Developmental considerations for understanding perceptions and impacts of identity-related differences: Focusing on adolescence

Lucina Q. Uddin[1] and Andres De Los Reyes[2]

[1]Department of Psychiatry and Biobehavioral Sciences, University of California Los Angeles, Los Angeles, CA, USA

[2]Department of Psychology, University of Maryland, College Park, MD, USA

Address correspondence to:

Lucina Q. Uddin, Ph.D.

Email: lucina@ucla.edu

Or

Andres De Los Reyes, Ph.D.

Email: adlr@umd.edu

Running Title: Perceptions of difference in adolescence

Keywords: bias, minority, prejudice, psychological distress, racism, social neuroscience

CITATION

Uddin, L.Q., & De Los Reyes, A. (2022). Developmental considerations for understanding perceptions and impacts of identity-related differences: Focusing on adolescence. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*. Advance online publication. https://doi.org/10.1016/j.bpsc.2022.04.006

FUNDING INFORMATION

LQU is supported by the National Institute on Drug Abuse (Grant No. U01DA050987). ADLR is supported by the Institute of Education Sciences (Grant No. R324A180032; National Center for Special Education Research).

Abstract

Biological psychiatry, like many other scientific fields, is grappling with the challenge of revising its practices with an eye towards promoting diversity, equity, and inclusivity (DEI). One arena in which much of this work will have significant impact is in developmental science generally, and the study of adolescence specifically. Adolescence is a critical period during human development during which important social, neural, and cognitive maturation processes take place. It is also a time marked by risky behaviors and the onset of a range of mental disorders. Social and developmental research has provided insight into the cognitive and neural processes by which perceptions of identity-related differences emerge. Clinical research aimed at understanding how individuals from diverse backgrounds navigate the transition period of adolescence is critical for identifying the unique factors underlying risk and resilience in minoritized populations. Taking a developmental perspective, we review processes by which the brain understands group differences and how the developmental timing of this can influence antecedents of psychological distress. We close with a call to action, pointing to important understudied areas within the field of biological psychiatry that are critical for supporting mental health among diverse adolescent populations.

Cognitive and neural processes by which perceptions of identity-related group differences emerge

At what point during childhood do we begin to notice differences between ourselves and others? How does the development of social preferences, biases and behaviors impact well-being throughout the lifespan? These are important questions that have challenged developmental, social, and clinical scientists for as long as there has been active research on these topics. Social determinants of health comprise environmental conditions reflecting people's day-to-day lived experiences, and as such can affect a range of health, functioning, and quality-of-life-outcomes and risks (1). These conditions may impact youth from before birth (2). An extensive literature focuses on how systemic inequities based on racial differences contribute to health disparities (3). Our focus in this selective review is to highlight the developmental period of adolescence within this broader discussion.

Adolescence is a developmental period during which peer relationships take on a heightened importance; it has been said that teens are "sensitized to social evaluation" (4). The confluence of the increased attention to social evaluation and the neurobiological changes affecting social and affective brain circuitry that accompany the adolescent developmental period creates unique challenges for individuals who are visible minorities navigating the turbulent social landscape of the teen years. Here we focus on developmental considerations for understanding impacts of identity-related differences as they emerge during adolescence, with an emphasis on the development of in-group/out-group bias, social neuroscience of prejudice, and antecedents of identity-related distress. As the majority of this literature has focused on biases related to racial and gender identity, we draw mainly from these studies in our selective overview.

In the wake of the racial justice movement that was reinvigorated in 2020, the fields of developmental and social psychology and neuroscience have shown a renewed interest in understanding the development of racial attitudes. Historically, four main questions have dominated this discourse, namely 1) how and when do children learn to identify with some people and differentiate from others? 2) how and when do children acquire racial attitudes and begin to express them in behavior? 3) what conditions in the environment foster the development of these attitudes and behaviors? and 4) how can the development and expression of negative racial prejudices in children be prevented? (5,6). We focus our discussion here primarily on the first two questions regarding perceptions of identity-related differences and the development of racial attitudes.

The landmark "doll study" conducted by Kenneth and Mamie Clark in 1947 demonstrated that among 3-7 year old children, the vast majority understand racial difference - an awareness of the relation between the physical characteristics of skin color and the racial concepts of White and Black. In this study, both White and Black children were shown to prefer a White doll and reject a Black doll (7). Since that initial groundbreaking study, the development of perceptions of difference has been analyzed using a variety of approaches. In one framework called the minimal group paradigm, children are told they are members of a group based on a trivial feature such as shirt color. Dunham, Baron & Carey found that children as young as five years of age are susceptible to the minimal group paradigm and display in-group/out-group biases. Even when explicit categorical labels are not applied to groups, 5 year olds can exhibit in-group/out-group biases as measured by explicitly recorded attitudes, implicit attitudes, resource allocation, expectations of reciprocity, and information distortion to favor the in-group (8). Even at this young age, children appear to act in accordance with social identity theory, which posits

that they are motivated to see in-groups as positive and distinct from out-groups (9). While these studies were mostly conducted in the United States, experiments evaluating social identity theory in other countries and minority groups have also produced similar findings (10–12).

Explicit bias involves preferences, beliefs, and attitudes that people are generally consciously aware of and can communicate to others, whereas implicit bias refers to unconsciously held negative attitudes or feelings about a racial group (13,14). Explicit intergroup attitudes are typically shared across parents and children throughout childhood and adolescence (15). Explicit race biases have been shown to emerge in children as young as 3-4 years of age, peaking in middle childhood before gradually declining (16,17). Of course, people are not necessarily conscious of their biases. Implicit attitudes in children can be assessed using reaction time paradigms to examine discrepancies between how quickly children associate their own group with good things and out-groups with bad things. Some studies suggest that implicit attitudes toward race may show a different developmental trajectory than explicit race biases. For white North-American participants, implicit pro-White/anti-Black bias as measured by the Implicit Association Task was evident in 6-year-olds, 10-year-olds, and adults. Self-reported explicit race attitudes, on the other hand, were less biased in older children and absent in adults. The authors suggest that from 6 years to adulthood, implicit biases or preferences do not decline with age whereas explicit attitudes diverge around age 10 (18). A large study examining children's implicit racial attitudes found that both groups of younger White children (5-8 years) and older White children (9-12 years) showed preference for White over Black target faces when they were categorized by race. Interestingly, these authors also found that White children did not show evidence of automatic negativity toward Black child exemplars, suggesting that implicit in-

group positivity and out-group negative attitudes can follow distinct developmental trajectories (19).

Understanding the development of bias is important for contextualizing mental health in adolescence. As described by the social determinants of health framework, cumulative effects of experiences with racism significantly impact mental health outcomes (20). Adolescence is a sensitive developmental period during which youth are particularly vulnerable for the onset of psychiatric conditions. Being a member of a minority group can exacerbate risk for developing these conditions. For example, everyday racial discrimination predicts depressive symptoms among Black young adults (mean age 25 years) (21). Some have suggested that the experience of racism should be considered an adverse childhood experience (22). Stronger associations between racism and depressive symptoms in childhood and adolescence than in young adulthood have led some researchers to suggest that experiencing racism in early life may be particularly harmful. For example, in one study, racism frequency and stress from racism before the age of 20 was related to risk of high depressive symptoms among Black women aged 23-34 (23). Findings like these highlight the unique impact of racism on minoritized youth during adolescence, a critical period for identity formation.

Another review in this special issue addresses the topic of the neuroscience of bias in great detail, outlining neural underpinnings of different forms of bias and cognitive mechanisms for challenging bias. Here we highlight a few major findings from the study of how the brain understands group differences. Lieberman and colleagues were among the first to test the hypothesis that the amygdala, a brain region responsive to emotionality, novelty, and arousing stimuli, might be involved in race-related prejudice. Participants performed a perceptual encoding task requiring them to choose a face from a pair presented at the bottom of a screen that

was the same race as the target face at the top of a screen. Both Black and White participants exhibited greater amygdala responses to Black target faces than to white target faces. The authors interpreted these findings to indicate that amygdala activity associated with race-related processing may reflect culturally-learned negative associations regarding Black individuals in the United States (24).

The growing literature on the neuroscience of prejudice - negative preconceptions about groups or individuals based on racial or other affiliations - has identified several brain regions that are involved in this type of evaluative judgment. The social neuroscience of race-based prejudice implicates the amygdala and anterior cingulate cortex (ACC) as critical players in this process, with a role for the amygdala in rapid processing of social category cues in terms of potential threat or reward as well as evaluative learning and expression, and a role for the ACC in conflict processing (25). Additional brain areas that play a role in these biases include the dorsomedial prefrontal cortex (involved in mentalizing and impression formation), the orbitofrontal cortex and ventral striatum (involved in affective judgements and reward processing), the dorsolateral prefrontal cortex (DLPFC, involved in executive functions) and the ventrolateral prefrontal cortex (involved in emotional regulation); the DLPFC and ACC are posited to work together during the motivated regulation of racial bias (26). Insular cortices are also involved in expressions of prejudice, as they integrate sensory and evaluative information and support visceral and subjective emotional responses towards social in-groups or out-groups (25,26).

Most of this neuroimaging work has been conducted in adults for whom biases are already formed. Very little work has attempted to explicitly characterize the neural basis of the development of biases using neuroimaging approaches. However, there is a large literature that

has examined development of the neural circuitry underlying social and affective behavior more broadly - the same circuitry involving amygdala, ACC, and other brain areas listed above that has been well-characterized in adults as being most relevant to the instantiation of biases. It is thought that social and affective brain function, including responsivity of amygdala and striatum, follows a nonlinear developmental trajectory relative to prefrontal cortices that can regulate emotional responses (4,27). According to one influential model of adolescent brain development, heightened emotional responsivity during adolescence may be attributed to differential development of subcortical limbic systems that mature earlier than prefrontal control systems in the brain (28). Adolescence is a time during which social evaluation is particularly intense, salient, persistent and emotionally evocative; high social sensitivity during this developmental period parallels heightened reactivity of socioaffective brain circuitry to social evaluation (4). Compared with younger children, adolescents experience greater self-reported embarrassment and heightened autonomic arousal and medial prefrontal activation when they believe that a peer is actively watching them (29). Enhanced engagement of medial prefrontal cortex during adolescence is thought to facilitate the development of identity by integrating the value of potential actions and value-based choices (30). The impact of experiencing racial discrimination during the adolescence period of heighted emotional reponsivity can manifest in complex ways in minoritized youth, resulting in unique risk and protective factors for substance use, for example (31).

Interestingly, excitation of the medial prefrontal cortex using transcranial direct current stimulation has been shown to decrease implicit biased attitudes toward out-group members (32). This observation aligns with the general notion that control systems in the brain are utilized to overcome negative biases towards members of social out-groups. Protracted development of

prefrontal control systems relative to subcortical limbic systems during adolescence might further impact perceptions of identity-related group differences during this developmental period.

In adults, the neural systems involved in regulation of prejudice and bias are well-studied. This work suggests that the ACC, involved in monitoring and detection of response conflict more generally, exerts cognitive control in social contexts to curb the unwanted influence of prejudices on behavior (25). Lateral prefrontal cortical areas that coordinate the control of action and attention are also thought to be involved in regulating amygdala response during biased behavior (25). The broader cognitive neuroscience literature describing brain networks important for attention, cognitive control, and executive function (33) provides insight into the neural mechanisms that work to override and guide responses away from those that are invoked by learned prejudice and biases. The next big questions for developmental and social cognitive neuroscience will involve further tracking the development of these neural systems as they mature across adolescence and understanding the ways in which these brain changes accompany cognitive and behavioral changes relevant to the emergence of bias.

The good news is, biases can be malleable. In the case of racial biases, changes in task demands, internal goals and motivation, and other aspects of the stimuli can alter neural responses in amygdala, ACC, and DLPFC in responses to out-group race faces (34). Importantly, however, neuroimaging investigations have not typically attempted to show whether racially-biased behavior changes alongside the observed neural response malleability. There have been some intriguing results, however, attempting to change implicit biases by experimentally changing the relationship between individuals and outgroups. When exposed to bodily illusions inducing ownership over a body differing from their own with respect to gender, age, or race,

individuals exhibited a reduction in implicit bias against that outgroup (35). It has been suggested that changing the mental representation of one's own body in a way that affects perceived similarity between one's own body and that of an outgroup may make social attitudes more malleable. This emerging line of research represents one intriguing potential intervention to reduce racial bias. We next consider the consequences of perceptions of difference as they emerge in early life and begin to disproportionately affect specific groups of individuals who are the target of prejudice.

Developmental timing influences antecedents of psychological distress

Early experiences with marginalization have long been known to impact neurodevelopmental and overall health and well being. A very large corpus of empirical literature documents the biological impact of socially-triggered adversity starting in childhood. As examples, victims of childhood bullying show increased systemic inflammation from childhood to young adulthood (36), and exposure to childhood bullying is associated with increased risk for obesity in adulthood (37). Minority psychosocial stress has also been clearly linked with a number of health outcomes. Adversity due to racial discrimination accelerates physiologic weathering and health declines among Black Americans through its impact on DNA telomeres (38).

Within the adolescent period, individuals are exposed to a host of environmental stressors long known to contribute to the development and maintenance of psychosocial distress. A particular form of stressor - aversive interactions with same-age peers - poses key risks because these interactions typically contain elements that increase the likelihood of aversive or distress-related reactions. These experiences contain a set of elements that humans perceive as generally stressful, namely that they are often unpredictable, difficult to control, and result in exposure to

information that threatens key aspects of adolescents' identities (for reviews, see (39–41)). For instance, adolescents may be exposed to teasing on social media about their hobbies, socially excluded because they do not engage in certain kinds of activities (e.g., substance use), or bullied because of where they live (42,43). These kinds of social experiences profoundly impact all adolescents, regardless of mental health status and groups or characteristics with which they identify (44). In fact, adverse social experiences impact psychosocial functioning across multiple domains including subjective experiences (e.g., self-perceived mood or arousal), unhealthy behaviors (e.g., smoking, substance use), and/or maladaptive inflammatory and neural activity (45–47). In these respects, we can characterize aversive peer relations as what some term *universal risk factors* (48). An important consideration germane to this paper is that adolescents with historically marginalized identities (e.g., minoritized racial/ethnic identities, and gender and sexual identities) experience universal risks like aversive peer relations at far higher rates than adolescents who do not share these identities (for reviews, see (49,50)).

A second set of elements, beyond those that typify universal risk factors, is that adolescents who identify with historically marginalized groups also experience *identity-related risks* at significantly high rates. When they come in the form of aversive peer relations, identity-related risks might display similar forms as universal risks, such as bullying and social exclusion. However, these risks function as targeted aversive relations that specifically stem from the adolescent's identifying with a particular group or intersecting groups (e.g., LGBTQIA+, racial/ethnic identity). Importantly, these aversive experiences can manifest at multiple levels from direct, interpersonal interactions with same-age peers, to more structural elements of the environment, whereby key institutions germane to adolescent functioning (e.g., schools) display policies and practices (or lack thereof) that threaten (rather than affirm) adolescents'

marginalized identities (e.g., lack of anti-gay bullying policies or absence of a gay-straight alliance organization (51)). Knowing the increased risk for psychological distress that minoritized adolescents face, researchers can design studies that more carefully consider the impact of identity-related risks on mental health.

Future directions and a call to action

Recent calls to action have summarized the impacts of discrimination on developing minoritzed youth, highlighting potential adverse outcomes on children's developmental trajectories (52). Taken together, the extant biobehavioral research on the links between developmental timing and antecedent effects on adolescents' psychosocial distress highlight important considerations for research on the neurobiology of perceived group differences. In particular, researchers seeking to understand how neurobiology factors into these antecedent experiences and antecedent-related outcomes must pay careful attention to four aspects of the participants they recruit and their lived experiences. First, researchers must be sensitive to *who* they recruit to address study aims and/or what stimuli they include in neurobiological assessments. That is, to the degree that the study aims involve understanding the psychosocial outcomes linked to neurobiological factors underlying perceived differences, researchers must ensure that the study stimuli used and/or participants sampled include adolescents across a variety of identities. In this way, the sampling approach captures individual differences that validly reflect the social environment(s) germane to the phenomena under investigation. Similarly, researchers must attend to *what* antecedents participants have been exposed. Specifically, to the degree that adolescents who identify with historically marginalized groups might experience significant levels of both universal and identity-related antecedents, each of these kinds of antecedents must be sampled. In sum, these first two aspects of study design call

for strategic sampling (i.e., of participants and/or study stimuli) that captures the rich diversity of adolescents and their lived experiences.

The third and fourth aspects of research on these issues relate to the nature of outcomes of antecedent-linked distress. By "antecedent-linked distress," we mean that studies must precisely and accurately focus on distress that one can clearly attribute to the antecedents being examined. Specifically, studies on these issues require sensitivity to *how* adolescents experience antecedent-linked distress. As mentioned previously, prior work indicates that adversities like aversive peer relations produce effects at multiple levels of analysis (e.g., subjective, behavioral, immune, neural). Thus, by construction, studies on these issues must take a holistic approach to assessing antecedent-linked outcomes, using an approach akin to those recommended within recent research initiatives involving assessment of multiple outcome domains and using multiple modalities or units of analysis (e.g., Research Domain Criteria (47)). Otherwise, studies might "miss" antecedent-linked outcomes if a given outcome domain (e.g., subjective, inflammation) and/or unit of analysis (e.g., self-report, observed behavior, immunological assays, neuroimaging) was not included in the measurement battery.

Lastly, studies must accurately detect *why* adolescents developed antecedent-linked distress. In particular, we noted previously that adolescents who identify with historically marginalized groups might experience universal and/or identity-related antecedents. Either one or both of these antecedents might produce outcomes that interact with each other in complex ways. As such, there exists the potential for researchers to misattribute an outcome to a universal antecedent that actually resulted from an identity-related antecedent, or vice versa. For example, if a research team classifies an adolescent's bullying experiences as a universal antecedent when in actuality it contained identity-related features, their study might underestimate the impact of

antecedents on identity-related distress outcomes. In sum, we recommend that researchers conducting work on these issues carefully consider the implications of their study designs on accurately estimating links between antecedents and psychosocial distress.

We anticipate that the next phase of research on these topics will leverage data collected as part of large ongoing consortia that have been established for the study of adolescent brain and cognitive development. Adolescent Brain Cognitive Development (ABCD) is a large longitudinal cohort study of 11,880 children and their parents that is currently being conducted across research sites in 21 metropolitan areas of the United States (53). The primary goal of the ongoing nationwide ABCD study is to define factors predictive of variability in individual developmental trajectories, with a particular focus on factors that influence the course or severity of substance abuse (54). The baseline sample was ethnically diverse by design (51% White, 21.4% Hispanic, 15.2% African American, 2.3% Asian, 10.01% multiracial/other). Children are followed annually for 10 years starting at approximately 9-10 years of age when they complete a baseline visit consisting of clinical interviews, surveys, neurocognitive tests, and neuroimaging (55).

Researchers are already urging for responsible use of these open access data, with the cautionary note to consider the broader social context in which development occurs. One particularly noteworthy recommendation is that researchers should be aware of the considerable heterogeneity in youth's experiences and environments, noting that no measure can fully capture the relevant environment and experiences, including structural racism and other forms of oppression and inequality, that can influence development (56).

At one-year follow-up assessment, children in the ABCD study completed the Perceived Discrimination Scale, which asks about experiences of being treated unfairly or feeling

unaccepted due to race, ethnicity, or color. Five percent of children reported discrimination due to their race/ethnicity, with Black children reporting the highest prevalence of discrimination (57). Understanding how perceived discrimination affects mental health, brain, and cognitive development will be one of the most critical questions to address using ABCD data going forward. Unfortunately, aside from this scale, ABCD does not include additional measures of prejudice, racism, or perceived in-group/out-group belonging. In addition, the disproportionate loss of participants of color during the COVID pandemic also affects researchers' ability to evaluate outcomes among minoritized populations.

While ABCD data will undoubtedly provide a wealth of information to explore the complex links between identity-related risks and health outcomes, it is important to remember that the study was not designed to study health disparities *per se*. As such, it is likely to be underpowered to test hypotheses regarding outcomes for specific minoritized populations. In addition, mistrust of the health care system among minoritized individuals is a barrier to research participation that further precludes data collection from diverse and representative samples (58). The ABCD uses strategies that have been developed in other biomedical research settings to improve participation of minorities, including the creation of community advisory boards. In addition, ABCD has assembled a justice, equity, diversity, and inclusion (JEDI) taskforce comprising three workgroups: Equitable & Inclusive Methods, Diversity & Inclusion in ABCD, and Responsible Use of ABCD Data. These three workgroups meet regularly to 1) ensure that all measures used within consortium are fair to participants of all races, genders, sexual orientations, abilities, socioeconomic status (SES), and cultural background, 2) understand and address historical, cultural, and institutional barriers that disproportionaltey impact ABCD researchers, staff, and participants who are person of color, and 3) promote principles of ethical condcut of

research to prevent further stigmatization, marginalization and injustice toward indivisuald because of racial, ethnic, or gender minority satus (https://abcdstudy.org/jedi-taskforce-workgroups/?swcfpc=1). Researchers planning to conduct analyses of ABCD data in ways that explicitly consider participant race (59), sexual identity, or other identity-related variables, are strongly encouraged to consult with ABCD JEDI workgroup 3 prior to or during data analysis and dissemination of findings.

The Healthy Brain and Cognitive Development Study is another collaborative data collection effort involving prospective examination of brain, cognitive, socioemotional, and behavioral development beginning prenatally and extending into childhood. The goal of this longitudinal, epidemiology observational cohort study is to enroll around 7500 pregnant women at multiple sites across the United States and measure prenatal and postnatal exposure to substances, family stress, medical history, socioeconomic status, nutrition, and assessments of brain and cognitive development to inform how exposures in early life influence risk for negative long-term psychological, behavioral, and neural developmental outcomes. A recent paper highlighted special considerations to be noted in order to ensure inclusive and equitable practices in the implementation of this study to align with the goal of avoiding perpetuation of narratives supporting systemic injustice. Specifically, the authors caution against common scientific biases including sampling bias, measurement and generalizability bias, and normativity bias (60). The recommendations put forth in this work are a great example of how careful consideration is necessary when interpreting data collected from marginalized communities to avoid causing stigma and harm.

Understanding the effects of biases and prejudice on cognitive and neural development in youth is a critical component of addressing mental health outcomes in marginalized populations. Researchers focusing on the adolescent period have an important role to play in this endeavor.

Disclosures

Dr. Uddin and Dr. De Los Reyes reported no biomedical financial interests or potential conflicts of interest.

Acknowledgements

LQU is supported by the National Institute on Drug Abuse (U01DA050987). ADLR is supported by the Institute of Education Sciences (R324A180032).

References

1. Marmot M, Wilkinson R (2005): *Social Determinants of Health*. OUP Oxford.

2. Dominguez TP, Dunkel-Schetter C, Glynn LM, Hobel C, Sandman CA (2008): Racial differences in birth outcomes: the role of general, pregnancy, and racism stress. *Health Psychol* 27: 194–203.

3. A Shared Bibliography on Systemic Racism and Health Disparities (n.d.): Retrieved March 28, 2022, from https://www.annfammed.org/content/shared-bibliography-systemic-racism-and-health-disparities

4. Somerville LH (2013): The Teenage Brain: Sensitivity to Social Evaluation. *Curr Dir Psychol Sci* 22: 121–127.

5. Carol S (2009): Dweck. Prejudice: How If Develops and How It Can Be Undone. *Hum Dev* 52: 371–376.

6. Clark KB (1988): *Prejudice and Your Child*. Wesleyan University Press.

7. Clark KB, Clark MP (1996): *Racial Identification and Preference in Negro Children*. Bobbs-Merrill.

8. Dunham Y, Baron AS, Carey S (2011): Consequences of "minimal" group affiliations in children. *Child Dev* 82: 793–811.

9. Tajfel H, Turner J (1979): Social identity theory. *dikutip dari www learning-theories com, diakses* 20. Retrieved from https://www.ozarktigers.org/cms/lib07/MO01910080/Centricity/Domain/472/Review%20of%20SIT%20and%20Stereotyping.pdf

10. Corenblum B (2014): Development of Racial–Ethnic Identity Among First Nation Children. *J Youth Adolesc* 43: 356–374.

11. Tanti C, Stukas AA, Halloran MJ, Foddy M (2011): Social identity change: shifts in social identity during adolescence. *J Adolesc* 34: 555–567.

12. Zhang Y, Wang K (2022): Effect of Social Exclusion on Social Maladjustment Among Chinese Adolescents: A Moderated Mediation Model of Group Identification and Parent–Child Cohesion. *J Interpers Violence* 37: NP2387–NP2407.

13. Axt JR, Ebersole CR, Nosek BA (2014): The rules of implicit evaluation by race, religion, and age. *Psychol Sci* 25: 1804–1815.

14. Dovidio JF, Gaertner SL (2010): Intergroup Bias. *Handbook of Social Psychology*. https://doi.org/10.1002/9780470561119.socpsy002029

15. Degner J, Dalege J (2013): The apple does not fall far from the tree, or does it? A meta-analysis of parent–child similarity in intergroup attitudes. *Psychol Bull* 139: 1270–1304.

16. Augoustinos M, Rosewarne DL (2001): Stereotype knowledge and prejudice in children. *Br J Dev Psychol* 19: 143–156.

17. Bigler RS, Liben LS (2006): A developmental intergroup theory of social stereotypes and prejudice. *Adv Child Dev Behav* 34: 39–89.

18. Baron AS, Banaji MR (2006): The Development of Implicit Attitudes. Evidence of Race Evaluations From Ages 6 and 10 and Adulthood. *Psychological Science*, vol. 17. pp 53–58.

19. Williams A, Steele JR (2019): Examining children's implicit racial attitudes using exemplar and category-based measures. *Child Dev* 90: e322–e338.

20. Paradies Y, Ben J, Denson N, Elias A, Priest N, Pieterse A, *et al.* (2015): Racism as a Determinant of Health: A Systematic Review and Meta-Analysis. *PLoS One* 10: e0138511.

21. Cénat JM, Kogan C, Noorishad P-G, Hajizadeh S, Dalexis RD, Ndengeyingoma A, Guerrier M (2021): Prevalence and correlates of depression among Black individuals in Canada: The

major role of everyday racial discrimination. *Depress Anxiety* 38: 886–895.

22. Ayodeji E, Dubicka B, Abuah O, Odebiyi B, Sultana R, Ani C (2021): Editorial Perspective: Mental health needs of children and young people of Black ethnicity.1 Is it time to reconceptualise racism as a traumatic experience? *Child Adolesc Ment Health* 26: 265–266.
23. Quist AJL, Han X, Baird DD, Wise LA, Wegienka G, Woods-Giscombe CL, Vines AI (2022): Life Course Racism and Depressive Symptoms among Young Black Women. *J Urban Health*. https://doi.org/10.1007/s11524-021-00574-7
24. Lieberman MD, Hariri A, Jarcho JM, Eisenberger NI, Bookheimer SY (2005): An fMRI investigation of race-related amygdala activity in African-American and Caucasian-American individuals. *Nature Neuroscience*, vol. 8. pp 720–722.
25. Amodio DM (2014): The neuroscience of prejudice and stereotyping. *Nat Rev Neurosci* 15: 670–682.
26. Mattan BD, Wei KY, Cloutier J, Kubota JT (2018): The social neuroscience of race-based and status-based prejudice. *Curr Opin Psychol* 24: 27–34.
27. Blakemore S-J (2008): The social brain in adolescence. *Nature Reviews Neuroscience*, vol. 9. pp 267–277.
28. Casey BJ, Jones R, Hare T (2008): The adolescent brain. The year in cognitive neuroscience. *Ann N Y Acad Sci* 11: 84–94.
29. Somerville LH, Jones RM, Ruberry EJ, Dyke JP, Glover G, Casey BJ (2013): The Medial Prefrontal Cortex and the Emergence of Self-Conscious Emotion in Adolescence. *Psychological Science*, vol. 24. pp 1554–1562.
30. Pfeifer JH, Berkman ET (2018): The Development of Self and Identity in Adolescence: Neural Evidence and Implications for a Value-Based Choice Perspective on Motivated

Behavior. *Child Development Perspectives*, vol. 12. pp 158–164.

31. Gibbons FX, Pomery EA, Gerrard M (2010): Racial discrimination and substance abuse: Risk and protective factors in African American adolescents. In: Scheier L, editor. *Handbook of Drug Use Etiology: Theory, Methods, and Empirical Findings , (pp*, vol. 689. Washington, DC, US: American Psychological Association, xxvi, pp 341–361.
32. Sellaro R, Derks B, Nitsche MA, Hommel B, van den Wildenberg WPM, van Dam K, Colzato LS (2015): Reducing Prejudice Through Brain Stimulation. *Brain Stimul* 8: 891–897.
33. Menon V, Uddin LQ (2010): Saliency, switching, attention and control: a network model of insula function. *Brain Struct Funct* 214: 655–667.
34. Kubota JT, Banaji MR, Phelps EA (2012): The neuroscience of race. *Nat Neurosci* 15: 940–948.
35. Maister L, Slater M, Sanchez-Vives MV, Tsakiris M (2015): Changing bodies changes minds: owning another body affects social cognition. *Trends Cogn Sci* 19: 6–12.
36. Copeland WE, Wolke D, Lereya ST, Shanahan L, Worthman C, Costello EJ (2014): Childhood bullying involvement predicts low-grade systemic inflammation into adulthood. *Proc Natl Acad Sci U S A* 111: 7570–7575.
37. Takizawa R, Danese A, Maughan B, Arseneault L (2015): Bullying victimization in childhood predicts inflammation and obesity at mid-life: a five-decade birth cohort study. *Psychol Med* 45: 2705–2715.
38. Chae DH, Wang Y, Martz CD, Slopen N, Yip T, Adler NE, *et al.* (2020): Racial discrimination and telomere shortening among African Americans: The Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Health Psychol* 39: 209–219.

39. Cannon CJ, Makol BA, Keeley LM, Qasmieh N, Okuno H, Racz SJ, De Los Reyes A (2020): A Paradigm for Understanding Adolescent Social Anxiety with Unfamiliar Peers: Conceptual Foundations and Directions for Future Research. *Clin Child Fam Psychol Rev* 23: 338–364.

40. Gunnar MR, Talge NM, Herrera A (2009): Stressor paradigms in developmental studies: what does and does not work to produce mean increases in salivary cortisol. *Psychoneuroendocrinology* 34: 953–967.

41. Prinstein MJ, Giletta M (2020): Future Directions in Peer Relations Research. *J Clin Child Adolesc Psychol* 49: 556–572.

42. Casper DM, Card NA (2017): Overt and relational victimization: A meta-analytic review of their overlap and associations with social-psychological adjustment. *Child Dev* 88: 466–483.

43. Olweus D (2013): *Bullying at School: What We Know and What We Can Do*. John Wiley & Sons.

44. Prinstein MJ, Giletta M (1159): Peer relations and developmental psychopathology. In: Cicchetti D, editor. *Developmental Psychopathology: Theory and Method, Vol*, vol. 1. Hoboken, NJ, US: John Wiley & Sons, Inc., xv, pp 527–579.

45. Hostinar CE, Nusslock R, Miller GE (2018): Future Directions in the Study of Early-Life Stress and Physical and Emotional Health: Implications of the Neuroimmune Network Hypothesis. *J Clin Child Adolesc Psychol* 47: 142–156.

46. Nusslock R, Miller GE (2016): Early-Life Adversity and Physical and Emotional Health Across the Lifespan: A Neuroimmune Network Hypothesis. *Biol Psychiatry* 80: 23–32.

47. Sanislow CA, Pine DS, Quinn KJ, Kozak MJ, Garvey MA, Heinssen RK, *et al.* (2010):

Developing constructs for psychopathology research: research domain criteria. *J Abnorm Psychol* 119: 631–639.

48. Russell ST, Fish JN (2016): Mental Health in Lesbian, Gay, Bisexual, and Transgender (LGBT) Youth. *Annu Rev Clin Psychol* 12: 465–487.

49. Fish JN (2020): Future Directions in Understanding and Addressing Mental Health among LGBTQ Youth. *J Clin Child Adolesc Psychol* 49: 943–956.

50. Jones SCT, Neblett EW (2017): Future Directions in Research on Racism-Related Stress and Racial-Ethnic Protective Factors for Black Youth. *J Clin Child Adolesc Psychol* 46: 754–766.

51. Hatzenbuehler ML (2017): Advancing Research on Structural Stigma and Sexual Orientation Disparities in Mental Health Among Youth. *J Clin Child Adolesc Psychol* 46: 463–475.

52. Njoroge WFM, Forkpa M, Bath E (2021): Impact of Racial Discrimination on the Mental Health of Minoritized Youth. *Curr Psychiatry Rep* 23: 81.

53. Barch DM, Albaugh MD, Baskin-Sommers A, Bryant BE, Clark DB, Dick AS, *et al.* (2021): Demographic and mental health assessments in the adolescent brain and cognitive development study: Updates and age-related trajectories. *Dev Cogn Neurosci* 52: 101031.

54. Jernigan TL, Brown SA (2018): Introduction. *Developmental Cognitive Neuroscience*, vol. 32. pp 1–3.

55. Karcher NR, Barch DM (2021): The ABCD study: understanding the development of risk for mental and physical health outcomes. *Neuropsychopharmacology* 46: 131–142.

56. Simmons C, Conley MI, Gee DG, Baskin-Sommers A, Barch DM, Hoffman EA, *et al.* (2021): Responsible Use of Open-Access Developmental Data: The Adolescent Brain Cognitive Development (ABCD) Study. *Psychological Science*, vol. 32. pp 866–870.

57. Nagata JM, Ganson KT, Sajjad OM, Benabou SE, Bibbins-Domingo K (2021): Prevalence of Perceived Racism and Discrimination Among US Children Aged 10 and 11 Years: The Adolescent Brain Cognitive Development (ABCD) Study. *JAMA Pediatr* 175: 861–863.

58. Scharff DP, Mathews KJ, Jackson P, Hoffsuemmer J, Martin E, Edwards D (2010): More than Tuskegee: understanding mistrust about research participation. *J Health Care Poor Underserved* 21: 879–897.

59. Lett E, Asabor E, Beltrán S, Cannon AM, Arah OA (2022): Conceptualizing, Contextualizing, and Operationalizing Race in Quantitative Health Sciences Research. *Ann Fam Med* 20: 157–163.

60. Nketia J, Amso D, Brito NH (2021): Towards a more inclusive and equitable developmental cognitive neuroscience. *Dev Cogn Neurosci* 52: 101014.