability and their family, content presentations, discussions, interactions with PWD, and placements at organizations serving PWD.
		X	X	X	11	PP	Poor	MS 3 students complete a multipart program including lectures, small group discussions, ward rounds, a visit to a group home, and self-study problem-solving exercises.
			X		15	PP	Poor	MS 4 students complete a 1-day course on deafness awareness and communication training. This includes the following: role-playing deafness, instruction from PWD, a video, and a presentation by a PWD discussing his/her experience of losing his/her hearing.
X			X		20	CI	Poor	Students in the intervention condition completed a short course on mental disability including lectures, interactions with community service providers, interactions with people with disability, an ethics debate, and case presentations.
	X	X	X		21	CI	Fair	A 3–4 hr self-study interactive videodisc program was implemented during the pediatric training rotation to teach students to recognize and assess motor dysfunction in infants.
			X		8	PP	Poor	MS 1 students participate in discussions with parents of children with disability as a part of a family life course, and they are provided with an opportunity to have a 12-wk elective experience. MS 3 students are exposed to developmental disability as part of their pediatric clerkship. MS 4 students can take a 1- to 2-mo elective related to disability.

(Continued on next page)

TABLE 4. *(Continued)*

						Objectives		
Year	First Author	Country	Type of Article	Year in Med. School	Sample Size	Attitude Change	Increase Skills	Increase Knowledge
1984	McCrory[84]	United States	Commentary	—	13	X	X	X
1984	Mitchell[85]	Australia	Empirical	Multiple Years for Cohort	64	X		
1980	Retish[86]	United States	Commentary	—	—			X
1977	Schwarz[87]	New Zealand	Commentary	Multiple Years for Cohort	—			X
1974	Romano[88]	United States	Commentary	MS 1	—		X	X
1968	Fishler[89]	United States	Empirical	MS 4	36	X		
1960	Gibson[90]	Canada	Commentary	MS 4	—			
Total # of Interventions (out of 77)					60	35	28	35
% of Interventions					78	45	36	45

Mixed group indicates the medical students who participated in the intervention were from multiple medical school classes; multiple years for cohort, the students in the same cohort experienced parts of the intervention during multiple years of their medical school training.

ADA, Americans with Disabilities Act; CI, quality assessment of controlled intervention studies; PP, quality assessment tool for before-after (pre-post) studies with no control group; PWD, people with disability.

these groups are also stigmatized and marginalized, and they experience functional limitations, they are groups many people conceptualize as separate from other people with disability.

Implications for Medical Education

Historically, teaching medical students about disability has not been a priority.[7] Knowledge and/or skills about disability are not important components of licensing examinations (as highlighted by the term "disability" not appearing in the National Board of Medical Examiners' 2017 content outline).[98] In addition, attitudes related to patient populations are not assessed or considered in determining ability to provide care. Therefore, there has been little incentive for medical students to learn disability-related knowledge and skills, and medical schools do not have a history of making it a part of their curriculum.[7,99,100]

However, more medical schools are starting to incorporate training related to disability as part of their cultural competency curriculum.[7] This action represents a key opportunity to better prepare medical students to meet the needs of people with disability. To ensure that medical educators advocating for better care for people with disability are able to capitalize on this opportunity, they need to know the most efficient and effective strategies to teach medical students about disability. This study suggests that the current scientific literature falls short of providing that information. A more robust evidence base is needed to ensure the time spent educating medical students about disability efficiently and effectively meets its objectives.

As a starting point, educators developing and evaluating educational interventions to teach medical students about disability would be advised to:

1. Focus on teaching medical students the knowledge and skills they need to behave in a way that meets the needs of patients with disability. Interventions with other minority groups focusing on improving knowledge and skills

Evaluation Domains					Risk of Bias			
Attitude	Skills	Knowledge	General Feedback	Follow-up Evaluation	STROBE Total	Quality Rubric	Quality Evaluation	Intervention Description
			X		10	PP	Poor	MS 1 students have the opportunity to take an elective focused on caring for PWD. This elective includes the following: lectures, visits to community service providers, and presentations by PWD discussing their experiences.
X				X	18	PP	Poor	Medical students are exposed to clinical experiences with people with physical disability starting during their first year in medical school.
					10	PP	Poor	During the pediatrics rotation, medical students participate in a 1-hr seminar covering the laws related to ensuring education for children with disability, the physician's role in developing individualized educational plans and counseling families. Students also visit schools. Finally, students visit group homes and conduct interviews with people with developmental disability.
			X		10	PP	Poor	Disability-related experiences were integrated across the upper-level clinical training, including visits to homes for PWD, visits to community service providers for PWD, clinical placements, and a disability role-playing exercise.
			X		8	PP	Poor	Students participate in a summer traineeship between their MS 1 and MS 2 years. This experience includes learning about the role of social work in patient care, a disability role-playing activity, visits to community service providers for people with disability, and communication training.
X					19	PP	Fair	MS 4 students completing their pediatric clerkship attended weekly teaching demonstrations to learn to conduct diagnostic evaluations of children with disability.
					5	PP	Poor	During their psychiatry clerkship, MS 4 students are given lectures and demonstrations related to mental and intellectual disability and visit a care institution for patients with these disabilities.
32	13	21	60	6	15.4		Poor = 47	
42	17	27	78	8			61	

have shown that changes to these constructs are more durable than changes to attitude.[94,101]

2. Use methodology that has the potential to provide clear evidence of effectiveness. Using established objective measures of desired outcomes, a pretest or control group to provide evidence of change or differential impact, and longitudinal follow-up evaluations to ensure that effects observed in immediate posttests are true effects and not situational artifacts can strengthen the empirical evidence in this domain.

3. Use established reporting guidelines when designing interventions and creating manuscripts to report the findings. Using reporting guidelines such as STROBE during the intervention and evaluation design phase can provide a check to help ensure that educators have considered and compiled all of the information they will need to fully report the details of the intervention. This in-and-of-itself will not guarantee the intervention will provide clear evidence

of effectiveness. This will be dependent on the methods underlying the implementation of the intervention and evaluation, but it does provide a concrete way to help ensure more complete reporting.

CONCLUSIONS

This study set out to determine the breadth of literature related to disability education and identify the most effective strategies for teaching medical students about disability. There are a significant number of publications; however, the overall low-quality scientific literature and insufficient evaluation methods do not allow for particular educational interventions or instructional methods to stand out as more effective than others. Although the focus of this study is on the scientific literature reporting educational interventions to teach medical students about disability, the deficiencies in study quality and evaluation rigor identified in this study are not unique to this

domain. Thus, this study does not intend to suggest that the evidence base for educating medical students about disability is particularly weak in comparison with the evidence base for educating medical students about other groups of people or concepts. Rather, the hope is that the critical evaluation of the scientific literature presented in this study will contribute to the advancement of educating medical students about disability by increasing the rigor of scholarship in this domain. To advance this area of medical education, more rigorous longitudinal evaluations of interventions need to be implemented, and educators need to ensure that they are fully reporting methodologically sound studies. This includes focusing less on students' opinions about the interventions and giving less weight to the results of immediate posttest evaluations of attitude change. Instead, focusing on more durable outcomes related to increasing knowledge and skills and using longitudinal follow-up to evaluate the long-term effectiveness of interventions may allow more accurate assessment of success.

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