A systematic review of implicit bias in health care: A call for intersectionality

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Abstract

Background and objectives: Health disparities are a growing concern in health care. Research provides ample evidence of bias in patient care and mistrust between patient and providers in ways that could perpetuate health care disparities. This study aimed to review existing literature on implicit bias (or unconscious bias) in healthcare settings and determine studies that have considered adverse effects of bias of more than one domain of social identity (e.g., race and gender bias) in health care.

Methods: This is a systematic review of articles using databases such as EBSCO, Embase, CINAHL, COCHRANE, Google Scholar, PsychINFO, Pub Med, and Web of Science. Search terms included implicit bias, unconscious bias, healthcare, and public health. The inclusion criteria included studies that assessed implicit bias in a healthcare setting, written in English, and published from 1997-2018.

Results: Thirty-five articles met the selection criteria – 15 of which examined race implicit bias, ten examined weight bias, four assessed race and social class, two examined sexual orientation, two focused on mental illness, one measured race and sexual orientation, and another investigated age bias.

Conclusions: Studies that measured more than one domain of social identity of an individual did so separately without investigating how the domains overlapped. Implicit Association Test (IAT) is a widely used psychological test which is used to determine existence of an implicit bias in an individual. However, this study did not find any use of an instrument that could assess implicit bias toward multiple domains of social identities. Because of possible multiplicative effects of several biases affecting a single entity, this study suggests the importance of developing a tool in measuring intersectionality of biases.

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Introduction

Gender inequality is a major social issue which may adversely affect women's health in developing countries. Similarly, race, gender, sexual orientation, body weight, social class, nationality, and religion are common social identities where discrimination or bias exists in many developing and developed societies. The combined adverse effects of implicit bias (or unconscious bias) towards persons with intersecting social identities are stronger than the separate effects of a single identity. An intersectionality framework is a useful approach to understanding the complexities of health disparities and inequalities.

Intersectionality is a theoretical framework for understanding how several social identities such as

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race, gender, socioeconomic status, sexual orientation, disability etc., intersect on a micro level of individual experience to show interlocking systems of privilege and oppression (i.e., racism, sexism, heterosexism, classism, etc.) at the macro social-structural level [1,2]. The term 'intersectionality' was first coined by Kimberlé Crenshaw in 1989. Crenshaw in her 1989 essay "Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory, and Antiracist Politics," described the understandings of race and sex/gender, by outlining marginalization of Black women from the discourse of White feminists and racism [3-5].

Social identities can be influenced by implicit bias, which is the unconscious negative attitude against individuals. Implicit bias resides in the subconscious level and does not require any endorsement from the perceiver. For instance, a person's skin color or accent silently exerts its influence on perception, memory, and behavior, and hence controlling implicit bias is not in any way straightforward [6-8]. The existence of implicit bias can be measured by the Implicit Association Test (IAT), a computer-based measure in which the strength of association is determined by a respondent's speed in sorting items under the concepts provided [9]. This test measures individual items of bias related to race, gender, region, sexual orientation, age, weight, disability, etc.

In the United States, the progress made in reducing implicit attitudes towards race and gender seem to have occurred at a surface level [9]. Such biases are well documented resulting in health disparities, inequities, and inequalities [6,10]–all focus areas of health care [7]. Intersectionality has been widely studied in law, psychology and gender studies, but is scarce in mainstream public health research [11,12]. Similar to intersectionality, the hypothesis of double jeopardy posits that when individuals, (especially women), belong to two or more subordinated groups, the disadvantage they face is added or multiplied. A common example is being a woman (gender bias) and being of color (racial bias). Chappell and Havens (2016) described this as the combined adverse effects of occupying two stigmatized statuses as being more significant than occupying each status separately [13]. Double jeopardy and intersectionality were confirmed in the empirical study by Williams (2014) [11]. The

study also noted that biases experienced by women differed not only by race but within race, such that women of color have experiences of discrimination that are different from other women of the same race [11].

In contexts such as politics and employment, people's behavior and decision making are greatly influenced by race and gender. The intersectionality of race and gender usually results in a multiplicative predictive value [14]. The presumption of intersectionality is not that all intersecting identities are equally disadvantageous. Instead, the theory considers how the low and high status of social identities multiplies to result in disparity. An intersectionality framework is useful for understanding the complexities of implicit biases and its result in health disparities and inequalities [12]. Therefore, the purpose of this study was to evaluate the literature on implicit bias in healthcare settings and determine whether the literature reflect studies that have considered the multiplicative effects of individuals when assessing implicit bias.

Methods

Search Strategy

Using recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [15], a comprehensive literature search was conducted from May 2017 to December 2018 of the databases such as EBSCO, Embase, CINAHL, COCHRANE, Google Scholar, PsychINFO, Pub Med, and Web of Science from the years 1997-2018 to capture studies investigating implicit bias. Studies were eligible for inclusion if they met the following criteria: 1) published in years 1997-2018; 2) assessed implicit bias in a healthcare setting; 3) the study population being patients or providers, and 4) the articles written in English. Dissertations were eligible, but editorials, responses, and commentaries were excluded. All experimental and quasi-experimental designs were included along with papers reporting any intervention used to reduce bias in a health setting.

Data Extraction

Of the 2,267 research articles identified through database searching (Figure 1), 1,952 research articles were screened after removing duplicates.

Next step of screening was to remove articles addressing implicit bias in non-health related fields and those which did not yield full articles ($n = 1,868$). The third step of screening was to exclude articles published before 1997 ($n = 20$), editorial or short commentary ($n = 11$), and those which did not meet other inclusion criteria ($n = 18$). This screening process yielded a total of 35 studies for final review.

Measurement Tools of Intersectionality

Quantitative methods

A number of statistical methods have been proposed for testing intersectionality. These are: 1) The Hierarchical Classes Analysis (HICLAS) in which subgroup differences are examined [16]; 2) Cross-tabulation which was used in a study by Covarrubias (2011) [17]; and 3) Logistic Regression has also been used in a number of studies, especially with an addition of the multiplicative interaction term [18,19], as well as by creating pattern of association in multiple domains of implicit bias using Latent Class Analysis [20]. Some of these methods are based on the propositions of Hancock (2007) and McCall (2005) [21,22]. McCall (2005) described three possible methods to measure intersectionality quantitatively: Anti-categorical Complexity - this approach sees categories as divisions which were socially constructed by people but not based on reality; Intra-categorical complexity -here, categories are not rejected, they are not made the central point; and Inter-categorical complexity - this approach uses categories, but the focus is on the changing relationships between the different identities [22,23].

Qualitative methods

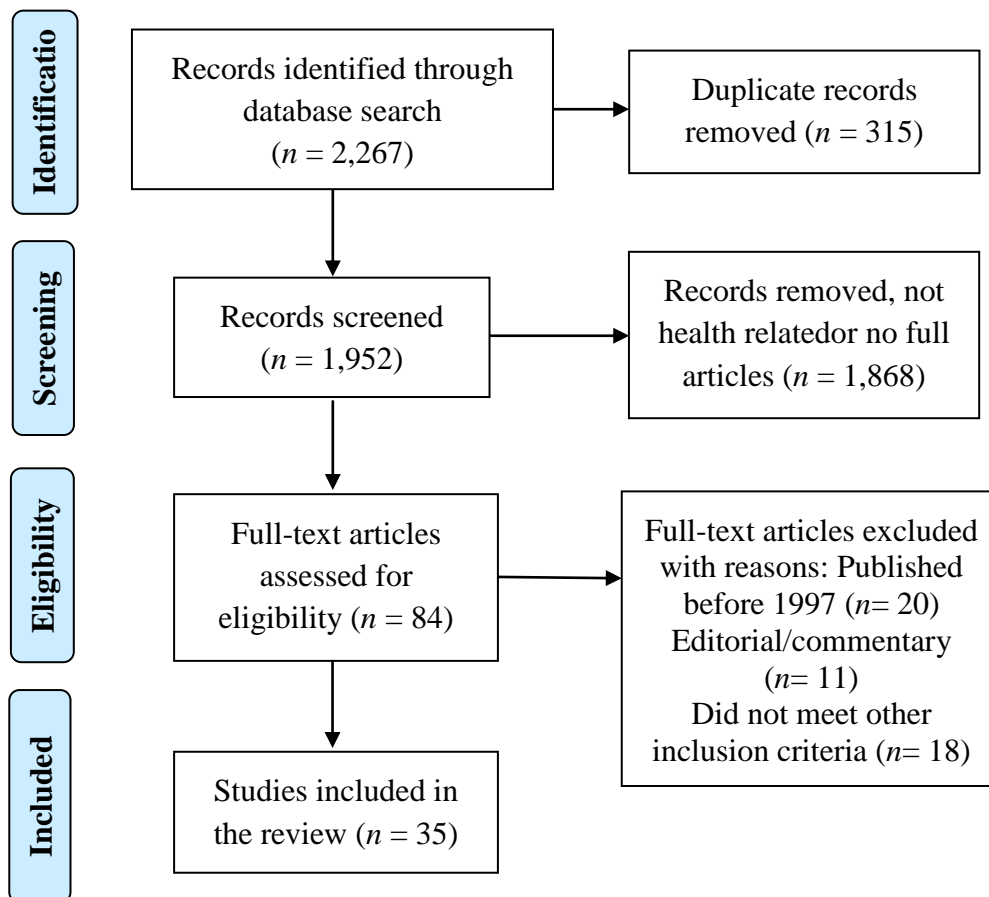Methods in qualitative research such as community participatory action research and ethnography

Fig-1. *PRISMA diagram*

(interviews and case studies) are well suited methods for conducting intersectionality research [24]. The intersectionality-informed qualitative research primer written by Hunting (2014) provides a comprehensive tool kit for qualitative research methods of intersectionality of social identities. Community participatory action research is useful in that the targeted population directly inform and dictate the direction of the research as well as appropriate interventions. Interviews and case studies are used to explore the intricacies of intersecting identities, and the effects on the lives of individuals [23,24].

Results

In this review, more than half of the studies (19 of 35, 54%) focused on race/ethnicity implicit bias, followed by weight or fat-bias (10 of 35, 29%), and race and social class bias (4 of 35, 11%). Only 14% (5 of 35) of the studies measured more than one domain of implicit bias such as race and social class bias, and race and sexual orientation. Two studies reported bias related to mental illnesses, and two reported weight bias alone (Figure 2).

Detailed information including the type of implicit bias, study population, aim of the study, and major findings of the 35 selected studies are presented in Table 1. Majority of the studies reported the presence of moderate to strong implicit bias among the participants. Twelve studies found strong evidence of implicit bias favoring White Americans [25-33], while two studies found weak to moderate evidence of race bias [34,35]. Green et al (2007) found implicit stereotypes of African Americans as less cooperative with medical procedures [10]. Some studies examined the relationship between clinician's implicit bias and the quality of the provider-patient relationship [27,31,32,36,37].

Race & Social Class

Cooper et al (2012) investigated the link between clinicians' unconscious attitudes concerning race with visit communication and patient ratings of care. This study found an association between implicit racial bias and markers of poor visit communication and poor ratings of care, especially in Black patients [36]. Three studies found evidence of implicit bias but found no evidence that it affects clinician's provision of care or that it predicts treatment recommendations to minority patients [27,32,34]. Similarly, two studies that measured race and social class implicit bias found that their participants had an implicit preference for White persons and for those in the upper social class [30,31]. Two others showed participants IAT scores that were significantly associated with clinical decision making [38,39].
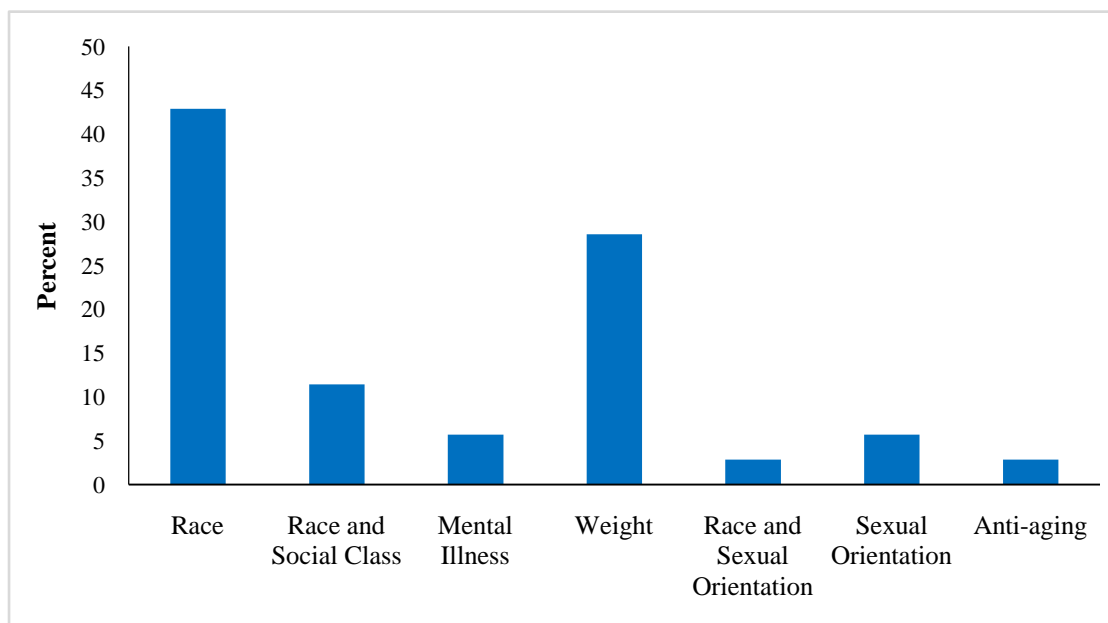

Fig-2. *Categories (percent) of implicit bias identified in this study (n = 35)*

Table-1: *Type of implicit bias, study population, adverse effects of bias, and major findings of 35 studies*

Author(s) [Reference]	Type of implicit bias measured	Study population; Aim of the study	Bias affected health outcome	Major findings
Boysen & Vogel 2008 [2]	Racial and sexual orientation bias	105 Counselor Trainees were assessed for implicit bias toward African Americans, lesbians and gay men and for self-reported multicultural competency.	Yes	Implicit bias existed among Counselor Trainees despite high self-reported multicultural competency.
Green et al. 2007 [10]	Racial implicit bias	Patients with acute coronary disease; Physicians' IAT measured to predict their clinical decision ($n = 287$)	Yes	IATs revealed implicit preference favoring Whites; Blacks less cooperative with medical procedures. White MDs more likely to treat White patients.
Sabin et al. 2009 [16]	Racial implicit bias	To measure doctors' ($n = 2,535$) implicit preference for patients by race.	Yes	Strength of implicit bias exceeded self-report among all MDs except Black MDs. Women showed less implicit bias than men.
Puumala et al. 2016 [26]	Racial implicit bias	154 emergency care providers. To assess both implicit and explicit racial bias and examine their relationship with clinical care.	No	84% of providers had an implicit preference for non-Hispanic White adults or children. Except for one study, no association between explicit bias or clinical vignettes and implicit bias.
Oliver et al. 2014 [27]	Racial implicit bias	543 family and internal medicine physicians. To evaluate whether the magnitude of implicit racial bias predicts physician recommendation of total knee replacement for black and white patients with osteoarthritis.	No	Participants had a strong implicit preference for Whites over Blacks, but this did not predict treatment recommendations.
Moskowitz et al. 2012 [28]	Racial implicit bias	To examine whether stereotypes are implicitly activated in physicians ($n = 27$).	Yes	Physicians stereotype certain diseases with Blacks. This suggests that diagnoses and treatment of Black patients may be biased.
Hausmann et al. 2015 [29]	Racial implicit bias	14 physicians and 162 patients with spinal cord injury (SCI). To examine implicit racial bias of physicians and its association with functioning and wellbeing for individuals with SCI.	Yes	Physicians had a strong pro-white/anti-black bias. Greater physician bias was associated with disability among individuals with SCI.
Haider et al. 2011 [30]	Racial and social class bias	202 medical students. To estimate unconscious race and social class bias among first-year medical students and investigate its relationship with assessments made during clinical vignettes.	No	69% of participants had IAT scores showing an implicit preference for White persons, and 86% for those in the upper class. No association existed between implicit preferences and the vignettes-based clinical assessments.

Haider et al. 2014 [31]	Racial and social class bias	To determine if unconscious race and class biases exist specifically among trauma/acute care surgeons and ($n = 248$); if so, whether those biases impact surgeons' clinical decision making.	No	74% of the participants had IAT scores demonstrating an unconscious preference toward White persons; 91% demonstrated an implicit preference toward upper social class persons. These biases were not statistically significantly associated with clinical decision making.
Blair et al. 2014 [32]	Racial/ethnic implicit bias	138 primary care physicians and 4,795 patients with hypertension. To determine if clinicians' implicit ethnic or racial bias is associated with treatment for hypertension among Black and Latino patients, relative to White patients.	No	Implicit bias did not affect clinicians' provision of care to their minority patients, nor did it affect the patients' outcomes.
Schaa et al. 2015 [33]	Racial implicit bias	67 genetic counselors. To explore the relationship between genetic counselors' implicit racial attitudes and their communication during simulated genetic counseling sessions.	Yes	Genetic counselors showed a moderate to strong pro-White bias on the Race IAT. Counselors with stronger pro-White bias tended to use less emotionally responsive communication when counseling minority simulated clients.
Rojas et al. 2017 [34]	Racial implicit bias	342 pediatricians. To evaluate whether implicit racial bias influences pediatricians' suspicion of child abuse as measured by 9 injury vignettes.	No	No statistically significant differences in suspicion for an abuse-related injury based on the race of the child. However, the study did not test for physicians' implicit bias.
Sabin et al. 2012 [35]	Racial implicit bias	86 academic pediatricians. To examine association between pediatricians' attitudes about race and treatment recommendations by patients' race.	Yes	Pediatricians' implicit attitudes about race affect pain management.
Cooper et al. 2012 [36]	Racial implicit bias	Cross-sectional study; 40 primary care clinicians and 269 patients. To seeassociations of clinicians' implicit attitudes about race with visit communication and patient ratings of care.	Yes	Clinician implicit race bias and race and compliance stereotyping are associated with markers of poor visit communication and poor ratings of care, particularly among Black patients.
Blair et al. 2013 [37]	Racial implicit bias	210 physicians, 2,908 patients. To investigate whether clinicians' explicit and implicit ethnic/racial bias is related to Black and Latino patients' perceptions of their care.	Yes	Clinicians' implicit bias may jeopardize their clinical relationships with Black patients, which could have negative effects on other care processes.
Haider et al. 2015 [38]	Racial and social class bias	215 physicians. To determine whether clinicians' unconscious race and/or social class biases correlate with patient management decisions.	No	Unconscious implicit biases were present among participants. No association between the IAT scores and vignette-based clinical assessments.

Haider et al. 2015 [39]	Racial and social class bias	245 registered nurses. To find association between racial and social class bias with clinical decision making.	No	Implicit association tests scores did not statistically correlate with vignette-based clinical decision making.
Stull et al. 2013 [40]	Mental illness bias	154 Assertive Community Treatment (ACT) staff. To examine implicit and explicit biases among ACT staff and explore the extent to which biases predicted the use of treatment control mechanisms.	No	Participants exhibited positive implicit attitudes towards people with mental illness.
Dabby et al. 2015 [41]	Mental illness bias	35 Psychiatry residents and 68 psychiatrists.	No	Psychiatrists and residents did not harbor negative implicit bias towards mental illness.
Teachman et al. 2001 [42]	Weight or anti-fat bias	84 health professionals. To investigate whether negative implicit attitudes and beliefs toward overweight persons exist among health professionals who specialize in obesity treatment, and to compare these findings to the implicit anti-fat bias.	Yes	Even among health professionals who specialize in obesity treatment, strong implicit anti-fat bias was evident in evaluations of overweight persons as bad and beliefs that overweight persons are lazy.
Schwart et al. 2003 [43]	Weight or anti-fat bias	389 clinicians and researchers. To determine the level of anti- fat bias in health professionals specializing in obesity.	Yes	Health professionals exhibited a significant pro- thin, anti- fat implicit bias on the IAT. In addition, the subjects significantly endorsed the implicit stereotypes of lazy, stupid, and worthless.
Sabin et al. 2015 [44]	Weight or anti-fat bias	134 Indian Health Service (HIS) clinicians. To explore association between weight and race bias with treatment approach for obesity.	No	Weight and race bias was found among long-term IHS clinicians, but this did not influence treatment approaches for overweight American Indian/Alaska Native children.
Miller et al. 2013 [45]	Weight or anti-fat bias	To determine the prevalence of weight-related biases among medical students ($n = 310$) and whether they were aware of their biases.	Yes	33% (101/310) self-reported a significant ("moderate" or "strong") explicit anti-fat bias. No students self-reported a significant explicit anti-thin bias. According to the IAT scores, over half of students had a significant implicit weight bias: 39% (121/310) had an anti-fat bias and 17% (52/310) an anti-thin bias. Two-thirds of students (67%, 81/121) were unaware of their implicit anti-fat bias.

Phelan et al. 2014 [46]	Weight or anti-fat bias	To examine the magnitude of explicit and implicit weight biases and identify factors predicting bias among 1st year medical students ($n = 4,732$).	Yes	A large number of students exhibited implicit (74%) and explicit (67%) weight bias. Explicit attitudes were more negative toward obese people than toward racial minorities, gays, lesbians, and poor people.
Sabin et al. 2012 [47]	Weight or anti-fat bias	2,284 medical doctors. To examine implicit and explicit attitudes about weight among MDs and determine the pervasiveness of negative attitudes about weight among MDs.	Yes	Strong implicit and explicit anti-fat bias is as pervasive among MDs as it is among the general public.
Swift et al. 2013 [48]	Weight or anti-fat bias	22 intervention and 21 control trainee health care professionals. Pilot a randomized controlled trial of the effects of educational films designed to reduce weight stigmatization toward obese patients on trainee dietitians' and doctors' attitudes.	Yes	Participants demonstrated weight bias. The intervention films significantly improved explicit attitudes and beliefs toward obese people but did not significantly improve implicit anti-fat bias.
Waller et al. 2012 [49]	Weight or anti-fat bias	45 nursing and 45 psychology students.	Yes	A statistically significant implicit bias was found in both groups.
Rukavina et al. 2010 [50]	Weight or anti-fat bias	To assess the efficacy of a multi-component intervention to reduce Kinesiology pre-professionals' implicit and explicit bias ($n = 78$).	Yes	On the pre-test, participants did not display overall explicit bias on the anti-fat attitudes test (AFAT) but had strong implicit bias and bias on the lazy/motivated semantic differential scale.
Phelan et al. 2015 [51]	Weight or anti-fat bias	1,795 medical students surveyed at the beginning of their 1st year and end of their 4th year. To assess medical school factors that influence change in implicit and explicit bias against people with obesity.	Yes	Increased implicit and explicit biases were associated with less positive contact with patients who have obesity and more exposure to faculty role-modeling of discriminatory behavior or negative comments about patients with obesity. Increased implicit bias was associated with training in how to deal with difficult patients.
Burke et al. 2015 [52]	Sexual orientation bias	Heterosexual first-year medical students ($n = 4,441$) were examined for both explicit and implicit biases against lesbian women and gay men among medical students, focusing on two predictors of such bias, contact and empathy.	Yes	Nearly half (45.8%) of the respondents had some explicit bias and 81.5% had expressed implicit bias against gay and lesbian individuals. Both cognitive and emotional empathy predicted positive explicit attitudes, but not implicit attitudes.

Sabin et al. 2015 [53]	Sexual orientation bias	To examine attitudes toward heterosexual people versus lesbian and gay people in 2,338 medical doctors, 5,379 nurses, 8,531 mental health providers, 2,735 other treatment providers, and 214,110 non-providers in the United States.	Yes	Generally, implicit preferences always favored heterosexual people over lesbian and gay people among heterosexual providers. Heterosexual nurses held the strongest implicit preference for heterosexual men over gay men (Cohen d = 1.30; 95% confidence interval = 1.28, 1.32 among female nurses; Cohen d = 1.38; 95% confidence interval = 1.32, 1.44 among male nurses).
Ruiz et al. 2015 [54]	Anti-aging bias	To assess medical students' explicit and implicit anti-aging bias and their intent to practice with older people in the future ($n = 103$).	Yes	Explicit attitudes toward older people were moderately positive. A majority of participants (90%) showed a preference for treatment of younger than older people. Female medical students demonstrated less ageist, anti-aging bias, higher internal motivation, and stronger intentions to practice with older people.
Penner et al. 2016 [55]	Racial implicit bias	18 oncologists, 112 patients. To examine whether oncologists' implicit bias negatively affect communication and patient reactions to recommended treatment.	Yes	Oncologist implicit racial bias was associated with less patient centered and supportive communication, and less patient confidence in treatment.
Blair et al. 2013 [56]	Racial implicit bias	To assess implicit and explicit bias against Latinos and African Americans among primary care providers ($n=210$) and community members ($n=190$).	Yes	Both primary care providers and community members demonstrated substantial implicit bias against both Latinos and African Americans.
van Ryn et al. 2015 [57]	Racial implicit bias	3,547 medical students. To examine the effect of medical education in changing students' racial implicit bias.	Yes	Medical school experience explored in the study was independently associated with a change in students' implicit bias.

Mental Health

Stull et al (2013) found that participants had implicit bias towards people with mental illness [40], while Dabby et al (2015) who measured implicit bias among psychiatrists and residents found no negative implicit bias towards patients with mental illness [41].

Weight

Eight studies measured weight implicit bias and found moderate to strongimplicit bias among participants [42-49]. Of the two studies that employed an intervention, the intervention did not significantly improve implicit weight bias [48,50]. One study conducted by Phelan et al (2015) [51] found evidence that medical school factors may influence weight implicit bias. Such medical school factors include: 1) The type of interaction medical students has had with overweight or obese patients during training, whether positive or negative, interacted with their weight implicit bias; 2) Medical students in training perceived obese patients to be 'difficult' to manage, because more time is spent treating them, even though the circumstances are that obese patients are likely to have many co-morbidities, hence, requiring more treatments; 3) The medical school disparity curriculum is focused on racial implicit bias, and much less on other kinds of biases; and 4) Working with senior medical colleagues and treating them as role models during clinical rotations make negative comments or show negative attitudes towards patients based on their weight among medical students [51].

Sexual Orientation & Aging

Boysen & Vogel (2008) measured race and sexual orientation bias and found implicit bias present towards African Americans, Lesbians and Gay men among the participants [2]. In both of the studies that examined implicit bias associated with sexual orientation, there were stronger implicit preferences for heterosexuals than Lesbians, and Gay, although the strength of association varied [52,53]. Ruiz et al (2015) showed that participants' implicit measure showed negativity towards the elderly, but there was no difference between the groups compared [54].

Bias in Healthcare

In an attempt to predict physicians' racial bias in the recommendation for thrombolysis in patients with acute coronary syndrome, three IATs were used: *Race Preference IAT, Race Cooperativeness IAT,* and *Race Medical Cooperativeness IAT* [10]. All three IATs showed significant racial bias. Physicians diagnosed more Blacks with coronary artery disease than White patients [10]. A similar study which measured implicit bias among physicians and people with terminal degrees found significant implicit bias especially among the female participants [25]. One study investigated the link between clinicians' unconscious attitudes concerning race with the physician-patient communication during clinic visits and patient ratings of care. In particular, they examined two implicit attitudes about race: general racial bias and racial bias regarding stereotyping patient compliance. Studies found that physicians' biases are associated with markers of poor visit communication and poor ratings of care, especially in Black patients [27]. Moskowitz et al (2012) observed that physicians stereotype certain diseases with Blacks. This suggests that diagnoses and treatment of Black patients may be biased [28].

The researchers focused on the following questions relating to the accessibility of healthcare professionals' stereotypes: 1) Are stereotypes made accessible without awareness whenever one person categorizes another as a member of a stereotyped group? 2) Does this unconscious event result in both the factual information associated with a group and the incorrect, undesired elements of the stereotype (which are explicitly rejected) attaining accessibility and heightened potential influence? This study concluded that diagnoses and treatment of African American patients may be biased implicitly. The conclusions from this study are similar to results from Green et al (2007), Blair et al (2013), Cooper et al (2012), and Penner (2016) [10,36,55,56]. However, in studies conducted by Oliver et al (2014), Blair et al (2014), and Rojas et al (2017), there were insufficient evidence to conclude that racial implicit bias of healthcare providers influenced the quality of care or clinical judgment, although implicit bias was present among participants [27,32,34].

Types of Healthcare Personnel Measured

About 64% of the studies measured implicit bias among medical doctors [10,26-32,34-37,41,42,44, 46,55-57], the rest included registered nurses (11%), medical students (20%), genetic counselors (0.2%), research and health professionals (0.8%) [42,43], and pre-kinesiology students (0.2%). Forty-two percent of the studies included specific medical specialties: internal medicine, primary care physicians, and emergency residents [10,27, 36,39,46]. Five studies showed evidence on both health care providers and patients. Types of patients were: patients with hypertension or spinal cord injury, and patients of different races [29,32, 36,37,55]. More than a quarter (26%) of the study included participants who were students, the category of students being medical students, nursing students, psychology students, and masters level dietetic students [30,34,45,48,49,51,52,54].

Types of Measurement Tools Used

Implicit Association Test

Thirty-three of the 35 articles (94%) included in the review used IAT to measure implicit bias among the participants. Two of these was a pen-and-paper IAT [2], others were computer-based or online. The IATs varied by the type of implicit bias being measured. Two of the studies measured racial implicit bias using different methods such as Race preference IAT, Race Cooperativeness IAT, and Race Medical Cooperativeness IAT [10,27].

Case study

Nine (26%) of the studies used case or clinical vignette [26,27,29,30,34,39,47]. One study used case vignette only, without the IAT, the rationale being that the latter is considered a non-blinded measure, and does not effectively measures behavior and clinical evaluation [34]. Another study used subliminal priming to measure implicit bias [28]. Another study had a pre-and post-test experimental design that used educational films as interventions and several measurements including IAT to compare the outcomes of the two groups [48]. Many of the studies in this review also measured explicit biases that are at conscious level and made on purpose, but information about explicit bias was not included in the scope of this review.

Intersectionality

Among the selected articles, 15 studies measured race/ethnicity implicit bias only; two studies focused on sexual orientation, two measured implicit bias of mental illness, ten examined weight (anti-fat) bias, while one article looked at anti-aging implicit bias only. Among the studies which measured more than one type of implicit bias, four assessed implicit bias on race and social class, one study measured race and sexual orientation. The studies that measured more than one domain (e.g., race and sexual orientation) did so separately without investigating how the domains overlapped or interacted with each other.

Discussion

The studies included in this systematic review showed the outcome of six types of implicit bias such as race, weight or fat, social class, sexual orientation, mental illness, and aging. The outcome measurements were physician's clinical decision making, physician's preference for patients by race, doctor-patient communication, physician's treatment recommendation, physician's quality of care, and patient's perception of their care. Of the 35 studies reviewed, the majority ($n = 24$, 68.6%) reported a positive adverse effect of bias on health outcome measurements. Two major biases identified in this study were race bias and weight or fat bias. These two biases, among others, could be considered major mediators of potential health disparities affecting the African American population in the United States.

According to U.S. Census Bureau 2016 estimate [58], the African American population are mostly distributed in District of Columbia (49%), and in some southern states including Mississippi (38%), Louisiana (34%), Georgia (33%), South Carolina (29%), and Alabama (28%). Likewise, some of the southern states including Mississippi (37.3%), Oklahoma (36.5%), Alabama (36.3%), Louisiana (36.2%), and Arkansas (35.0%) are also ranked worst in terms of adult obesity rates in the country [59]. As a result of double whammy of having

majority of Black population and the burden of obesity, these southern states are especially vulnerable to implicit bias in health care.

In our analysis, only 14% (5 of 35) of the studies reported more than one domain of implicit bias affecting a single entity, whereas the studies did not examine the intersectionality of the domains investigated. Although intersectionality has been widely studied in law, psychology and other fields, this topic has received little attention in public health, especially in identifying the contributions of intersecting implicit biases to health disparities [12]. It is known that social identities intersect, and this has the potential to influence individuals' life experiences, social interactions, and health status. Although some interlocking identities are favorable, the precept of intersectionality helps explain how neglect of overlapping social identities may translate into a health disparity. In a study, Bowleg (2012) identified intersectionality theory as an important theoretical framework for public health. The theory has the potential to enhance the precision of identifying marginalization, and developing intervention strategies with relevant outcomes [12,13].

In developing countries, such as Bangladesh, India, Malaysia, Nepal, and Pakistan, the problem of biases in healthcare services is often overlooked. In these societies, preference for a male child is near universal and utilization of health care is preferred for boys over girls. In a cross-sectional study of 3,100 families in a rural community in western India, significantly more boys than girls (88.9% vs. 76.5%, respectively) were given treatment by a registered medical practitioner (odds ratio, 2.51) [60]. Referrals for further treatment were followed by parents significantly more often for their sons than daughters (69.2% vs. 25.0%; OR 6.75). Similar bias toward preferential healthcare for males was observed in a treatment center in Bangladesh [61]. In-depth surveys of intra-family food distribution showed that males were given more calorie- and protein-rich foods compared with females of all ages, even when nutrient requirements due to varying body weight, pregnancy, lactation, and activity levels were considered [61]. Due to scarce of data, there is an urgent need of future research on the issue of intersectionality of biases based on religion, cast, ethnic minority, and economically marginalized population (especially landless impoverished villagers, and ever-expanding urban slum dwellers) and their effects on the healthcare services in developing countries.

To measure the intersectionality of implicit bias or evaluate multiple domains of social identities, an appropriate measurement tool is essential. IAT is the most widely used tool for assessing implicit bias, while this instrument measures a broad range of biases, each independently. The Hierarchical Classes Analysis (HICLAS) and statistical methods such as regression analyses, ANOVA, and qualitative methods have been identified as novel approaches to measuring interactions and the intersectionality of multiple identities [16]. However, the results of these analyses do not seem to describe the intersectionality theory. Issues such as differences in terminology, the amount of value ascribed to each identity in order to have a true mathematical meaning and incorporating intersectionality to population health models are described by Bauer (2014) [18]. Future studies are needed to measure the multiplicative effects of several biases identified in a single health care entity.

The field of public health is inherently intersectional, which further emphasizes the need to employ multiple methods in the study of the intersectionality of implicit biases. The focus of implicit bias research has mostly been in a healthcare setting. Researches have also examined the effects of implicit bias on clinical judgment and its contribution to health disparities. It is high time that public health professionals focus on implicit bias within public health.

Finally, intersectionality presents the field of public health with a framework for addressing health disparities, considering the dearth of public health research that addresses the multiplicity of social identities [1]. Nevertheless, the benefits of studies of intersectionality are not without their own challenges. The challenges of intersectionality research include: a lack of precise methodology to study intersectionality; the difficulty in determining weight of all intersectional identities; whether to focus on intersectional identities or processes [1, 12]; and lack of evidence of appropriate statistical methods in measuring the intersectionality of multiple identity.

Public Health Implications

1. The theory of intersectionality has not exhausted its movement. To further understand the relationships between implicit bias towards individuals based on their identities, and health disparity, the application of the intersectionality may provide new insight.

2. The IAT has been well received in many fields of academia. It has been used by hundreds of studies and programs to measure implicit bias. However, the present IAT seem largely insufficient to measure the intersectionality of these biases. Hence, to fully explore these, a measurement tool that fulfills this need must be developed.

3. Within the last decade, there has been an avalanche of studies programs and interventions aimed at mitigating health disparity. An interesting dimension would be studies that examine the intersectionality of these determinants of health, and how much the multiplicative effects contribute to health disparity and its effects on the health status of the population.

4. The theory of intersectionality is similar to the theory behind the epidemiological and statistical procedure of effect modification using the multiplicative model. An exploration of the similarities between these should be explored, and the results would be instrumental in understanding and designing interventions directed at health disparity in public health.

Conclusions

Intersectionality promises to be useful in understanding the interactions and complexities of social determinants of health, health disparities, and the effects of the multiplicities of various forms of implicit biases. This review shows a research gap of not measuring the multiplicative effects of implicit biases in public health. Intersectionality studies have several challenges, but it continues to evolve and should be explored by public health researchers and professionals.

Authors' contributions

OO collected data, wrote the initial draft, and revised the manuscript; AKM developed the concept, supervised the study, and edited the manuscript; and JKR developed the concept, collected data, and critically reviewed the manuscript.

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