

PSYCHOLOGICAL SCIENCE

A brief social-belonging intervention in college improves adult outcomes for black Americans

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Could mitigating persistent worries about belonging in the transition to college improve adult life for black Americans? To examine this question, we conducted a long-term follow-up of a randomized social-belonging intervention delivered in the first year of college. This 1-hour exercise represented social and academic adversity early in college as common and temporary. As previously reported in *Science*, the exercise improved black students' grades and well-being in college. The present study assessed the adult outcomes of these same participants. Examining adult life at an average age of 27, black adults who had received the treatment (versus control) exercise 7 to 11 years earlier reported significantly greater career satisfaction and success, psychological well-being, and community involvement and leadership. Gains were statistically mediated by greater college mentorship. The results suggest that addressing persistent social-psychological concerns via psychological intervention can shape the life course, partly by changing people's social realities.

INTRODUCTION

For many people, a life well lived includes professional success, personal well-being, and engagement in one's community (1). What factors help people achieve these outcomes?

Certainly, resources and opportunities to develop important life skills (e.g., executive function) in childhood and adolescence contribute to adult success (2–4). However, access to resources does not automatically translate to better outcomes, partly because social-psychological concerns can impede people's ability to use resources and pursue opportunities available to them (5–7). College, for instance, offers young people substantial opportunities for learning and the development of diverse skills and relationships (8). However, black and other racial minority students also enter college aware of the underrepresentation of their group in higher education and how the ways in which stereotypes and discrimination can shape the experiences of students from their group. Past research shows that this context reasonably evokes worries in students about whether they, or their group, can belong, a phenomenon known as “belonging uncertainty” (9–11). These worries can lead students to perceive common everyday challenges in college, such as exclusion from a social outing or receiving critical academic feedback, as confirming that they do not belong. This perception can become self-fulfilling. For instance, it may make students less likely to join student groups or to reach out to prospective mentors, undermining supports and achievement during college (9, 10, 12). Through this process, worries about belonging, rooted in a history of social disadvantage, can perpetuate racial inequality in higher education (see Fig. 1A for a conceptual model illustrating this process).

Our understanding of this process derives largely from past field experimental research testing a targeted exercise called the social-belonging intervention. The intervention, described more fully below, is designed to mitigate worries about belonging in the transi-

tion to college. Although it is delivered early in college and lasts less than an hour, it has been shown to improve diverse outcomes in college, including academic performance, physical health, and well-being, for students from groups disadvantaged in higher education (13). Research on the social-belonging intervention draws on a tradition in psychology in which intervention field experiments serve both theoretical and applied functions (5–7, 14). First, they advance basic theory, in several ways. They assess the causal role of a specific psychological process within an ecologically valid context. In doing so, they can assess how this psychological process interacts with other processes in the world. For example, if an intervention that lessens belonging uncertainty improves outcomes by helping students access campus resources and relationships (10), then that suggests how psychological and structural processes interact to influence people's lives. Furthermore, intervention field experiments can illuminate the contribution of psychological processes to social problems. If an intervention that lessens belonging uncertainty improves outcomes experienced by people from disadvantaged groups, then that means that belonging uncertainty contributes to those outcomes under status quo conditions as observed in the control group. Second, intervention field experiments offer valuable applied insights by evaluating the effectiveness of specific approaches to social problems.

If belonging uncertainty undermines the college outcomes of students from socially disadvantaged groups, then are these students less well-positioned to thrive after college? If so, could the belonging intervention enhance success not only during college, as shown in past research, but also subsequently? If adult benefits are observed, then what would explain how a 1-hour exercise early in college could alter the life course? To address these questions, we followed up with participants from the original randomized controlled trial of the intervention. At the time of the follow-up, it had been almost a decade since participants had taken part in the intervention and they were, on average, 27 years old. We examined their professional success, psychological well-being, physical health, and community engagement, with the prediction that black adults who had completed the intervention materials years earlier would show benefits on these outcomes relative to their counterparts who had completed the randomized control materials.

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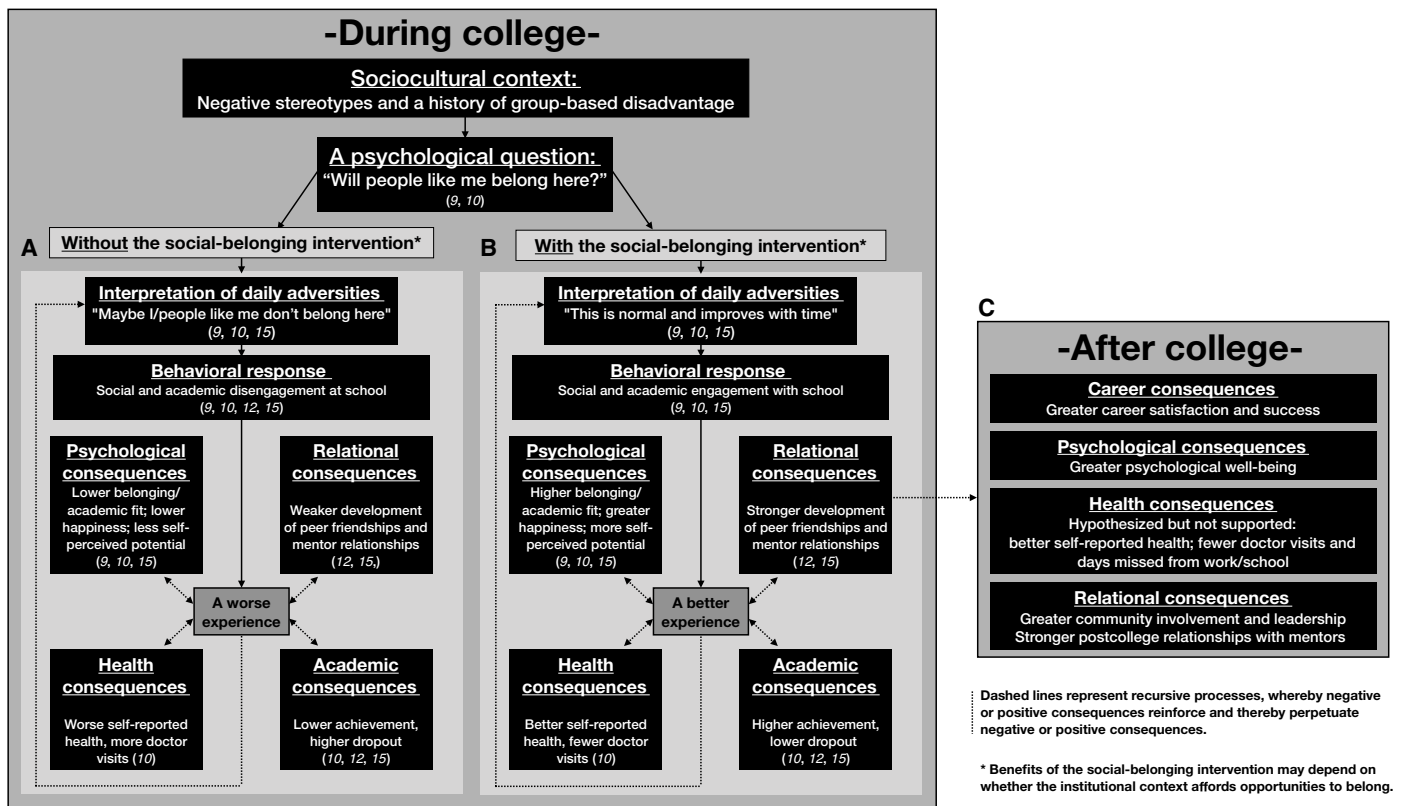


Fig. 1. Conceptual model. (A) For students from socially disadvantaged groups, awareness of negative stereotypes and a history and current reality of group-based disadvantage can give rise to worries about belonging. This belonging uncertainty may fester in the face of common everyday adversities in college and ultimately undermine important outcomes in college. (B) The social-belonging intervention offers students a nonthreatening lens through which to view daily adversities. It can thereby sustain engagement with school and improve the college experience, especially for students from disadvantaged groups who disproportionately bear the burden of belonging uncertainty. The present study examines whether the better trajectory fostered by the intervention can improve students' outcomes after college (C) and whether gains in life outcomes are statistically mediated by postintervention grades and/or college mentorship.

The social-belonging intervention

In an effort to interrupt the self-fulfilling nature of belonging uncertainty (11), the social-belonging intervention offers students a nonthreatening lens with which to make sense of common social and academic adversities in the transition to college (9, 13). To do so, it shares stories from diverse older students, who describe experiencing a range of everyday challenges to belonging in the transition to college and how their experiences improved with time. These stories thus represent challenges to belonging as normal in the transition to college, as temporary, and as due to the transition itself—not as evidence of a permanent lack of belonging on the part of the self or one's group. The intervention is appropriate for school environments that, in fact, offer opportunities for belonging and the development of positive relationships for all students. It would not be expected to be helpful in contexts that are unmitigatedly hostile or that lack relevant resources.

The original randomized controlled trial of the social-belonging intervention included black and white students in their first year at a selective university. In a 1-hour immersive in-person experience, students read the intervention stories and reflected on their own experience in college in light of them [$N = 92$; (10)]. As previously reported, compared to multiple randomized control conditions and a nonrandomized campus-wide comparison group ($N = 162$ addi-

tional black students), this treatment raised black students' grade point averages (GPAs) from sophomore to senior year, halving the racial achievement gap (10). Moreover, at the end of college, treated black students reported being more confident in their belonging, happier, and healthier than control peers. Subsequent studies have found academic benefits of the intervention in other populations and contexts (15, 16). These include multiple scaling studies with thousands of students, in which online versions of the intervention raised first-year completion rates and grades of students from socially disadvantaged groups (12).

How does the intervention help students succeed? Most hour-long experiences quickly recede from memory. Indeed, by the end of college, few students in the original experiment (8%) accurately recalled the treatment message (see the Supplementary Materials) (10). Likewise, few (14%) attributed any of their success in college to it. Thus, the gains do not hinge on the salience of an idea. The intervention also does not provide students objective resources or the kind of practice that is necessary for skill-building (4, 17). Rather, we propose another model for understanding life success, one that prioritizes how people make sense of and respond to their social context. From this perspective, a single targeted exercise that shifts how people make sense of their experiences at a key time may alter the recursive cycles that play out between an individual and their social context over time

(5, 6). In the case of social belonging, awareness of disadvantage perpetuates inequality by seeding plausible but pejorative and self-fulfilling interpretations for everyday adversities. Yet, providing students a narrative for understanding adversities that saps them of their threatening meaning could sustain students' engagement in the academic and social contexts of school. In turn, this engagement may help students build valuable relationships; reinforce confidence in their belonging; and provide cascading psychological, academic, health, and relational benefits during college—resources that might support better life outcomes later (see Fig. 1B for an illustration of this process).

Consistent with this theorizing, daily diary measures administered in the first week after the intervention (i.e., in students' first year of college) showed that the intervention lessened the degree to which black students suffered a drop in their feelings of belonging on days of higher adversity (10). They were less likely, it seems, to globalize the implications of adversities into the conclusion "I don't belong here." This change in the interpretation of daily experiences appears to have had academic consequences. It statistically mediated the 3-year gain in black students' GPA. Moreover, treated black students were more engaged on campus in the first week after intervention, for instance, emailing professors and attending office hours more (9). Subsequent studies have found that the intervention can lead students from socially disadvantaged groups to participate more in student groups, to develop more friendships on campus, and to be more likely to develop a mentor relationship in the first year of college (12, 16).

A better life trajectory?

Could these improvements in college benefit their people's adult lives after college? In our model, even as worries about belonging serve as a causal lever for change, they do not exist only in a person's head (5, 6, 18). First, they arise from the social context, particularly from awareness of societal disadvantage and the existence of negative stereotypes about one's group. In turn, they perpetuate disadvantage in students' lived experience. Of particular importance, feelings of belonging uncertainty may lessen the likelihood that students form valuable relationships with mentors. Worried that they do not belong and with an interpretative lens that renders social adversities as global threats, students may avoid situations where these relationships could naturally form and not take the actions necessary to nurture them. While this could have consequences in students' immediate circumstances, it could also affect outcomes over time. Mentors play a central role in fostering success and well-being for their mentees in and beyond school (19, 20), and may be especially meaningful for mentees from marginalized backgrounds whose ties to relevant social networks may be more tenuous to begin with (21). Testing this model, here, we examined whether remedying worries about belonging in the transition to college (via the social-belonging intervention) might help black students form mentor relationships that support their thriving long after college (see Fig. 1C).

To examine postcollege benefits, we asked participants from the original randomized controlled trial to describe their lives along four broad dimensions: career satisfaction and success, general psychological well-being, physical health, and community involvement and leadership. These outcomes are of inherent importance; they also mirror outcomes improved by the intervention in college (e.g., academic achievement, happiness, health, and participation in extracurricular activities). Table 1 shows the measures used to assess these dimensions. Although self-reported measures are limited in

some respects, they capture how people experience their lives (22) and can be particularly appropriate when people are in diverse contexts, each with different metrics of objective success, as was the case here (e.g., participants were pursuing different careers and were at different stages of doing so). To capture different aspects of these broad life dimensions, we assessed each with multiple measures. We report results for both the individual measures (Fig. 2, with illustrative examples in the main text) and the composites formed from them (Fig. 2 and main text), as each is of interest. Given the breadth of the individual measures assessed for each dimension, the reliabilities for the composites vary. Narrower measures of secondary interest (e.g., participants' connection with their alma mater) are reported in the Supplementary Materials (see table S9).

To test the hypothesis that the social-belonging intervention would improve each main outcome for black participants, we focus on the most direct test: the simple effect of condition among black participants. We also report, and illustrate in Fig. 2, the treatment effect among white participants, the main effect of treatment, and the race \times condition interaction for each outcome. In the Supplementary Materials, we additionally report the main effect of race. We also provide results for analyses of the individual measures that comprise each composite and results from extensive robustness tests in the form of specification curves (see table S4). Consistent with the theory that belonging uncertainty would not undermine the outcomes of white participants (and thus an intervention addressing it would not benefit them), the simple effect of treatment among white participants was not significant for any of the main outcomes. After examining the direct effects of treatment on life outcomes, we conduct mediation analyses to test whether the observed treatment effects might arise, in part, from a greater development of substantive mentor relationships in college among black students.

RESULTS

Participants from the original social-belonging intervention trial (10) sample were recontacted 3 to 5 years after college graduation and invited to complete an online survey. They were told only that the survey extended a previous study related to the transition to college, which they had completed in their first year of college. Re-recruitment was high (87%; $N = 80$); achieved through repeated efforts and a \$50 incentive; and did not vary by participant race, condition, or their interaction (see the Supplementary Materials, fig. S1, and tables S2 and S3). On average, respondents completed the follow-up survey 8.50 years after intervention delivery ($SD = 1.22$ years; range: 7.20 to 10.77 years).

All respondents had graduated from college. They were approximately 27 years old ($M_{\text{age}} = 27.42$, $SD = 1.31$; range, 25.43 to 30.97). Most were full-time employed (49%), full-time students (38%), or both (3%). Median annual household income was \$40,000 to \$49,999 (range: $<\$1000$ to $>\$200,000$). Fifty-six percent were in long-term romantic relationships, and none had children. These factors did not differ by race, condition, or their interaction (see the Supplementary Materials).

First, we examined participants' professional lives. Eight and a half years after the treatment, black adults reported greater satisfaction and success in their careers in the treatment condition than in the control condition, $B = 0.74$, $SE = 0.23$, $t(75) = 3.23$, $P = 0.002$, $d = 1.19$ (see Fig. 2). To illustrate, black adults rated their potential to succeed in the future relative to their classmates 16 percentile

Table 1. Primary outcomes and college mentorship mediator. See Measures section of Materials and Methods for greater detail on the individual measures, including citations for established scales.

Composite	Individual measures	No. of items	Sample item
Career satisfaction and success (individual measures standardized and averaged; $\alpha = 0.77$)	Job satisfaction ($\alpha = 0.89$)	8	"I enjoy going to work." 1 = strongly disagree; 6 = strongly agree
	Workplace belonging uncertainty ($r = 0.52$)	2	"When something bad happens, I feel that maybe I don't belong at my workplace." 1 = strongly disagree; 6 = strongly agree
	Self-rated percentile success to date	1	"Using a percentile rank, assess your current level of success compared with other [school] alumni from your class." 0% to 100%
	Self-rated percentile potential to succeed in the future	1	"Using a percentile rank, assess your potential, compared with other [school] alumni from your class, to succeed in the future." 0% to 100%
General psychological well-being (individual measures standardized and averaged; $\alpha = 0.77$)	Subjective happiness ($\alpha = 0.89$)	4	"In general, I consider myself..." 1 = not a happy person; 7 = a very happy person
	Life satisfaction ($\alpha = 0.80$)	5	"In most ways my life is close to my ideal." 1 = strongly disagree; 7 = strongly agree
	Perception of life stress as overwhelming ($\alpha = 0.85$)	4	"In the last month, how often have you felt that you were unable to control the important things in your life?" 1 = never; 5 = very often
Physical health (individual measures standardized and averaged; $\alpha = 0.71$)	Self-reported general health ($\alpha = 0.80$)	5	"My health is excellent." 1 = definitely false; 5 = definitely true
	Sick days (reverse coded)	1	"In the past 3 months, how many days of work or school did you miss due to illness?" open response: numeric
	Doctor visits (reverse coded)	1	"In the past 3 months, how many times did you go to the doctor?" open response: numeric
Community involvement and leadership (summed to yield 0 to 16 scale)	Number of areas very involved in (up to eight)	2	"Since [you received your undergraduate degree], to what extent have you participated in [eight different types of activities, e.g., sports/games, cultural/identity organizations, religious, professional]?" count of activities involved in "a lot"
	Number of areas in which a leadership position was held (up to eight)		"Have you held a leadership position in any of these activities?" count of activities indicated "yes"
College mentorship (individual measures standardized and averaged; $\alpha = 0.61$)	Had a general mentor during college	1	"While you were an undergraduate, was there anyone associated with [school], other than fellow undergraduates, to whom you could turn for support, advice, or encouragement when you faced a problem or difficulty in or out of school?" yes/no
	Had an academic mentor during college	1	"While you were an undergraduate, did anyone associated with [school], other than fellow undergraduates, take a special interest in you and your academic development?" yes/no
	Whether academic mentorship continued after college	1	After having identified an academic mentor they had in college, participants were asked: "When did you receive mentorship from [this college]?" selected "mentorship continued after graduation" or did not
	Importance of "most meaningful" college mentorship	1	"How important to you was the [most meaningful mentorship you received during college]?" 1 = not very important; 5 = extremely important

points higher in the treatment condition than in the control condition (69th percentile versus 53rd percentile), $B = 16.34$, $SE = 5.79$, $t(75) = 2.82$, $P = 0.006$, $d = 1.05$. Whites showed the same pattern on the composite measure but nonsignificantly, $B = 0.28$, $SE = 0.25$,

$t(75) = 1.14$, $P = 0.26$, $d = 0.35$. Thus, the main effect of condition was significant, $B = 0.51$, $SE = 0.17$, $t(75) = 3.02$, $P = 0.003$, $d = 0.73$, and the race \times condition interaction was not, $B = 0.46$, $SE = 0.34$, $t(75) = 1.34$, $P = 0.18$.

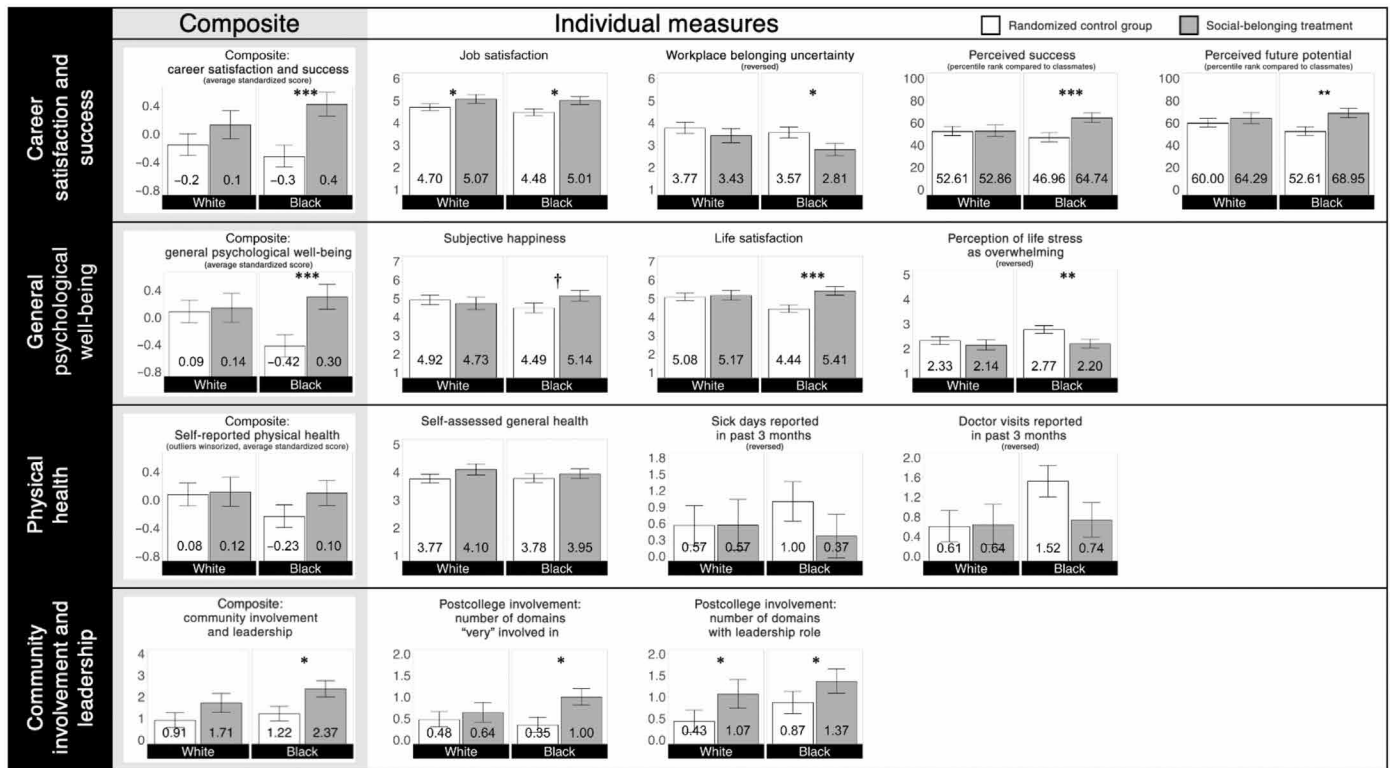


Fig. 2. Graphs of primary results. Primary outcomes 7 to 11 years after intervention by race and condition for composites and the individual scales that comprise them (see Table 1). Error bars represent ± 1 SE. The y axis represents the full range of each scale or, for variables without a fixed scale, a range that captures nearly all of the variation in responses. † $P < 0.10$, * $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$.

In some cases, people achieve professional success at a cost to well-being and health (23), for instance, if success requires exceptional self-regulation. There was no such trade-off here. On indices of general psychological well-being, black adults reported better outcomes in the treatment than in the control condition, $B = 0.72$, $SE = 0.25$, $t(75) = 2.94$, $P = 0.004$, $d = 0.96$. To illustrate, black adults rated their life satisfaction just above the scale midpoint in the control condition ($M = 4.44$, $SD = 1.06$, on a 7-point scale) but nearly a full point higher in the treatment condition ($M = 5.41$, $SD = 0.87$), $B = 0.97$, $SE = 0.31$, $t(75) = 3.15$, $P = 0.002$, $d = 1.01$. Whites showed no effect of treatment on the composite measure, $B = 0.06$, $SE = 0.27$, $t(75) = 0.21$, $P = 0.84$, $d = 0.07$. Because the treatment effect was so strong for black participants, the main effect of condition was significant, $B = 0.39$, $SE = 0.18$, $t(75) = 2.14$, $P = 0.04$, $d = 0.50$, and the race \times condition interaction marginally so, $B = 0.67$, $SE = 0.37$, $t(75) = 1.83$, $P = 0.07$. Notably, there was a significant racial inequality in the control condition; black participants reported significantly less well-being than white participants, $B = -0.51$, $SE = 0.23$, $t(75) = 2.16$, $P = 0.03$, $d = 0.63$. Treatment eliminated (directionally reversed) this disparity, $B = 0.16$, $SE = 0.28$, $t(75) = 0.58$, $P = 0.57$, $d = 0.22$.

Next, we examined self-reported physical health. Consistent with research that feelings of social connectedness are one of the strongest predictors of physical health (24), treatment had improved this outcome among black students at the end of college (10). However, at this more distal point, black participants reported directionally better health with treatment, but the effect was not statistically significant,

$B = 0.36$, $SE = 0.25$, $t(75) = 1.48$, $P = 0.14$, $d = 0.41$. The effect was also nonsignificant for whites, $B = 0.14$, $SE = 0.27$, $t(75) = 0.52$, $P = 0.60$, $d = 0.23$, and overall, $B = 0.25$, $SE = 0.18$, $t(75) = 1.38$, $P = 0.17$, $d = 0.32$, with a nonsignificant race \times condition interaction, $B = 0.22$, $SE = 0.37$, $t(75) = 0.61$, $P = 0.54$.

An important goal of college is to prepare people to join and lead new communities (25). At its heart, the belonging intervention addresses the opportunity to integrate into new communities, even when doing so is difficult at first. Therefore, we examined the extent to which participants reported substantial contributions to nonwork community groups (e.g., outreach/service, cultural/identity, and political organizations) after college. Black adults reported greater involvement and leadership with treatment, $B = 1.15$, $SE = 0.51$, $t(75) = 2.27$, $P = 0.03$, $d = 0.66$. For example, 68% of black adults in the treatment condition, but only 35% in the control condition, reported having held at least one leadership position outside of work, $B = 1.40$, $SE = 0.66$, $z = 2.12$, $P = 0.03$, *Odds Ratio* (OR) = 4.06. In particular, the treatment increased black adults' contribution to outreach/service and cultural/identity organizations (see table S5). White participants also showed a trend toward greater community involvement and leadership, $B = 0.80$, $SE = 0.55$, $t(75) = 1.44$, $P = 0.15$, $d = 0.57$, so the main effect of treatment was significant, $B = 0.98$, $SE = 0.38$, $t(75) = 2.60$, $P = 0.01$, $d = 0.64$, and the race \times condition interaction was not, $B = 0.35$, $SE = 0.75$, $t(75) = 0.47$, $P = 0.64$.

How could a 1-hour exercise cause lasting gains in broad life outcomes? Undoubtedly, life outcomes unfold dynamically over years and are multiply mediated by an array of psychological, behavioral,

structural, and relational processes (see Fig. 1). For the present study, we examined the potential role of two factors, postintervention college grades and college mentorship. Both represent important aspects of the “better experience” fostered by the social-belonging intervention in college. Furthermore, both may be understood as reflecting the cumulative effects of diverse processes in college (see Fig. 1).

First, although black students attained higher postintervention grades with treatment (10), grades only modestly predicted black adults’ career success ($r = 0.38, P = 0.03$), well-being ($r = 0.23, P = 0.18$), and community involvement ($r = 0.35, P = 0.05$) in bivariate correlations (see table S6A). Furthermore, results from mediation analyses indicated that postintervention grades did not explain intervention effects on any of the life outcomes examined. Zero was included in the confidence interval (CI) for the indirect effect in the bootstrapped mediation analysis for each outcome, although the mediation analysis approached significance for community involvement and leadership (see table S7).

Second, black adults reported greater mentorship during and after college with treatment, $B = 0.67, SE = 0.21, t(75) = 3.16, P = 0.002, d = 1.16$ (see Fig. 3A). To illustrate, the percentage of black adults who reported having developed an academic mentor during college was nearly twice as high in the treatment condition (84%) than in the

control condition (43%), $B = 1.94, SE = 0.76, Z = 2.56, P = 0.01, OR = 6.93$. The percentage who reported that this mentorship continued after college was also much higher with treatment (37%) than without (4%), $B = 2.55, SE = 1.13, Z = 2.26, P = 0.02, OR = 12.83$. Whites showed a trend in the same direction on the composite measure, $B = 0.34, SE = 0.23, t(75) = 1.46, P = 0.15, d = 0.45$, so the main effect of condition was significant, $B = 0.50, SE = 0.16, t(75) = 3.21, P = 0.002, d = 0.76$, and the race \times condition interaction was not, $B = 0.33, SE = 0.31, t(75) = 1.06, P = 0.29$.

For black participants, the composite mentorship measure robustly predicted career success ($r = 0.54, P < 0.001$), psychological well-being ($r = 0.65, P < 0.001$), and community involvement ($r = 0.38, P = 0.01$) in bivariate correlations (see table S6A). Of note, these correlations were of smaller magnitude and did not reach significance for white participants ($-0.08 \leq r \leq 0.29$) [see table S6B; see also (21)]. Furthermore, results from mediation analyses indicated that the composite mentorship measure statistically mediated the gains in career success and psychological well-being for black adults. Zero was not included in the CI for the indirect effect in the bootstrapped mediation analysis for either outcome (see Fig. 3B). For community involvement and leadership, the mediation analysis approached but did not reach significance (see table S7).

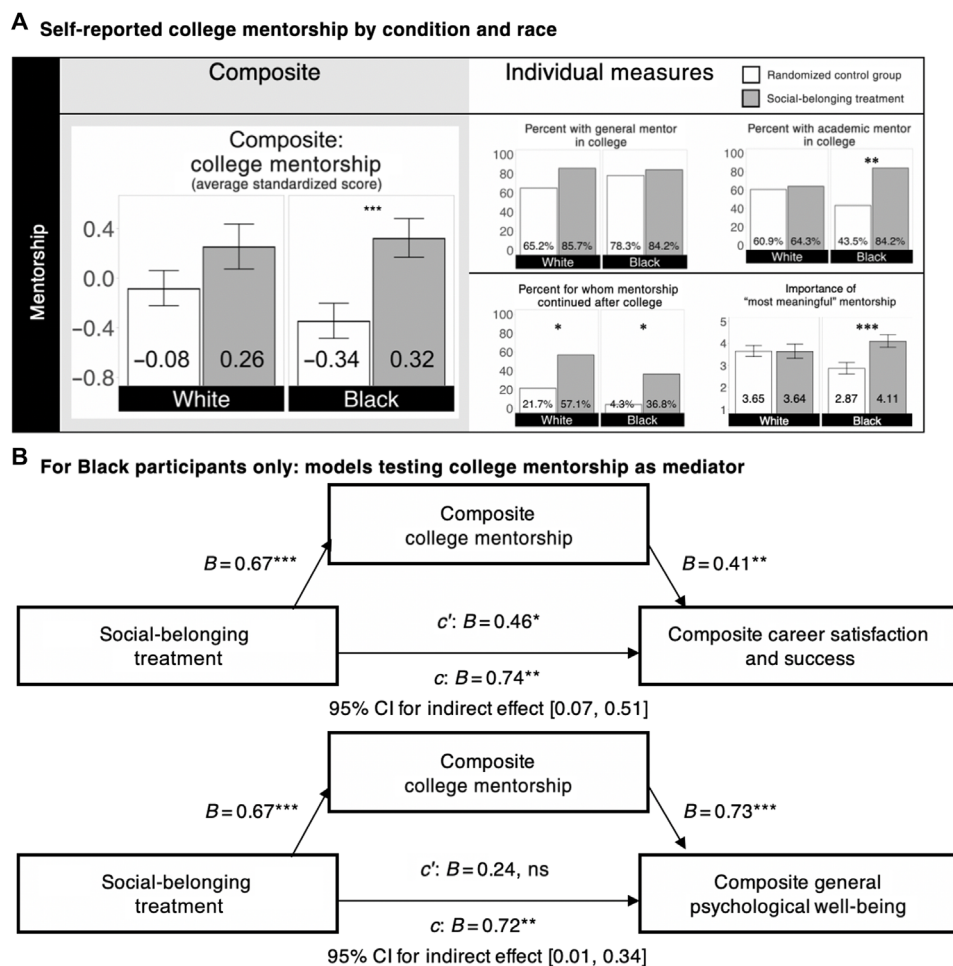


Fig. 3. College mentorship outcome and mediation models. (A) Self-reported college mentorship by race and condition. Error bars represent ± 1 SE. (B) For black participants, college mentorship mediated intervention effects on composite career satisfaction and success and on general psychological well-being. Mediation was observed ($\alpha = 0.05$) if the bootstrapped 95% CI of the indirect effect did not include zero, which occurred in both cases. * $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$. ns, not significant.

Although these results are correlational, they are consistent with our theorizing. Participants' open-ended comments illustrate their experiences with mentors in college. One black participant (control condition) wrote, "I wouldn't say I received any mentorship at [school] - not for lack of interested professors, but I didn't really seek it." Another (treatment condition) wrote, "The first semester of my freshman year was very difficult for me. I was struggling academically, didn't feel like I fit in...I began to spend more time speaking with my freshman counselor. We really bonded, and she helped me to realize that I did belong at [school]. Thanks to her, I was able to connect better with my peers and perform better academically. We've kept in touch ever since." Table 2 provides the full text of these and other responses. They illustrate the importance of mentors to students' development and the difference in black participants' experiences by condition.

DISCUSSION

The present study shows that a brief intervention to address worries about belonging in the transition to college improved major life outcomes for black Americans 7 to 11 years later. The outcomes improved by the intervention—career satisfaction and success, psychological well-being, and community involvement and leadership—represent key aspects of a life well lived. The magnitude of the effects on well-being is particularly noteworthy, given the past findings that many kinds of interventions, including therapy (26), and major life events such as marriage, divorce, and unemployment (27), have quite modest effects on well-being. Moreover, we provide evidence for one way the intervention seems to have helped black adults thrive: by helping them connect to a valuable resource in their college environment, a mentor.

A major contribution of this study is to highlight a social-psychological barrier to the thriving of black Americans: belonging uncertainty. Without an intervention to address uncertainty about belonging in the transition to college, our results indicate that black students ended up with worse outcomes in adulthood than they, and their postsecondary context, had the potential to achieve. Opportunities to form consequential, lasting relationships with mentors went unrealized. Lower rates of professional success and personal well-being followed.

The results underscore the importance of mentors in college. Relationships with mentors, not grades, mediated the long-term gains. Yet, the intervention was not a mentorship program in which students were assigned a mentor by college administrators. Instead, the intervention lifted a psychological obstacle—persistent group-based worry about belonging, rooted in awareness of social disadvantage—to allow students to develop, on their own, authentic relationships of significance that, in many cases, lasted well past college graduation (28). Such student-initiated relationships may be more meaningful and garner greater commitment from both students and mentors (29). The results suggest the value for institutions of assessing and addressing disparities in the organic development of social ties on campus, especially by examining the structures, opportunities, and psychological processes that foster or inhibit the development of student-initiated mentor relationships.

Although mentor relationships statistically mediated the lasting gains of the intervention in this context, the intermediary factor by which a belonging intervention improves distal outcomes may differ elsewhere (13). For instance, at colleges with lower persistence

rates, graduation may be the most important predictor of later life success (although mentors may also facilitate this outcome), a milestone toward which the belonging intervention can facilitate progress (12). In middle school, interventions to reduce psychological threat can yield lasting gains (e.g., increasing college-going) because short-term academic gains fostered by the intervention can help students enter more advanced academic tracks (18). While the mechanism that gives rise to lasting gains may differ in each case, an important lesson is that the subjective can become objective. A new way of thinking afforded by a psychological intervention concatenates through self-reinforcing processes to improve the objective reality of people's lives (5–7).

Why did the treatment fail to improve the health outcomes of black adults when it had done so years earlier in college (10)? Perhaps the initial health benefits faded with time. Alternately, perhaps the present study was underpowered to detect health benefits, a possibility made more likely by the heterogeneity in our participants' lives after college. The end of college is a relatively homogeneous and uniformly stressful context (30), which may have increased our ability to detect effects at that point. After college, factors beyond the reach of the intervention may have a relatively larger impact on health, such as the availability of health care or the idiosyncratic timing of occupational stress. If power is the key issue, then more sensitive measures, such as measures that go beyond self-report assessments, or more distal measures when greater health issues have arisen may again reveal differences.

In its focus on the psychological determinants of life success, the present study invites comparison to classic research on major structural reforms that can improve life trajectories, such as increasing opportunities for early childhood education (31). Bringing these areas together, it is essential to ensure both that opportunities are available and that people make sense of these opportunities in ways that promote success. Structural investments are often necessary to support positive life trajectories (3, 31). Yet their full benefit will not be realized if psychological barriers such as doubt about belonging get in the way. Although our study focused on college students, the mutual dependence between individual psychology and social structure is broadly applicable. Where else do the reasonable ways people make sense of themselves and their situation impede them from taking full advantage of opportunities and resources available to them (5, 32)? Where are people confident and ready to learn, to connect, and to grow but necessary structures or opportunities are inadequate for them to thrive?

As the present study followed up on the only social-belonging intervention whose participants have reached their late 20s, our sample size was constrained by the original study. In addition, for many reasons, it is often difficult to achieve large samples at distal assessments. Despite this, we were able to retain 87% of the original sample.

Notably, the magnitude of the treatment effects reported here may represent an upper bound, as all participants attended a single, well-resourced college and the intervention was an intensive, in-person experience, albeit a brief one. An open question, and an important direction for future research, involves boundary conditions: In what kinds of school contexts are treatment benefits more or less likely (16, 33)? For instance, how might the belonging intervention function in less selective institutions with lower graduation rates, or in majority-minority institutions where belonging concerns, may differ (12)? In general, we expect the greatest benefits in settings

Table 2. Mentorship stories. Illustrative examples of participants' open-ended descriptions of their most meaningful mentor relationships during college.

Control condition	
Black woman (from main text)	I wouldn't say I received any mentorship at [school] - not for lack of interested professors, but I didn't really seek it.
Black man	As a student who spend most of my life living abroad, having a freshman counselor who understood the challenges associated with adjusting to life both from a social aspect and an academic aspect in the US was key. He helped to me to see and adjust to new ways of thinking about problems, skills that I will need moving forward.
Black man	I don't think I necessarily had a mentor-mentee relationship with anyone at [school]. I definitely looked up to and sought out advice from older brothers in my fraternity, but it wasn't until having graduated from [school] that I realized the importance of meaningful mentorship relationships.
White woman	I had a very deep relationship with my senior thesis adviser. One summer, while I was doing an internship in Greece in a field related to my studies, my mentor came to visit me all the way from the United States. Given his old age, I think this was a true sign of how much he cared. He always took interest in how am I balancing academia and athletics and took an effort to get to know me personally.
White man	My senior year I had been struggling with some personal issues. The Dean of my college took a personal interest in my predicament and was very supportive. He provided academic advice and post-graduate employment assistance.
White man	A lot of professors, one in particular, influenced the way I thought. They made me smarter and they helped me write well. I loved the material, though, not the professors, and I left [school] without mentors.
Social-belonging treatment condition	
Black man (from main text)	The first semester of my freshman year was very difficult for me. I was struggling academically, didn't feel like I fit in, and was unhappy with my major. I really did not feel like I belonged at [school]. At the halfway point in that semester I was totally miserable. Around that time, I began to spend more time speaking with my freshman counselor. We really bonded, and she helped me to realize that I did belong at [school]. Thanks to her, I was able to connect better with my peers and perform better academically. We've kept in touch ever since.
Black man	I had several professors with whom I had either taken multiple classes and/or worked on independent projects. Those professors offered me advice on academic and professional development at and after [school] and continue to be in touch with me. I met with the on various occasions during my senior year to talk about my life and my interests. Since graduating from [school], I returned one year later to meet with those professors individually to help decide potential next steps for myself. I was uncertain whether I wanted to pursue [career], [career], [career], or [career] as a career. My professor mentors not only spoke with me in person when I visited [location of school] but also put me in connect with other people.
Black woman	One of my most powerful mentors was professor in [my major] department. For some reason, he took a particular interest in me and we met often informally for lunch to talk about kinds of things -- current events, my career and of course my research. We stayed in touch (though I should e-mail him more) and he ended up writing me a rec for grad school several years after I graduated.
Black woman	One of the most meaningful mentorships came from my Math professor. I started in basic mathematics, but was interested in [other related discipline]. However, on the first math mid-term, I almost failed the test. I went to speak to the professor and, when he learned I wanted to be an engineer, he said "well, basic calculus is the foundation of all engineering, so you'd better shape up", or something like that. It actually really discouraged me at first. But, then I spoke with my mom and realized that I just needed to get back to basics. I started going to math tutor sessions... and also bought a basic geometry/trig book to help me remember the basics. In fact, the next two mid-terms, I scored the 3rd or 4th highest in the class and ended up acing calculus. Along the way, the professor saw my improvement and started mentoring me. He and I would talk after class, not just about the class, but more about life, in general, and my interest in engineering, specifically. He helped me tremendously and we stayed in touch, even as I left his class in the Spring. He nominated me for a scholarship and in general kept in touch with me throughout the next year, until he retired.
White man	My professor, [name], has stayed in touch with me since I graduated and has helped me connect to various health policy experts....However, I wouldn't say that I had one specific mentor who worked with me throughout all four years, but rather a series of professors who helped connect me to new resources....I had good relationships with several professors who offered several different pieces of advice that has helped me in my career.
White woman	I had a very good relationship with my college dean. He was easy-going and always available to chat if needed. Additionally, he remained objective when listening to questions/concerns. He made me feel important in the [school] community and also supported.

where belonging uncertainty constitutes a barrier to success—where there are resources to succeed, and genuine opportunities to belong, yet negative stereotypes and a history of group-based disadvantage lead students to question their belonging. Conversely, the intervention is likely to have limited benefits in contexts where genuine opportunities to belong are lacking and/or where resources are sorely lacking, as this could undermine the ability of students to

act productively on the new way of thinking afforded by the intervention. For instance, if a context lacks opportunities to cultivate mentors, then outreach from students will not meet with success. And we would expect later life course benefits of the intervention when it helps students accrue benefits in college—such as an outlook on adversity, a credential, and/or relationships—that perpetuate positive outcomes in the next stage of their lives.

When people do not thrive, it can seem that they lack essential skills or that their context lacks of opportunity. However, black participants in our sample were academically prepared and attended a well-resourced university. Still, their thriving as both students and adults was impeded by a persistent uncertainty about their belonging in college. The results highlight the potential, already present in at least some individuals and some institutions, to achieve substantially better outcomes. This potential can be hidden yet realized if institutions anticipate and proactively address overriding social-psychological concerns that shape individuals' lives (32, 34). In illuminating this dynamic, our findings highlight a psychological mechanism by which a history of sociocultural disadvantage can perpetuate inequality to new generations and how this process can be interrupted with targeted and timely intervention.

MATERIALS AND METHODS

Experimental design

The present study examined effects of the social-belonging intervention, particularly for black participants, on major life outcomes after college. The design of the original study was a 2 (condition: control or social-belonging intervention) \times 2 (race: black or white) between-subjects experiment. The follow-up study preserved the same design, and no new manipulations were introduced. We obtained human subjects approval from the Stanford University Institutional Review Board (IRB) and followed ethical guidelines in conducting this research. The original study procedures, including the sampling procedure, random assignment to condition, and intervention and control materials, are described in detail in the Supplementary Materials for the report of college outcomes (10).

University context of original intervention study

The original intervention study took place at a selective university in the United States. Its selectivity is illustrated by the high college entrance exam scores of the study participants. Overall, black participants had an average SAT-Math + Verbal score of 1399 on a 1600-point scale, and white participants had an average score of 1500. At the university, black students were a numeric minority, representing between 5 and 15% of the undergraduate student body at the time of the study.

Despite its selectivity, there were large racial disparities in achievement at the university. This was illustrated in the previously published study reporting college outcomes (10): Black students in the control condition had GPAs for the final 3 years of college that were almost a third of a letter grade lower than the GPAs of their white peers.

Participant recruitment

To recruit participants, we obtained contact information from the alumni directory at students' alma mater and from social media (e.g., LinkedIn). We first sent all participants for whom we had a physical mailing address a letter inviting them to participate in the study. This letter was followed by subsequent phone, email and social media outreach. Final attempts to reach participants included a postcard to their home address from college. Recruitment took place over a 19-month period. The first participant responded on 29 June 2012. We closed the survey on 30 January 2014. Most participants (64%) took part within the first 5 months of study recruitment (between 29 June 2012 and 1 December 2012). Participants were offered a \$50 Amazon gift card as compensation.

As noted, the study was described to participants as extending a previous study they had taken part in during their first year of college on the transition to college. No additional information on study hypotheses, methods, or results was provided.

Participants

Participants completed the study between 7 and 11 years after the initial study participation. At this time, most participants were 26 to 29 years old. All had earned their undergraduate degree from the selective private university, most within 4 years of initial matriculation, consistent with the high on-time graduation rate at the institution.

At follow-up, nearly all participants identified themselves as being full-time employed (49%), full-time students (38%), or both (3%). Common career fields were health care (23%), law (20%), technology/engineering (14%), and education (10%). Of the eight participants who did not identify themselves as full-time students or full-time employed, two reported being full-time homemakers, one was studying full-time for the bar exam, one had just left a full-time job to start a company, one was finishing a second bachelor's degree (part-time) while looking for a job, and three did not provide more information about employment. The median annual salary was \$40,000 to \$49,999 (mode, less than \$1000; range, less than \$1000 to more than \$200,000). The median household income was also \$40,000 to \$59,000 (mode, \$30,000 to \$39,999; range, less than \$1000 to more than \$200,000). Among those not attending school full-time, the median annual salary was \$50,000 to \$59,000.

To help characterize the sample, we also asked participants about their home life and civic engagement. Overall, half (56%) of participants reported being in a long-term romantic relationship, including marriage. None had children. Most (84%) had voted in the most recent U.S. Presidential Election, and very few (5%) had ever been convicted of a crime. See table S1 for demographic factors reported by race and treatment condition. As the table illustrates, none of these factors differed significantly by condition or the interaction between race and condition.

Measures

Below, we briefly describe each measure that contributed to the composites, describe how composites were constructed, and provide correlations between scales that formed composites. The one variable not assessed via the survey was postintervention grades, which we tested as a mediator. For this variable, we used the primary post-intervention academic outcome from the end-of-college follow-up (10): sophomore-through-senior year GPA earned during normal academic terms (i.e., excluding summer courses), obtained from official university records during the previous wave of the study.

Survey instrument

An annotated version of the Survey Instrument is available on Open Science Framework (osf.io/xz3hr). The survey instrument document provides the full text of primary and secondary measures and accurately represents the order in which measures were assessed. Below, we include the page number(s) on which particular measures can be found.

Given the nature of the study and the extensive efforts required to reach the sample, the survey instrument included a wide variety of questions. The present report focuses on participants' reports along four major indices of adult thriving: career satisfaction and success, psychological well-being, physical health, and community

involvement and leadership. It also examines college mentorship as a mediator of adult thriving. In the Supplementary Materials, we additionally report results for narrower outcomes of secondary interest (participants' connection to their alma mater, clinical measures of mental health, social support and loneliness, perceived social status, and cognitive accessibility of stereotypes and self-doubt) and for variables related to racial attitudes and experience on which we did not expect intervention effects. Measures not included in the present report assessed participants' experiences during or before college, other outcomes on which we did not expect intervention effects (e.g., grit and primary appraisal of stress), open-ended questions, and outcomes we may report elsewhere (e.g., current friendship networks).

Career satisfaction and success

The career satisfaction and success composite comprised four measures, which were standardized and then averaged to create the composite ($\alpha = 0.77$) (see Table 1).

1) Job satisfaction. Job satisfaction was measured with eight items on or rescaled to be on a 1 to 6 scale ($\alpha = 0.89$). Items were drawn or adapted from various career satisfaction or related scales (35, 36). We had originally intended to include a ninth item focused on job burnout ("I feel emotionally drained from my work"). However, the item reduced scale reliability and did not load on the same factor as the other items, so it was dropped (see pp. 57–58 of the Survey Instrument).

2) Workplace belonging uncertainty. Workplace belonging uncertainty was measured with two items [adapted from (10)]. We included a third item ("When something good happens, I feel that I really belong at my workplace") but, consistent with past practice (10), we dropped it because of its low correlation with the other items. Both items were assessed on a 1 to 6 scale ($r = 0.52$) (see p. 45 of the Survey Instrument).

3) Perceived success. Perceived success was measured with one item [adapted from (9)]. It asked participants to compare their success to date to the success of other students from their alma mater who graduated in the same year using a percentile ranking between 0 and 100 (see p. 45 of the Survey Instrument).

4) Perceived future potential. Perceived future potential was also measured with one item [adapted from (9)]. It asked participants to compare their potential to succeed in the future to the potential of other students from their alma mater who graduated in the same year to succeed in the future using a percentile ranking between 0 and 100 (see p. 44 of the Survey Instrument).

Psychological well-being

The psychological well-being composite comprised three measures, which were standardized and then averaged to create the composite ($\alpha = 0.76$) (see Table 1).

1) Subjective happiness. Happiness was measured with the four-item Subjective Happiness Scale (37). All items were assessed on a 1 to 7 scale ($\alpha = 0.89$) (see pp. 25–26 of the Survey Instrument).

2) Life satisfaction. Life satisfaction was measured with five items. Four items were drawn from the Satisfaction With Life Scale [SWLS; (38)]. The fifth was based on a single-item life satisfaction measure widely used in national panel studies (39). The single-item measure was originally on a 10-point scale but was rescaled to 1 to 7 so as to be on the same scale as the SWLS and then averaged with the other four items ($\alpha = 0.80$) (see pp. 22–24 of the Survey Instrument).

3) Perceived stress. Following past research (16), we were primarily interested in how overwhelming people found stress they experienced (secondary appraisal) rather than how much stress people reported they experienced (primary appraisal). Therefore, we measured perceived stress with the short version of the Perceived Stress Scale (40). All items were assessed on a 1 to 5 scale ($\alpha = 0.85$) (see pp. 28–29 of the Survey Instrument).

Physical health

The physical health composite comprised three measures, patterned on those used previously with this sample (10). The three measures were standardized and then averaged to create the composite ($\alpha = 0.71$) (see Table 1).

1) Self-assessed general health. We assessed self-reported general health with the five-item general health component of the Medical Outcomes Study Short-Form Health Survey (41). All items were assessed on a 1 to 5 scale ($\alpha = 0.80$) (see p. 35 of the Survey Instrument).

2) Sick days in the past 3 months. Participants reported how many sick days they had taken from work or school in the past 3 months (open response) (see p. 36 of the Survey Instrument). There were a few outliers on this measure. In primary analyses, we used a nontransformed version of the variable. However, we also created a winsorized version of the variable. The specification curve results (discussed below) indicated that the results were substantively similar regardless of which variable was used.

3) Doctor visits in the past 3 months. Participants reported how many times they had visited the doctor in the past 3 months (open response) (see p. 36 of the Survey Instrument). There were a few outliers on this measure. In primary analyses, we used a nontransformed version of the variable. However, we also created a winsorized version of the variable. The specification curve results (discussed below) indicated that the results were substantively similar regardless of which variable was used.

Community involvement and leadership

The community involvement and leadership composite comprised two measures ($r = 0.24$), which were summed to create the composite (see Table 1).

1) Number of domains very involved in. On a three-point scale (1 = not at all, 2 = some, and 3 = a lot), participants were asked about the extent of their involvement in activities related to eight nonwork domains since earning their undergraduate degree. The domains are listed in table S5. We counted the number of domains in which participants reported "a lot" of involvement [see (42)] (see p. 62 of the Survey Instrument).

2) Number of domains with leadership role. For each domain in which participants reported at least "some" involvement, they were asked whether they had held a leadership position in that domain since earning their undergraduate degree. We counted the number of domains in which participants reported having had a leadership position (up to eight) (see p. 63 of the Survey Instrument).

College mentorship

The college mentorship composite comprised four measures, which were standardized and then averaged to create the composite ($\alpha = 0.69$) (see Table 1). As these measures are retrospective, it is possible that it assesses only how much mentorship participants recalled, not how much they experienced. However, the pattern of results accords with immediate postintervention daily diary measures of greater

engagement with faculty from the same sample (9) and with greater contemporaneously reported mentor development in the first year of college in other trials (12).

1) Had a general mentor in college. Participants were asked whether they had someone “to whom you could turn for support, advice, or encouragement when you faced a problem or difficulty in or out of school” in college (binary “yes” or “no”) (see p. 17 of the Survey Instrument).

2) Had an academic mentor in college. Participants were asked whether they had someone who “[took] a special interest in you and your academic development” in college (binary yes or no) (see p. 18 of the Survey Instrument).

3) Whether academic mentorship continued after college. Participants were asked when they had received mentorship from the person(s) they identified as their academic mentor. Options included each semester of college and “mentorship continued after graduation.” Selecting yes to the postcollege time period was coded as 1 (otherwise 0) (see p. 20 of the Survey Instrument).

4) Importance of “most important” mentorship. After answering the other mentorship questions, participants were asked to write an open-ended prompt to the question, “Describe the nature and quality of the most meaningful mentorship you received at [school].” Then, they were asked to rate the importance of this mentorship (1 = not very important and 5 = extremely important) (see p. 21 of the Survey Instrument).

Statistical analysis

Primary outcomes

Outcomes were analyzed using linear or logistic regression, as appropriate, with intervention condition (control or social-belonging treatment) and participant race (black or white) as contrast-coded between-subjects factors. To test the robustness of the results, we conducted a specification curve analysis (43) for each main outcome and the mentorship composite. As discussed in the Supplementary Materials (see table S8), analyses indicated that results were robust across various plausible model specifications and not likely due to chance. Thus, the main text reports results from the most parsimonious models without covariates.

Mediation analyses

To conduct the mediation analyses, we used the structural equation modeling R package lavaan (44). As predicted by theory and consistent with past findings (9, 10) treatment effects emerged only or especially for black participants. Thus, we only included black participants in the mediation analyses. Analyses of postintervention grades controlled for preintervention grades. We specified a 95% CI and 10,000 resamples. We considered mediation to be observed ($\alpha = 0.05$) if the resulting 95% CI of the indirect effect did not include zero.

Data

All data needed to evaluate the conclusions in the paper are present in the paper and/or the Supplementary Materials. Additional data are available from authors upon request and, if needed, IRB approval.

SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at <http://advances.sciencemag.org/cgi/content/full/6/18/eaay3689/DC1>

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Acknowledgments: We thank A. Alston, M. Bong, N. Cantor, J. Clark, K. Hullar, and J. P. Ospina for research assistance and J. and B. Detweiler-Bedell for inspiration for the mentorship measure. **Funding:** Support for this research was provided by a grant from the Robert Wood Johnson Foundation to G.M.W. The views expressed here do not necessarily reflect the views of the Foundation. The research was also supported by a National Science Foundation Graduate Fellowship awarded to S.N.J. **Author contributions:** Conceptualization and methodology: S.T.B., G.M.W., and G.L.C. Project administration: S.T.B. Supervision: G.M.W. and G.L.C. Funding acquisition: G.L.C., G.M.W., and S.T.B. Investigation: S.T.B., G.L.C., and G.M.W. Formal analysis and data curation: S.T.B. and S.N.J. Writing (original draft): S.T.B. and G.M.W. Writing (review and editing): S.T.B., G.M.W., S.N.J., and G.L.C. **Competing interests:** The authors declare that they have no competing interests. The authors have disseminated findings from research to K-12 schools, universities, nonprofit entities, or private entities via paid or unpaid speaking appearances or consulting. No author has a financial relationship with any entity that sells social-belonging products or services. **Data and materials availability:** All data needed to evaluate the conclusions in the paper are present in the paper and/or the Supplementary Materials. Additional data related to this paper may be requested from the authors (IRB approval may be needed.) Study materials are available on Open Science Framework (osf.io/xz3hr).

Submitted 12 June 2019

Accepted 5 February 2020

Published 29 April 2020

10.1126/sciadv.aay3689

Citation: S. T. Brady, G. L. Cohen, S. N. Jarvis, G. M. Walton, A brief social-belonging intervention in college improves adult outcomes for black Americans. *Sci. Adv.* **6**, eaay3689 (2020).