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Children's racial bias in perceptions of others' pain

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Previous research indicates that American adults, both Black and White, assume *a priori* that Black people feel less pain than do White people (Trawalter, Hoffman, & Waytz, 2012, *PLoS One*, **7**[11], 1–8). The present work investigates when in development this bias emerges. Five-, 7-, and 10-year-olds first rated the amount of pain they themselves would feel in 10 situations such as biting their tongue or hitting their head. They then rated the amount of pain they believed two other children – a Black child and a White child, matched to the child's gender – would feel in response to the same events. We found that by age 7, children show a weak racial bias and that by age 10, they show a strong and reliable racial bias. Consistent with research on adults, this bias was not moderated by race-related attitudes or interracial contact. This finding is important because knowing the age of emergence can inform the timing of interventions to prevent this bias.

There are widespread disparities in health and health care, both within and between countries. Social groups holding privileged status (e.g., those of high socioeconomic status; Caucasians) have greater access to health care and, as such, are healthier and live longer than their less privileged counterparts (e.g., those of low socioeconomic status; ethnic minorities; Centers for Disease Control & Prevention, 2011; Hertzman, 1999; Marmot & Wilkinson, 2005). For example, in a review of health inequalities across 22 European countries, including the United Kingdom, mortality rates were consistently higher for those of lower socioeconomic backgrounds relative to those of higher socioeconomic backgrounds (Mackenbach *et al.*, 2008). In the United States, health disparities are particularly striking between Blacks and Whites (Smedley, Stith, & Nelson, 2003; U.S. Department of Health & Human Services, 2007). Treatment differences are seen in many domains, including pain management: Black patients are systematically undertreated for pain relative to White patients (Bonham, 2001; Drwecki, Moore, Ward, & Prkachin, 2011; Green *et al.*, 2003). Previous research has found that factors such as assumptions about Black patients' inability to pay for health care, potential abuse of medications, and racial prejudice all contribute to racial bias in pain management (Green *et al.*, 2003; Shavers, Bakos, & Sheppard, 2010).

Another possible factor in this discrepant treatment is that physicians underestimate Black patients' pain (Staton *et al.*, 2007). Indeed, studies have shown that people – including medical personnel – assume a priori that Blacks feel less pain than do Whites (Trawalter, Hoffman, & Waytz, 2012). Participants saw a photograph of either a Black or a

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White target person and rated how much pain this person would feel across various situations, such as slamming their hand in a car door and hitting their head. Across numerous samples including both White and Black adults, participants rated the Black target's pain as significantly less than the White target's pain. This bias was not associated with explicit or implicit racial attitudes, suggesting that racial prejudice and intergroup dynamics are not the (sole) source of this bias.

Here, we examine the developmental trajectory of this bias in children. The primary aim was to determine when in development, children begin to form race-based expectations about others' pain. Determining when racial pain bias emerges is a crucial first step in determining the appropriate timing of interventions to address the bias during childhood. Below we outline race-related milestones in development. Although research has found that these constructs are not related to adults' racial bias in pain perception, they could be relevant to the emergence of the bias during childhood.

Race-Related Cognitions and Attitudes in Development

Racial attitudes and biases emerge and develop throughout the early childhood years. Infants show a preference for own-race faces and, as adults, are more accurate at recognizing own-race compared with other-race faces (Kelly *et al.*, 2005, 2007). Young children spontaneously sort people by race by age 3 (Nesdale, 2001). By age 5, White children show an own-race social preference: they would prefer to be friends with other White children rather than with Black children (Kinzler, Shutts, DeJesus, & Spelke, 2009; Kinzler & Spelke, 2011) Around this same age, children also show a pro-White bias in attributing more positive traits to Whites and more negative traits to Blacks (Doyle & Aboud, 1995; Williams, Best, Boswell, Mattson, & Graves, 1975). These kinds of explicit biases decline in later childhood (Raabe & Beelmann, 2011). Older children, however, begin to exhibit more sophisticated race-related attitudes: by age 7, children know about and apply both positive and negative racial stereotypes to Blacks, for example the stereotype that Blacks are good at basketball (Bigler, Averhart, & Liben, 2003; Pauker, Ambady, & Apfelbaum, 2010).

Research has found that general racial attitudes are not related to adults' racial bias in pain perception, so we would not expect these developments to be related to the bias in children. However, although we consider it unlikely, it is possible that these constructs could be relevant to the emergence of the bias during childhood and become disassociated later in life. To confirm our expectation that, as in adulthood, racial attitudes do not explain the bias in childhood and rule out the possibility that the development of the pain perception bias in childhood can be explained by general racial attitudes, we included two measures of racial attitudes in the current study.

To explore the developmental trajectory of the racial pain bias, we asked 5-, 7-, and 10-year-old children to rate the pain of both a White and a Black target child using an adapted version of the Trawalter *et al.* (2012) paradigm; children also rated their own pain. We administered measures of social preference and evaluative stereotyping with the expectation that, as in the research with adults, they would not be related to the bias. Social preference was measured using a procedure from Kinzler *et al.* (2009), in which 5-year-olds could choose either same-race and other-race children to be their friends. An evaluative stereotype measure was adapted from Augoustinos and Rosewarne (2001) to measure children's tendency to evaluate Whites more highly on positive traits than

Blacks. Finally, we asked parents to respond to questions about their education level and their and their child's interactions with people of other races. These variables were included to assess whether children's interactions with other-race individuals or their socioeconomic status would influence the extent to which they show the racial bias in pain perception.

Method

Participants

Participants were 159 children in three age groups: 52 five-year-olds (*M* age = 5;3, *SD* = 2.00 months, range = 5;0 to 5;7, 28 girls), 54 seven-year-olds (*M* age = 7;5, *SD* = 3.46 months, range = 7;0 to 8;0; 27 girls), and 53 ten-year-olds (*M* age = 10;5, *SD* = 3.68 months, range = 10;0 to 11;0, 25 girls).[1] Thirteen additional children participated and were excluded due to failure to complete the procedure (two children), experimenter error (four children), technical issues (three children), and failure to demonstrate understanding of pain scale (four children).[2] Children were drawn from a database of families willing to have their children participate in research. Children were primarily White and middle to upper-middle class, reflecting the composition of local families who volunteer for research. Eight parents (5%) did not provide their child's ethnicity; of the 151 who did, 90% identified their child as Caucasian, representing a slightly higher White representation than that of the surrounding community (83%). Of the remaining children, four were identified as Asian, one as Hispanic, and one as African-American; nine parents chose the 'other' response option to identify their child's ethnicity or chose more than one response option. Parents' education level was high: 19.50% of fathers and 13.84% of mothers had less than a college degree, whereas 25.79% of fathers and 35.85% of mothers had a 4-year-college degree, and 54.72% of fathers and 50.31% of mothers had a post-college degree. Neither ethnicity nor maternal or paternal education differed significantly between age groups (p = .30, p = .31, and p = .96, respectively, Fisher's exact tests).

Design

All children rated their own pain and then the pain of two targets, a Black target child and a White target child, in response to 12 events. Presentation order (Black or White target first) was counterbalanced across children.

Procedure and materials

Children completed the pain rating task, a social preference measure, and an evaluative stereotype measure, in that order.

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[1] *The sample size was determined using the effect size from the research with adults (*d *= .79 for between-subjects comparison), indicating that we would need 26 children per target race to have 80% power to see a between-subjects effect. We used race as a within-subjects factor to further increase our power, but planned to also examine the data as a between-subjects comparison using only the first target for each child.*

[2] *Thirty-three children whose data are not included here were run using an alternative version of the evaluative stereotype measure before it was changed due to parental concerns. Four additional children (two 9-year-olds and two 11-year-olds) were run in the process of determining appropriate age groups to test. We report here all other measures and conditions that were conducted in relation to the current study.*

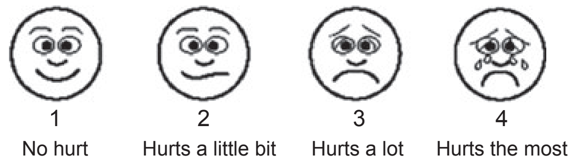

Figure 1. Adapted Wong–Baker FACES Pain Rating Scale.

Pain rating task

Children were trained to use an adapted version of the Wong–Baker FACES Pain Rating Scale (Wong & Baker, 1988). Because pilot testing indicated that the youngest children had trouble using the full 6-point scale, a 4-point scale, shown in Figure 1, was adapted for use across all age groups. Stimuli were gender-matched, because we expected there might be expectations about the experience and expression of pain that differ for one's own versus the other gender.

Children were trained to use the pain rating scale through a short story about a child experiencing events resulting in different levels of pain. Children responded to four comprehension questions relating to their understanding of each point on the scale (i.e., 'Can you point to the face that shows someone hurting a lot?'). Children who made a mistake were corrected.

After training, children first rated the amount of pain they themselves would feel in response to the 12 events. Children were allowed to respond either verbally using a phrase from the pain scale or by pointing to a face on the pain scale.

Target stimuli were 12 colour photographs of faces with neutral facial expressions (LoBue & Thrasher, in preparation). There were three different faces for each gender and race combination (Black/White, Girl/Boy). Each child saw only one photograph of a Black child and one photograph of a White child (both of their own gender) throughout the procedure, but we used three photographs of each gender and race across the sample to guard against the possibility that any effects seen were specific to a particular photograph. An approximated Latin Squares design was used to assign pairs of faces for each participant. To introduce the target pain rating items, children were told that they would now be asked about all those same things that might happen to another boy/girl and should indicate how much those things might hurt him/her. They were then shown a picture of a Black or White target child, and the items were repeated in the same order, but referring to the target child. Finally, similar instructions were repeated to introduce the ratings for the second target child. The experimenter was unaware of which target was being shown to the child during the ratings.[3] The painful event items were adapted from the corresponding research with adults (Trawalter *et al.*, 2012) and included 10 test items such as 'You burn your tongue on some really hot food' and 'You bang your toe on a chair'. Two control items were inserted ('You hug a teddy bear' and 'You play with a puzzle') during each item set (self, Black target and White target) to ensure that children were paying attention and responding to the items in a meaningful way; the control items were not included in analyses. The Appendix lists all 12 items.

[3] *Prior to each testing session, a research assistant chose the order according to counterbalancing needs and set out the pictures for the experimenter. During the testing session, the experimenter held the picture towards the child while keeping the picture facing away from herself, thereby preventing her from seeing which race child was being presented.*

To score this task, the response chosen on the pain rating scale for each item was given a score from 0 to 3 (Figure 1). Scores for the 10 items were summed for self, White target child, and Black target child, resulting in three scores for each child that ranged from 0 to 30.

Social preference measure

Children completed eight trials of a racial social preference task. The stimuli were the 16 children's faces used by Kinzler *et al.* (2009), making up eight same-gender pairs. Within each trial, one child was Black and the other child was White. The task was introduced by saying, 'Now we're going to look at pictures of some other children and I want you to tell me which one you would want to be friends with'. Children were scored 1 for each trial on which they chose the White child and 0 for each trial on which they chose the Black child, for a possible range of 0 to 8.

Evaluative stereotype measure

In this task, children were told: 'I'm going to ask you some questions about what you think other people would say about these kids. I want you to think of *all* the people you know and tell me what *they* think, not what you think'. Children were shown drawings of individual children and asked how most people would rate that child on a variety of positive traits. For example, 'Would most people say this girl/boy is very smart, sort of smart, or not smart at all?' The other adjectives tested were pretty/handsome, good, clean, and kind. We used only positive traits because parents of children who participated in piloting were uncomfortable with their children being asked to attribute negative traits to individuals or racial groups.

There were 10 trials: 5 showing Black children and 5 showing White children. The Black and White children in the drawings corresponding to a particular trait (i.e., smart) were identical except for skin colour. The stereotype items were asked in one quasi-random order across participants, with the caveat that the same trait never appeared in two consecutive questions. For each trial, children received a score of 2 for choosing 'very', a score of 1 for choosing 'sort of', or a score of 0 for choosing 'not at all'. Sum scores were created for Black and White, each ranging from 0 to 10, and a difference score was created by subtracting the Black sum from the White sum, resulting in possible scores from -10 to 10, with higher numbers indicating stronger pro-White stereotype awareness.

Parent questionnaire

Parents completed a questionnaire about their and their child's interaction with people of different races (i.e., 'How many friends does your child have of another race?'), as well as parents' highest levels of education.

Results

First preliminary analyses will be discussed, including pain scale comprehension and control items. Then the primary analyses will be presented, describing the racial differences in pain ratings. Finally, we will discuss supplementary analyses relating to the other experimental and parent-report measures.

Preliminary analyses

Of the participants, 82% correctly responded to all four pain scale comprehension questions (i.e., 'Can you point to the face that shows someone hurting a lot?'). All but three incorrect answers were in response to the second comprehension question, asking them to point to the face showing someone hurting a lot (face no. 3 on the scale). The children who were incorrect on this question tended to point to the face that was described as showing 'someone hurting as much as you can imagine' (face no. 4).

Control items (i.e., 'You hug a teddy bear') were included to ensure that children maintained attention during the pain scale ratings. Only 7 of the 159 children answered one or more of the 6 items (2×3 targets) incorrectly. Of these, 4 children answered one item incorrectly and 3 children answered 2 items incorrectly.

The analyses include data from all participants, but results were similar when excluding the children who answered comprehension questions incorrectly or the children who answered control questions incorrectly.

Primary analyses

Table 1 shows the means and standard deviations for pain ratings for each target in each age group. Figure 2 shows the means graphically. Children's ratings for self, Black target, and White target were highly related, presumably due to individual differences in scale use and overall attitudes towards painful events (Self/White: $r = .45$, $p < .001$; Self/Black: $r = .56, p < .001$; Black/White: $r = .7, p < .001$). Thus, we controlled for self-pain ratings in the primary analyses.

Table 1. Mean (and standard deviation) of pain ratings by target race and child age group

		Target race	
Age group	Self	White	Black
5-year-olds	19.17 (3.02)	20.46 (3.48)	20.27 (3.67)
7-year-olds	18.78 (3.50)	20.06 (3.30)	19.41 (3.37)
10-year-olds	17.40 (2.78)	20.42 (3.78)	19.15 (3.36)

Note. Sum scores were computed based on a 0–3 scale for 10 items, so the possible range was 0–30.

To examine racial bias in pain ratings, a mixed-effects regression model was conducted predicting pain rating from self-pain rating, target race, age group, and the interaction between target race and age group, as well as the random effect of subject to account for the repeated measures design. Age group was dummy-coded with age 10 as the reference group to test the effect of age group as compared to 10-year-olds. Our primary interest was in the interaction between target race and age group, which would show whether age groups differed in whether or to what extent they showed a racial bias in pain ratings. As shown in Table 2, there was a significant interaction between target race and age group (age 5), $B = 1.07, p = .042$, showing that the effect of race in 5-year-olds differed from the effect of race in 10-year-olds. In an analogous analysis using 7-year-olds as the reference group, there was not a significant interaction between target race and age group, showing that the effect of race in 7-year-olds did not differ significantly from the effect of race in either 5- or 10-year-olds ($B = 0.46$, $p = .38$ and $B = -0.62$, $p = .24$, respectively).

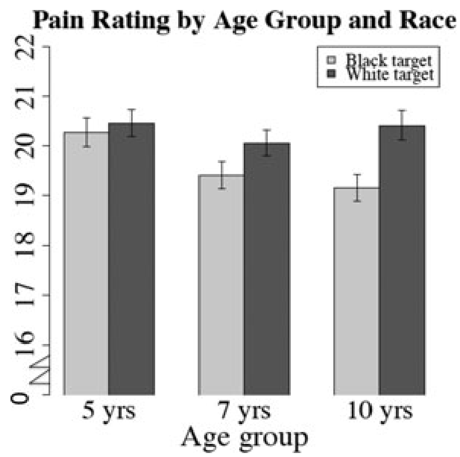

Figure 2. Pain Ratings by Target Race and Child Age Group.
Note. Error bars represent standard errors. The possible range is 0–30.

Table 2. Regression model predicting pain rating

	B	*SE*	*t*	*p*
Intercept	10.42	1.27	8.19	<.001***
Race (Black)	−1.26	0.37	−3.43	<.001***
Self-pain rating	0.57	0.07	8.30	<.001***
Age group (5-year-olds)	−0.97	0.60	−1.62	.11
Age group (7-year-olds)	−1.15	0.59	−1.95	.05†
Target race (Black) × Age group (5-year-olds)	1.07	0.52	2.04	.04*
Target race (Black) × Age group (7-year-olds)	0.62	0.52	1.19	.24

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

To further examine the interaction between target race and age group, we conducted separate mixed-effects regression models for each age group predicting pain rating from self-pain rating, target race, and the random effect of subject. The 5-year-olds showed no racial bias; there was no main effect of target race (p = .53). The 7-year-olds showed a trend-level effect of target race: their pain ratings were lower for a Black (M = 19.41, SD = 3.37) than for a White target (M = 20.06, SD = 3.30), B = −0.65, p = .06, d = .25.[4] The 10-year-olds clearly showed the bias: their pain ratings were significantly lower for a Black (M = 19.15, SD = 3.36) than for a White target (M = 20.42, SD = 3.78), B = −1.26, p = .006, d = .53.

Our study design also allows us to examine the effect of target race on perceptions of pain as a between-subjects comparison, using only participants'

[4] *All effect sizes are calculated from the regression models, controlling for self-pain rating and the random effect of subject.*

responses to the first target. This analysis parallels the research with adults, which has used a between-subjects design. We conducted a regression model using just the first target for each participant and predicting pain rating from target race, age group, and the interaction between target race and age group. There was a significant interaction between target race and age group showing that the effect of race in 5-year-olds differed from the effect of race in 10-year-olds, $B = 3.09$, $p = .03$. In the analogous analysis using 7-year-olds as the reference group, there was not a significant interaction between race and age group, showing that the effect of race in 7-year-olds was not significantly different from the effect of race in either 5- or 10-year-olds, $B = 1.39$, $p = .31$ and $B = -1.71$, $p = .21$, respectively.

To further examine the interaction between target race and age group in the between-subjects analysis, we conducted regression models for each age group using just the first target for each participant and predicting pain rating from target race. Ten-year-olds showed a significant main effect of race, $B = -2.02$, $p = .049$, $d = .56$, whereas 7-year-olds and 5-year-olds did not (ps $> .27$). Thus, it appears that the racial bias in pain ratings in 10-year-olds was reliable even when examining the effect in a between-subjects analysis. Although 7-year-olds showed some evidence of the bias in the within-subjects analysis, the effect is smaller and less reliable than the effect in 10-year-olds and it is not strong enough to emerge when only examining the first target.

Note that, surprisingly, children seem to rate their own pain as more in line with the Black targets than with the White targets. Indeed, given that older children's ratings for the self are significantly lower than those for either target, it is possible that children rated the Black child's pain lower because they anchored the Black target's pain level to their own, which is lower still. However, in addition to this being unlikely theoretically, an analysis of the overlapping correlations (Meng, Rosenthal & Rubin, 1992) from the data for just the 7- and 10-year-olds shows that the correlation between Black and Self and that between White and Self are not significantly different, suggesting that the Black target is unlikely to be anchored to the self-ratings any more than the White target is. An explanation is then needed for why older children's rating for the self are significantly lower than those for either target, and why self-pain ratings decline with age. One possibility is that children want to appear tough or brave, given that children tend to rate themselves positively on a variety of traits (Harter & Pike, 1984) and so rate the items relatively low for themselves but are more realistic in their ratings of the targets' pain and that this tendency increases across childhood. Another possible explanation for the decline with age is that older children are more likely to have experienced very painful events in their lives that those make the events presented seem mild in comparison.

Secondary analyses

Table 3 provides descriptive statistics for each of the potential moderators. As is apparent in the table, the evaluative stereotype measure had limited variability and means were close to 0, indicating that children were likely to ascribe the positive traits approximately equally to Black and White targets. Presumably due to this limited variability, there were no significant age trends in children's scores. Thus, although we present the relevant analyses, this measure is of limited use in drawing conclusions.

Table 3. Descriptive statistics and age differences in secondary measures

	M	*SD*	Range	*F*	*p*
Social preference					
5-year-olds	5.77[a]	1.78	2 to 8	3.10	.048
7-year-olds	5.61[a,b]	1.66	1 to 8		
10-year-olds	5.02[b]	1.43	1 to 8		
Evaluative stereotyping					
5-year-olds	0.17	1.68	−6 to 5	−0.52	.60
7-year-olds	−0.06	1.42	−3 to 3		
10-year-olds	0.26	1.89	−3 to 5		
Number of child's other-race friends					
5-year-olds	2.11	2.44	0 to 12	0.40	.67
7-year-olds	1.76	1.50	0 to 7		
10-year-olds	2.02	2.31	0 to 15		
Number of different other-race friends parent has socialized with in past month					
5-year-olds	3.72	5.18	0 to 20	0.15	.86
7-year-olds	3.73	7.99	0 to 50		
10-year-olds	3.15	4.72	0 to 30		
Days a month child interacts with people of other races					
5-year-olds	15.55[a,b]	8.58	0 to 30	3.14	.046
7-year-olds	13.89[a]	8.66	0 to 30		
10-year-olds	18.24[b]	8.49	0 to 31		
Days a month the child sees parent socialize with people of other races					
5-year-olds	7.20[a]	9.02	0 to 31	2.01	.14
7-year-olds	4.13[b]	6.44	0 to 31		
10-year-olds	6.52[a,b]	9.15	0 to 31		

Note. Different superscripts indicate that two age groups are different from each other at $p < .05$. Higher values on the social preference task indicate choosing more White children than Black children, where 8 indicates choosing the White child on all trials and 0 indicates choosing the Black child on all trials. Higher values on the stereotype awareness task indicate ascribing higher levels of positive traits to White children than Black children, where 10 indicates choosing 'very' for all traits for Whites and 'not at all' for all traits for Blacks, 0 indicates ascribing traits equally to Whites and Blacks, and −10 indicates choosing 'very' for all traits for Blacks and 'not at all' for all traits for Whites.

To examine whether these variables moderated the main effect of race, separate regression models were conducted predicting pain rating from self-pain rating, target race, age group, the interaction between target race and age group, and the two-way interaction between each variable and target race. None of these interactions were significant. The effect of target race on pain ratings was not moderated by social preference ($p = .17$), evaluative stereotyping ($p = .93$), paternal or maternal education (ps > .17), or child or parent interaction with people of other races (ps > .38). Social preference and evaluative stereotyping were weakly, but not significantly correlated, $r = .13, p = .096$.

Discussion

In the current research, we documented a racial bias in perceptions of others' pain in a sample of mostly White American children. Using an adapted version of a paradigm previously used with American adults, we found no detectable bias at age 5, a trend-level bias at age 7, and a significant bias at age 10.[5] Specifically, 10 year-old children rated the pain of a Black target as lower than the pain of a White target. By age 10, then, American children, as American adults, judge that Black people feel less pain than do White people. When examining data from the first target alone, the trend-level bias was not seen in 7-year-olds, but the significant bias was still apparent in 10-year-olds. This finding, along with the smaller effect size in 7-year-olds, suggests that although the bias begins to emerge at age 7, it is in full force by age 10.

In addition, we found that this bias was not moderated by social preference. Although null findings must be interpreted with caution, these results are consistent with findings from research with adults: American adults' racial bias in perceptions of others' pain is not linked to race-related attitudes or concerns (Trawalter *et al.*, 2012). An alternative possibility is that in children, this bias is related to implicit rather than explicit racial attitudes – attitudes that are less conscious and less controllable. The current study did not measure implicit biases, but based on our pattern of findings, it seem unlikely that the racial bias in pain perception is related to implicit bias. Implicit biases generally emerge early in development and, unlike explicit biases, remain relatively stable over time (Dunham, Baron, & Banaji, 2008). On measures such as the Implicit Association Test, young White children show the same implicit bias for their own in-group as adults (but see Degner & Wentura, 2010 for a different form of implicit race bias that appears to emerge later). Thus, if the racial bias in pain perception is related to implicit bias, we would expect it to emerge early and remain stable, which is not consistent with the data reported here. Rather, the bias emerges in middle childhood and continues to strengthen through the elementary school years.

We did include a measure of evaluative stereotyping knowledge in the current study. However, due to parent concerns about asking children to assign negative traits to individuals or social groups, we had to modify the measure to ask children only about positive traits. This modification resulted in low variance in children's responses, rendering our measure ineffective. Thus, we cannot rule out the explanation that stereotyping is related to the emergence of the racial bias in pain perception. Future research should use stereotype measures with both positive and negative traits as well as those that assess more specific stereotypes such as behaviours and other characteristics in addition to positive/negative traits, to determine whether stereotyping is related to the pain bias. It is possible that when children, around the age of 7, begin to recognize both positive and negative racial stereotypes, it leads them to begin to exhibit this bias. However, in adults, general stereotype measures are not related to the bias, suggesting that if stereotyping is related to the emergence of the bias in children, the two become disassociated later in development.

[5] *One concern could be that children used the scale differently across age groups. We do not believe that is the case for three reasons. First, we measured and controlled for self-pain rating, such that if children of different ages used each point on the scale differently, our results control for these differences. Second, generally children of all ages responded appropriately to control items (e.g., 'You hug a teddy bear') by choosing the 'no hurt' response, indicating that younger children were paying attention and were not responding randomly across the items. Finally, there was a moderate level of agreement across all age groups regarding which events would be most and least painful. For example, children of all age groups rated getting your fingers caught in the car door as very painful (*M *for 5-year-olds = 2.50,* M *for 7-year-olds = 2.85,* M *for 10-year-olds = 2.74, on the 0 to 3 scale, averaged across self and targets) and rated biting your tongue as not very painful (*M *for 5-year-olds = 1.59,* M *for 7-year-olds = 1.37,* M *for 10-year-olds = 1.30, on the 0 to 3 scale, averaged across self and targets). The difference between the ratings for these two items was significant for all age groups, 5-year-olds:* $t(99) = 7.89$, $p < .001$; *7-year-olds:* $t(97) = 16.90$, $p < .001$; *10-year-olds:* $t(87) = 17.28$, $p < .001$. *These data suggest that comparisons across age groups are indeed meaningful.*

A related possibility is that the bias is related to a specific negative stereotype, rather than to general stereotype knowledge. Specifically, very recent research has shown that adults' bias is related to and, in fact, fully mediated by perceptions of hardship (Hoffman & Trawalter, 2013). American adults seem to think that Blacks feel less pain than do Whites but only to the extent that they think Blacks have faced more hardship than Whites. It is possible that the bias we documented among American children is also tied to perceptions of hardship.

Although the research is scarce, one study's findings are in line with this possibility. Zinser, Rich, and Bailey (1981) found that when told that two children both were poor, third-graders, but not first-graders, reported that the Black child was poorer than the White child. Perhaps the association between race and poverty undergoes important changes during early elementary school, which are reflected in our findings with 7- and 10-year-olds. If children are aware of the link between poverty and experiences of hardship, then older children might show the bias because, as adults, they believe that Blacks experience more hardship than Whites and are tougher as a result. Younger children, on the other hand, would not show the bias, perhaps because they do not hold this belief or have knowledge of stereotypes related to hardship and toughness.[6]

Although the current study provides an important initial exploration, there are several limitations. First, because the methodology of the present study was adapted for children (e.g., simplified pain items, faces pain rating scale), we cannot meaningfully compare the effect sizes obtained to effect sizes in studies with adults. Nonetheless, the current research shows that older children, as adults, exhibit a racial pain bias, suggesting that the bias can originate even prior to adolescence. A second limitation is that the present study did not test a mechanism that explains why older but not younger children show this bias. We speculate, based on findings from adults, that the bias might be related to children's developing knowledge about negative racial stereotypes or to children's developing knowledge of racial group differences in hardship. Future research should examine these possible mechanisms more directly.

Future research should also explore racial and demographic differences in the development of this bias. For example, the age that Black children show this bias might differ from the ages seen in the current sample. Moreover, this study did not use a representative sample and is thus limited in its generalizability. Although the goal of the current study was to determine whether children exhibit this bias and, if so, when in development the bias emerges, future research should include a larger and more representative sample to better approximate population means. Similarly, this research provides evidence of a racial bias only in the U.S. Future research should examine whether this bias occurs in other countries, where it might not manifest itself as a racial bias but rather might be related to other status-based differences (e.g., social class in the United Kingdom and Europe). If this bias does exist in other countries, it might also contribute to social disparities in health and health care internationally.

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[6] *There is, however, evidence that in some circumstances, children are aware of racial differences in social status even earlier. Black first-graders rated a novel occupation performed by Blacks as lower in status than the same novel occupation performed by Whites (Bigler et al., 2003). In another study, as early as age 3, South African children matched high-value belongings with Whites more often than with Blacks (Olson, Shutts, Kinzler, & Weisman, 2012). That being said, these populations (Black children and children in South Africa) might learn about status differences at an earlier age than White children in the United States because status is more salient and important in their daily lives. There is other evidence to suggest White children in the United States are sensitive to social status on an implicit level in their intergroup biases (Bigler, Brown, & Markell, 2001; Newheiser & Olson, 2012), but not that children associate Blacks with lower status or more difficult life circumstances.*

These limitations notwithstanding, the present data contribute to our understanding of racial bias in pain perception, a bias that might have dire consequences. As discussed previously, adults in medical fields who hold this bias might systematically undertreat Black patients because they underestimate Black patients' pain. The bias might also be more broadly related to the intergroup empathy gap – if a White child sees a Black child get hurt, he or she might be less likely to feel empathy or to help, because he or she underestimates the Black child's pain.

Importantly, the present data can inform the timing of future interventions. Such interventions might include empathy training – encouraging children to take the perspective of others and imagine their feelings (Ozawa-de Silva & Dodson-Lavelle, 2011). Whatever the intervention content, the current data suggest that interventions will be most effective at preventing this racial bias by age 7 or age 10 at the latest. Targeting specific interventions at younger children may be ineffective because the bias in pain perception is not present at age 5. Conversely, interventions focusing on adolescents or pre-adolescents may not be ideal because the bias appears to be firmly in place by age 10. Rather, the present data suggest that if we want to prevent, rather than reduce, this bias, interventions will need to take place during middle childhood.

Although some parents and educators may feel uncomfortable talking with children about race and racial bias, our data suggest that early interventions may be critical to *preventing* racial bias in pain perception. Because this racial bias is likely to be consequential – it may contribute to racial disparities in health and health care – such early interventions may have far-reaching implications. In time, it may help reduce health disparities.

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Appendix: Pain rating items

1. You burn your tongue on some really hot food.
2. You bang your toe on a chair.
3. You hug a teddy bear.
4. You get soap in your eye.
5. You get a shot at the doctor's office.
6. You get your fingers caught in the car door.
7. You bite your tongue.
8. You play with a puzzle.
9. You get sand in your eye.
10. You get hit on the head with a ball.
11. You hit your head on the corner of the table.
12. You walk on a really hot driveway with bare feet.