Research article

Examining implicit bias of physicians who care for individuals with spinal cord injury: A pilot study and future directions

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Context: Despite evidence that healthcare providers have implicit biases that can impact clinical interactions and decisions, implicit bias among physicians caring for individuals with spinal cord injury (SCI) has not been examined.
Objective: Conduct a pilot study to examine implicit racial bias of SCI physicians and its association with functioning and wellbeing for individuals with SCI.
Design: Combined data from cross-sectional surveys of individuals with SCI and their SCI physicians.
Setting: Four national SCI Model Systems sites.
Participants: Individuals with SCI ($N = 162$) and their SCI physicians ($N = 14$).
Outcome measures: SCI physicians completed online surveys measuring implicit racial (pro-white/anti-black) bias. Individuals with SCI completed questionnaires assessing mobility, physical independence, occupational functioning, social integration, self-reported health, depression, and life satisfaction. We used multilevel regression analyses to examine the associations of physician bias and outcomes of individuals with SCI.
Results: Physicians had a mean bias score of 0.62 (SD = 0.35), indicating a strong pro-white/anti-black bias. Greater physician bias was associated with disability among individuals with SCI in the domain of social integration (odds ratio = 4.80, 95% confidence interval (CI) = 1.44, 16.04), as well as higher depression ($B = 3.24$, 95% CI = 1.06, 5.41) and lower life satisfaction ($B = -4.54$, 95% CI= −8.79, −0.28).
Conclusion: This pilot study indicates that SCI providers are susceptible to implicit racial bias and provides preliminary evidence that greater implicit racial bias of physicians is associated with poorer psychosocial health outcomes for individuals with SCI. It demonstrates the feasibility of studying implicit bias among SCI providers and provides guidance for future research on physician bias and patient outcomes.

Keywords: Racism, Social discrimination, Spinal cord injuries, Wheelchair

Introduction

There is a growing body of evidence that healthcare providers, like the general population, hold implicit biases.[1–6] Implicit bias refers to unconscious or unintentional preferences that occur outside of our awareness. This is in contrast to explicit bias, which refers to preferences that operate within our conscious awareness.[7–10] Hundreds of studies in the social psychological literature have focused on developing valid measures of implicit bias and documenting its prevalence, magnitude, and impact on behavior.[11,12] Although implicit and explicit bias are sometimes consistent with one another, they are distinct constructs and are often only weakly correlated.[13,14] Moreover, behavior is typically more aligned with implicit attitudes

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than with explicit attitudes.[12] For example, studies of interracial social interactions demonstrate that whites' negative implicit, but not explicit, bias against African Americans is correlated with more negative behavior during interactions with African Americans.[7,15]

Research has begun examining the magnitude of implicit bias among healthcare providers and its potential association with medical decision-making and interactions with patients.[2–6,16–18] Studies have documented strong implicit bias against African Americans relative to whites in several samples of providers, including medical doctors in general,[3] pediatricians,[4] internal medicine and emergency medicine residents,[1] as well as nurse practitioners, general internists, and family physicians who provide primary care for low-income and racial/ethnic minority populations.[5,16] Although some studies have found little to no bias in certain samples of providers,[2,4] most studies have found strong levels of implicit racial bias among healthcare providers, similar in magnitude to levels of bias found in the general population[3] and among community members in the areas served by the providers.[16]

Bias and stereotyping on the part of healthcare providers has been proposed as a factor contributing to widespread healthcare disparities.[19,20] It has been theorized that provider bias can affect patient treatment experiences and health-related outcomes through several mechanisms.[20] For example, provider beliefs about patients, both implicit and explicit, are hypothesized to shape provider decision-making, diagnoses, treatment recommendations, and interpersonal behavior during clinical encounters with patients, all of which can affect patient satisfaction, adherence to recommendations, future healthcare utilization, and, ultimately, health outcomes.[20] Recent studies provide some evidence supporting the hypothesized association between provider implicit bias and patient experiences.[2,5,17,18] For example, higher levels of implicit racial bias against African Americans among providers has been linked to differences in communication patterns observed during clinical encounters[5,18] and poorer patient ratings of care.[5,17] One study also found that provider implicit racial bias was associated with the amount of time physicians talked relative to patients during clinical encounters (i.e. more bias = higher physician/patient talk ratio) and that relative talk time predicted patients' subsequent self-reported adherence to medical advice, although provider bias was not directly associated with adherence.[18] Studies have yet to link provider bias with patient outcomes, other than self-reported adherence, that occur beyond the clinical encounter.

Most of the research on provider implicit racial bias and its potential consequences has focused on pediatric, adult primary care, or emergency medicine providers.[1,2,5,6,16,17,21] The issue of implicit racial bias among physicians who specialize in caring for individuals with spinal cord injury (SCI) has not been examined. Given the well-documented racial and ethnic disparities in health and health-related quality of life among individuals with SCI,[22–25] it is important to examine whether SCI providers have implicit racial bias, and whether such bias is associated with health-related outcomes for individuals with SCI. To begin addressing this gap, we conducted a pilot study to examine implicit racial bias of SCI physicians and its association with functioning and wellbeing of wheelchair users with SCI.

Methods

Participants

Data were collected from individuals with SCI and their physicians at four national Spinal Cord Injury Model Systems (SCIMS) sites funded by the Department of Education, National Institute on Disability and Rehabilitation Research. Each site obtained individual Institutional Review Board approval and was responsible for identifying and recruiting participants with SCI and their physicians into the study. Participants with SCI were drawn from an on-going study of assistive technology used by individuals with SCI. Individuals were eligible for that study if they were age $\geq$16 years, had discernible neurological impairments from SCI that occurred $\geq$1 year ago, used a power or manual wheelchair as their primary means of mobility, were non-ambulatory except for exercise purposes, and were treated at a participating SCIMS facility. Individuals were excluded if they were non-English speakers, were unable to communicate due to neurological impairment, or used a wheelchair due to a disease other than SCI. Participants with SCI were recruited between 2007 and 2011 using the National Spinal Cord Injury Database and other local registries, study flyers posted at SCIMS facilities, and identification by clinical staff.

Physicians who treated participating individuals with SCI were identified through chart reviews. Study sites were provided a list of participants and the date each participant completed the survey that assessed outcomes included in the current analysis. Chart reviews were conducted for each participant to identify rehabilitation SCI physicians with whom they had outpatient visits in the year prior to completing the survey and the dates of those visits. All SCI physicians who met with at least one of the participants were invited to complete an online provider survey. The physician surveys were completed in 2011.

Procedures

Individuals with SCI

Eligible individuals with SCI completed 60-minute, face-to-face, structured interviews conducted by trained research assistants at the enrolling SCIMS site. Participants received financial compensation for completing the interviews. The interviews assessed a broad set of factors regarding use of and experience with wheelchairs and other assistive technology, level of participation in society, experience with and attitudes towards the healthcare system, physical and emotional wellbeing, clinical background, and demographic characteristics. The following variables were included in the current analysis. Participation in society was assessed with a modified version of the Craig Handicap Assessment and Reporting Technique Short Form (CHART-SF).[26] Four subscales were used to assess mobility (ability to move about effectively), occupation (ability to participate in various activities such as employment or school), physical independence (need for assistance in daily activities), and social integration (ability to participate in and maintain customary social relationships). The maximum score for each subscale was 100. As is typical with CHART-SF scores,[27] the data were heavily skewed. Therefore, scores were dichotomized to indicate disability (score <100) or non-disability (score $= 100$) in each domain, as recommended in the CHART manual.[28]

General health status was assessed using a single item from the SF-36.[29] Due to the non-normal distribution of responses, a dichotomized version of this variable (fair/poor vs. good/very good/excellent) was used in the analyses. Emotional wellbeing was assessed using the Patient Health Questionnaire-9 (PHQ-9)[30] to measure depression and the five-item Satisfaction with Life Scale.[31] Responses were summed across items within each scale for analyses, with possible scores ranging from 0 to 27 for depression and 5 to 35 for life satisfaction. In addition to these outcomes, self-reported race and ethnicity, sex, age, level of SCI injury (paraplegia vs. tetraplegia), and years since injury were assessed for use as covariates. The number of times the patients were seen by their SCI physician in the past year and the number of days between their most recent visit and when they completed the outcomes survey were determined from chart reviews for use as covariates.

SCI physicians

Physicians were invited to complete a 15-minute online survey. The first part of the survey assessed demographics and clinical background, including sex, age, race and ethnicity, clinical specialty/primary duty, whether they completed certification in spinal cord medicine, the number of patients they see who have SCI, and years they have worked with patients with SCI.

The second part of the survey consisted of the Implicit Association Test (IAT), a reliable and validated measure of implicit racial bias.[10,12,32] The IAT is a reaction time test consisting of a series of stages in which stimuli appear on the screen and must be categorized as quickly as possible by pressing a key by the right or left hand. Each stage includes stimuli from two contrasting social categories (e.g. African American and white faces), positively and negatively connoted words, or a mix of both types of stimuli. The assumption underlying the IAT is that better performance (i.e. faster categorization of stimuli with fewer errors) occurs when the respondent perceives as congruent the two sets of stimuli being categorized using the same hand. For example, better performance during trials where negative words and African American faces are both categorized using the same hand, compared with trials when positive words and African American faces are categorized using the same hand, indicates more pro-white/anti-black implicit racial bias.

Implicit bias scores were calculated using a scoring algorithm that takes into account response latency, latency variability, and errors across trials when African American faces are categorized with the same hands as positive or negative words.[33] The rigorously developed scoring algorithm yields an IAT D score that ranges from -2 to $+2$, with 0 indicating no implicit preference for African Americans or whites.[14,33] Positive scores indicate implicit preference for whites and negative scores indicate implicit preference for African Americans. The magnitude of implicit bias is typically interpreted by calculating Cohen's d,[34] a standardized measure of effect size used in the social sciences. Guidelines for interpreting Cohen's d suggest that values of 0.20, 0.50, and 0.80 indicate small, medium, and large effect sizes, respectively.[34]

Data reduction and analyses

For analyses, participants with SCI were matched with the SCI physician whom they saw most frequently during the study timeframe. Participants for whom a primary SCI physician could not be identified or whose designated physician did not complete the online survey were excluded. Given that the race IAT assessed implicit pro-white/anti-black bias, participants with SCI who reported a race other than African American or white were excluded from analyses. Due to the multilevel nature of the data, and to allow for clustering of participants who were seen by the same

physician, we further restricted the data to participants with SCI whose physicians matched up with at least two participants. A minimum of two participants per physician allowed us to assess within-cluster (physician) variability.

We used descriptive statistics to summarize characteristics of participants with SCI and their physicians. We used multilevel logistic and linear regression to examine the association of physician IAT scores with outcomes of participants with SCI. Physician IAT score served as the independent variable of interest and was treated as a continuous variable. The following characteristics of participants with SCI were included in the models as covariates: race, sex, level of SCI, the number of years since injury, and the number of times they saw their SCI physician in the past year. Age and the number of days between their last visit and completion of the outcomes survey were omitted due to multicollinearity with years since injury and the number of visits with their SCI provider in the past year, respectively. Physician characteristics could not be included in the models due to sample size limitations. Analyses were performed using SAS version 9.2 (SAS Institute Inc., Cary, NC, USA).

Results

Chart reviews were completed for 256 participants with SCI. A total of 37 SCI physicians who had medical visits with these participants were invited to complete the online physician survey. Eighteen physicians (48.6%) completed the survey, with 172 of the participants with SCI matching up with one of those physicians. Participants with SCI who reported a race other than African American or white ($N = 9$) and/or whose physicians matched up with less than 2 participants ($N = 4$) were excluded, resulting in a final sample of 162 participants with SCI and 14 physicians. Participants with SCI who were excluded from the analyses did not differ from those who were included on race, age, years since injury, or level of SCI. Participants with SCI who were excluded from the analysis were more likely to be female ($P = 0.02$), had fewer visits with their SCI physician ($P = 0.002$), and had more days between their last visit and when they completed the survey ($P = 0.02$). Physicians who were excluded from the analyses did not differ significantly from those who were included on any assessed characteristics or IAT scores.

Sample characteristics

The sample of participants with SCI ($N = 162$) was 77% male, 60% white, and had a mean age of 40 years (Table 1). The sample was evenly split between those with paraplegia (49%) and tetraplegia (51%), with a mean of 9 years since their injury occurred. On average, participants had seen their SCI provider three times in the previous 12 months and their last appointment had been 55 days prior to when they completed the survey. The physician sample ($N = 14$) was also predominantly male (93%), white (57%), and had a mean age of 48 years. The majority of physicians had subspecialty certification in SCI medicine (64%), clinically managed or co-managed at least 50 patients with SCI (64%), and had at least 15 years of experience treating patients with SCI (57%; Table 1).

Table 1 Characteristics of participants with SCI and their physicians

	M (±SD) or *N* (%)
Participants with SCI ($N = 162$)	
Age, mean (±SD)	40 (±14)
Male, *N* (%)	124 (77%)
Race, *N* (%)	
White	97 (60%)
African American	65 (40%)
Years since injury, mean (SD)	9 (±10)
Level of SCI, *N* (%)	
Paraplegia	79 (49%)
Tetraplegia	81 (51%)
Number of visits with SCI provider in past year, mean (SD)	3 (±2)
Number of days since last visit, mean (SD)	55 (±86)
Physicians ($N = 14$)	
Age, mean (±SD)	48 (±10)
Male, *N* (%)	13 (93%)
Race, *N* (%)	
White	8 (57%)
Asian	4 (29%)
Black or African American	1 (7%)
Native Hawaiian or other Pacific islander	1 (7%)
Certified in SCI medicine, *N* (%)	9 (64%)
Manage ≥50 patients with SCI, *N* (%)	9 (64%)
Treated patients with SCI for ≥15 years, *N* (%)	8 (57%)

Physician implicit racial bias and outcomes of participants with SCI

Physician IAT scores ranged from 0.10 to 1.13, with a mean of 0.62 (SD = 0.35); this indicates that all physicians implicitly associated positive concepts with white faces and negative concepts with African American faces. This corresponds to a large effect size in the social sciences (Cohen's $d = 2.00$)[34] and indicates a strong pro-white/anti-black implicit race bias among physicians. IAT scores were not significantly associated with any provider demographic or clinical characteristics (data not shown).

As shown in Table 2, most participants with SCI were categorized as disabled in the domains of mobility (76%), occupation (66%), and physical independence (79%), but not social integration (40%). About a

Table 2 Functioning and wellbeing outcomes of participants with SCI

Outcomes	M (±SD) or *N* (%)
Disability on CHART domains*	
Mobility, *N* (%)	122 (76%)**
Occupation, *N* (%)	101 (66%)
Physical independence, *N* (%)	106 (79%)
Social integration, *N* (%)	64 (40%)
Poor or fair health status, *N* (%)	36 (23%)
Depression (PHQ-9), mean (±SD)	4.8 (+4.5)
Satisfaction with life, mean (±SD)	19.6 (±7.6)

*CHART outcomes were dichotomized to indicate disability (score <100) or non-disability (score = 100). The table contains the number (%) of participants with disability in each CHART domain.
**The number of cases with available data varied across outcomes: mobility, $N = 160$; occupation, $N = 154$; physical independence, $N = 135$; social integration, $N = 159$; health status, $N = 158$; depression, $N = 161$; satisfaction with life, $N = 160$.

quarter of the sample (23%) reported poor or fair health status, and the mean depression score was 4.8 out of 27, which falls in the *mild depression* category of the PHQ-9.[35] On average, participants with SCI had satisfaction with life scores near the middle of the range (mean = 19.6 out of 35).

In multilevel regression analyses adjusted for characteristics of participants with SCI, implicit bias of physicians was associated with several outcomes of participants with SCI (Tables 3 and 4). Specifically, physician implicit racial bias was associated with greater likelihood of disability in social integration (odds ratio (OR) = 4.80, 95% confidence interval (CI) = 1.44, 16.04) (Table 3). Physician implicit bias was also associated with higher levels of depression (B=3.24, 95% CI = 1.06, 5.41) and lower life satisfaction ($B = -4.54$, 95% CI = −8.79, −0.28) among patients with SCI (Table 4).

Table 3 Adjusted associations of physician implicit racial bias and dichotomized outcomes of participants with SCI[a]

	Disability on CHART domains									
	Mobility (*N* = 158)		Occupation (*N* = 152)		Physical independence (*N* = 136)		Social integration (*N* = 157)		Current health status (*N* = 156)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Physician implicit racial bias	0.38	(0. 11, 1.35)	0.61	(0.20, 1.89)	2.91	(0.57, 14.80)	**4.80**	**(1.44, 16.04)***	1.40	(0.38, 5.16)
Participants with SCI										
Female	1.68	(0.64, 4.46)	**0.50**	**(0.23, 1.12)†**	0.58	(0.19, 1.81)	1.22	(0.56, 2.69)	1.24	(0.49, 3.09)
Black race	1.65	(0.72, 3.38)	**1.99**	**(0.93, 4.25)†**	2.40	(0.84, 6.82)	**1.88**	**(0.95, 3.75)†**	**2.74**	**(1.23, 6.11)***
Years since injury	0.98	(0.94, 1.02)	**0.97**	**(0.93, 1.00)***	**0.95**	**(0.91, 1.00)†**	1.00	(0.97, 1.03)	**0.96**	**(0.91, 1.00)†**
Level of SCI[b]	0.65	(0.29, 1.43)	0.58	(0.28, 1.18)	**0.12**	**(0.04, 0.38)***	0.68	(0.34, 1.34)	0.67	(0.30, 1.51)
Number of visits with SCI provider	**1.25**	**(1.00, 1.57)***	1.05	(0.90, 1.22)	1.05	(0.88, 1.27)	1.06	(0.92, 1.22)	1.10	(0.94, 1.29)

For CHART domains, 0 = disabled and 1 = not disabled. For current health status, 0 = poor/fair and 1 = good or better. The probability of outcome = 0 (disabled; poor/fair health status) was modeled.
*$P < 0.05$; †$P < 0.10$.
[a]Models clustered by physician and adjusted for the following characteristics of participants with SCI: race, sex, years since SCI, level of SCI, and the number of visits with SCI provider in past year.
[b]Tetraplegia served as the reference category.

Table 4 Adjusted associations of physician implicit racial bias and continuous outcomes of participants with SCI[a]

	Depression (*N* = 147)		Satisfaction with life (*N* = 146)	
	B	(95% CI)	*B*	(95% CI)
Physician implicit racial bias	**3.24**	**(1.06, 5.41)***	**−4.54**	**(−8.79, −0.28)***
Participants with SCI				
Female	−0.38	(−1.97, 1.21)	0.15	(−2.62, 2.92)
Black race	−0.14	(−1.53, 1.25)	0.33	(−2.07, 2.74)
Years since injury	−0.02	(−0.09, 0.05)	**0.13**	**(0.01, 0.25)***
Level of SCI[b]	0.50	(−0.87, 1.86)	0.68	(−1.67, 3.04)
Number of visits with SCI provider	**0.36**	**(0.07, 0.65)***	−0.23	(−0.73, 0.27)

*$P < 0.05$.
[a]Models clustered by physician and adjusted for the following characteristics of participants with SCI: race, sex, years since SCI, level of SCI, and the number of visits with SCI provider in past year.
[b]Tetraplegia served as the reference category.

Discussion

In this pilot study, we examined the implicit racial bias of SCI physicians and its association with self-reported functioning and wellbeing of individuals with SCI for whom they provided healthcare in the past year. We found evidence of strong pro-white/anti-black implicit race bias among SCI physicians in our sample. Furthermore, we found that implicit racial bias of SCI physicians was associated with worse reported social integration, depression, and life satisfaction in a sample of individuals with SCI who received healthcare from these physicians. Physician implicit bias, however, was not associated with reported disability in the domains of mobility, occupation, or physical independence, or overall self-reported health status of participants with SCI, suggesting that certain patient outcomes may be more sensitive than others to the bias of healthcare providers.

This is the first study to examine implicit racial bias among SCI physicians. The magnitude of implicit bias observed in this sample (Cohen's $d = 2.00$) was stronger than what has been observed in other samples of healthcare providers and the general population.[1,3,4] Varying levels of implicit pro-white/anti-black racial bias have been documented among primary care providers serving predominantly minority patient populations, with IAT effect sizes ranging from 0 (no bias)[2] to medium (Cohen's $d = 0.59$)[5] to large (Cohen's $d = 0.79$)[16] across studies. Other studies have documented large effect sizes for racial bias among internal medicine and emergency medicine residents (Cohen's $d = 0.90$)[1] and a national convenience sample of those with medical degrees (Cohen's $d = 0.89$).[3] One study found a medium level of implicit bias in a sample of pediatricians (Cohen's $d = 0.41$),[4] suggesting that a provider's medical specialty may be associated with one's implicit bias.

It is unclear why SCI physicians in the current study demonstrated stronger implicit racial bias than what has been found in other samples of healthcare providers. It could be due to factors such as the region in which these providers practice or their experience interacting with minority patients. Given the small sample size of physicians in the current study, however, one must proceed with caution in drawing conclusions about whether SCI physicians, in general, display more or less implicit racial bias than other populations. Our findings should be taken as a demonstration that SCI providers are susceptible to implicit biases rather than an assessment of the magnitude of implicit bias that exists among SCI providers, as a group. Large-scale studies are needed to determine how factors such as medical specialty, region, clinical training or experience, make-up of patient panels, or other factors influence levels of implicit bias of healthcare providers.

This study is among the first to link physician implicit racial bias to patient outcomes assessed beyond the clinical encounter. Prior studies have found mixed evidence for the impact of provider bias on clinical decision-making using clinical vignettes.[1,6,36] Green *et al.*[1] demonstrated that implicit pro-white/anti-black bias among medical residents was associated with less likelihood of using thrombolysis to treat African American patients suspected of cardiac artery disease. In contrast, implicit racial bias among pediatricians and medical students was not consistently related to racial differences in treatment decisions regarding patients described in clinical vignettes.[6,36] Two studies with actual patients and their physicians found that physician bias was associated with less positive patient–provider interactions during clinical encounters and lower patient satisfaction with care received.[2,5] One study found that implicit racial bias of physicians was associated with more physician verbal dominance and less shared decision-making during visits with both white and African American patients.[5] Physicians with higher levels of implicit racial bias were also rated less positively by their African American patients.[5,17]

Our findings extend existing literature by showing that implicit bias among SCI physicians is associated with some outcomes in individuals with SCI that were measured well-beyond a single clinical encounter. By showing that physician bias was associated with greater social integration disability, greater depression, and lower life satisfaction among patients with SCI, our results provide preliminary evidence that implicit bias of healthcare providers can be associated with important downstream patient outcomes. Although we were unable to determine the mechanisms by which physician bias may impact patient outcomes in the current study, it is possible that physician bias influences downstream outcomes by affecting patient provider communication or rapport, clinical recommendations, or patient adherence to recommendations. It is well-documented that patient perceptions of discrimination while seeking healthcare are associated with less positive health behaviors (e.g. not getting needed care, poorer adherence) and poorer health outcomes.[37,38–43] However, studies examining the association of patient-reported discrimination with patient health behaviors and outcomes have not also assessed physician implicit bias. Thus, additional work is needed to determine whether physician bias leads to poorer patient health outcomes by shaping patient

health behaviors. Another possible mechanism by which physician bias affects patient outcomes is by negatively affecting patients' emotional health, as research suggests that discrimination may lead to poor physical health by harming one's psychological wellbeing and overall outlook on life. For example, in a sample of African American, Asian American, and Hispanic/Latino patients with hypertension, the link between perceived racial discrimination and poorer overall health was fully mediated by depression, anxiety, and cynical hostility.[44] The pattern of results in the current study also suggests a link between discrimination and psychological health, as greater physician implicit racial bias was associated with poorer socioemotional outcomes (i.e. social integration, depression, life satisfaction), but not physical outcomes (i.e. mobility, physical independence).

Study limitations

In this pilot study, we were limited to recruiting SCI physicians who had provided healthcare for individuals with SCI, who were enrolled in an ongoing study being conducted across four SCIMS sites. Our analytic sample was therefore limited to physicians who completed the online survey for the current study and could be matched to at least two patients in the parent study sample, which was necessary for clustering purposes. This procedure resulted in a small number of physicians and individuals with SCI in the analytic sample, which limited both the statistical power of the analyses and the generalizability of the findings. The sample size also prohibited including physician characteristics in the models, adjusting for more patient characteristics, or examining interactions between physician bias and individual characteristics such as race. Due to the latter-most limitation, it was not possible to examine whether physician implicit racial bias had a differential impact on outcomes for minorities or contributed to racial disparities in outcomes. Given the cross-sectional study design, one cannot determine causality and the observed associations could be due to something other than a direct impact of physician bias on patient outcomes. For example, individuals with SCI who have better clinical profiles could choose to leave physicians who have higher levels of implicit bias if those with worse outcomes face more barriers to switching physicians. Finally, this study focused only on the association between physician bias and patient outcomes, and did not consider whether patients have implicit bias that may also affect outcomes. The impact of patient implicit bias is just starting to be explored[45,46] and is not yet well understood. Existing evidence suggests that implicit bias among patients may actually act as a buffer against poor health outcomes when patients are faced with explicit acts of discrimination.[45]

Future directions

This pilot study provides several directions for future research. Despite the study's limitations, our preliminary findings underscore the need for more research on the existence of implicit bias among physicians caring for individuals with SCI and the impact of such bias on patient wellbeing. It also highlights multiple factors to consider when designing future studies to explore the relationship between implicit bias of physicians, patient outcomes, and disparities in patient outcomes. To ensure adequate statistical power to test the association between physician characteristics and patient outcomes, it is important to recruit a larger number of physicians than what we were able to recruit in this retrospective study. It is also necessary to link a larger number of patients to each physician in the sample, with each physician being linked to both white and African American patients so that the interactions between physician bias and patient race can be tested. This could be accomplished by enrolling physicians first, then prospectively recruiting a minimum number of patients after they have received treatment from enrolled physicians.

Future studies should also collect and control for additional patient and physician characteristics that may affect physician–patient interactions and patient outcomes. Due to sample size constraints in this pilot study, we were unable to control for potentially important patient characteristics, such as insurance or education. We were also unable to explore whether physician demographic characteristics or clinical experience were associated with implicit bias or patient outcomes.

In the current study, we focused on outcomes pertaining to functioning and wellbeing of patients that were collected as part of the parent study. Future studies should be expanded to explore additional processes of care and outcomes, such as patient satisfaction with care and adherence to treatment recommendations. Outcomes specific to individuals with SCI should also be examined, such as prescribed method of bladder management, occurrence of pressure sores, urinary tract infections, and overall pain management. Type of wheelchair prescribed should also be examined, given that minorities are prescribed lower-quality wheelchairs more often than whites.[22] It is important to determine whether implicit racial bias contributes to differential wheelchair prescribing and other clinical decisions that

could, in turn, lead to poorer functioning, wellbeing, and overall health of patients. Future research examining the association of implicit bias with a more comprehensive set of process and outcome measures will ultimately inform the development of appropriate interventions to address implicit bias in the care of individuals with SCI.

Conclusions

In conclusion, this pilot study offers preliminary evidence that physician implicit bias could have real consequences for outcomes in individuals with SCI. Additional research is needed to replicate the current findings in a larger sample of physicians and individuals with SCI and to further our understanding of the mechanisms by which implicit bias among physicians are associated with health-related outcomes. Although work of this nature is difficult on multiple levels, our pilot study demonstrates the feasibility of collecting data on implicit bias and linking it to outcomes. We are in the process of conducting a larger, prospective study that is informed by this pilot work. Developing a better understanding of the impact of physician bias on healthcare delivery and outcomes is essential to the eventual development and implementation of effective strategies to prevent physician bias from negatively affecting clinical outcomes or contributing to health disparities.

Disclaimer statements

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Conflicts of interest None.

Ethics approval This work was approved by the Institutional Review Board at the University of Pittsburgh.

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