CHILD DEVELOPMENT

Child Development, July/August 2013, Volume 84, Number 4, Pages 1241–1252

Role Models and the Psychological Characteristics That Buffer Low-Socioeconomic-Status Youth From Cardiovascular Risk

Edith Chen
Northwestern University

William K. Lee, Lisa Cavey, and Amanda Ho
University of British Columbia

Little is understood about why some youth from low-socioeconomic-status (SES) environments exhibit good health despite adversity. This study tested whether role models and "shift-and-persist" approaches (reframing stressors more benignly while persisting with future optimism) protect low-SES youth from cardiovascular risk. A total of 163 youth, ages 13–16, completed role model interviews and shift-and-persist measures while cholesterol and inflammatory markers, interleukin-6 (IL-6), and C-reactive protein were assessed. Low-SES youth with supportive role models had lower IL-6. Low-SES youth high in shift-and-persist also had lower IL-6. Shift-and-persist partially mediated the interaction of SES and role models on IL-6. Benefits were not found among high-SES youth. Identifying psychological buffers in low-SES youth has implications for health disparities.

Low socioeconomic status (SES) is one of the most robust social determinants of chronic disease in developed countries. For example, individuals living under low-SES circumstances consistently experience greater morbidity and mortality from cardiovascular diseases (CVD), including coronary heart disease and stroke (Kaplan & Keil, 1993; Pollitt, Rose, & Kaufman, 2005). Low-SES is also associated with established risk factors for CVD, including markers of systemic inflammation such as C-reactive protein (CRP) and interleukin-6 (IL-6), and metabolic symptoms such as high cholesterol and obesity (Alley et al., 2006; Dowd, Zajacova, & Aiello, 2010; Karlamangla et al., 2005).

Furthermore, research has identified childhood as an important time during which low-SES seems to have especially potent and lasting effects on health. For example, low childhood SES is associated with greater metabolic risk and insulin resistance during adolescence (Goodman, Daniels, & Dolan, 2007; Goodman, McEwen, Huang, Dolan, & Adler, 2005). In addition, low childhood SES increases the risk of developing stroke and coronary heart disease later in adult life, independent of current SES (Galobardes, Smith, & Lynch, 2006; Miller, Chen, & Parker, 2011).

This study was funded by Canadian Institutes of Health Research Grant FRN: 97872. All authors declare no conflicts of interest.

Correspondence concerning this article should be addressed to Edith Chen, Department of Psychology, Northwestern University, Vancouver, BC V6T1Z4, Canada. Electronic mail may be sent to echen@psych.ubc.ca.

Resilience in a Low-SES Context

Studies that have linked low-SES to poor health, however, have often left unanswered an important question: Why do some individuals *not* get sick despite facing persistent and severe adversity? Although there are certainly numerous environmental and behavioral factors that explain why low-SES is detrimental to health, including heightened exposure to toxic pollutants, greater engagement in detrimental health behaviors such as smoking, and negative psychological states such as depression (Evans, 2004; Lynch, Kaplan, & Salonen, 1997; Matthews, Gallo, & Taylor, 2010), these factors cannot explain why some individuals thrive despite confronting adverse circumstances such as poverty. This type of thriving has been labeled by researchers as resilience (Masten, 2001; Masten et al., 1988).

Resilience has been extensively discussed within the developmental psychopathology literature (Garmezy, 1985; Masten & Coatsworth, 1998; Rutter, 1987; Werner, 1995). Over the years, this resilience literature has identified key factors at the child (e.g., temperament, emotion regulation), family (e.g., warm, responsive caregiving), and neighborhood (e.g., connections to community adults) levels that buffer children facing adversity from behavioral problems and academic failures (Garmezy,

 0009-3920/2013/8404-0010
DOI: 10.1111/cdev.12037

1985; Luthar, 2006; Masten, 2001; Masten & Coatsworth, 1998; Rutter, 1987). For the most part, however, these studies have focused on psychological adaptation among children (Masten & Coatsworth, 1998; Werner, 1995).

Rarely has the notion of resilience been explored with respect to physical health in children. When considering psychological factors that would promote positive physical health, it is important to identify characteristics that not only are beneficial in the context of adversity but that also have plausible effects on physiological systems that are implicated in disease. For example, traditional models state that low-SES evokes acute physiological stress responses, which over the long term can promote pathogenic processes, such as systemic inflammation, that result in chronic illnesses such as CVD years later (Miller, Chen, & Cole, 2009; Treiber et al., 2003). Hence, psychological factors that buffer the effects of low-SES on health would need to be able to mitigate the physiological responses of these systems to the barrage of stressors that low-SES children face.

Shift-and-Persist

We recently developed a theoretical account of the factors that are protective from a physiological and physical health perspective, identifying a set of psychological characteristics—labeled "shift-and-persist"—that represents a physiologically adaptive approach to dealing with stressors in a low-SES context (Chen & Miller, 2012). We propose that a lifetime of facing constraints with limited options leads those living in a low-SES context to place value on the ability to accept and adjust oneself to stressors that occur in daily life (*shifting*). Shifting entails accommodating the self to stressors through cognitive reappraisals (i.e., reframing the meaning of a stressor in a less threatening manner) and emotion regulation. Coping via efforts to regulate the self may be particularly beneficial under conditions in which stressors are largely uncontrollable and when resources for dealing with stressors are limited (and may in fact be more fruitful than proactively trying to resolve stressors).

At the same time, in this context, successful adaptation entails enduring adversity with strength, finding meaning in difficult situations, and holding on to hope or optimism in the face of adversity (*persisting*). Persisting may be beneficial because it allows low-SES individuals to focus on their futures (rather than on current adversities) and because the search for meaning allows people to maintain hope, particularly when confronting adversity (Updegraff, Silver, & Holman, 2008). We propose that it is the combination of approaches (shifting plus persisting), rather than either one on its own, that will reduce physiological responses to stress acutely among low-SES individuals, and by doing so, over time will mitigate the long-term progression of pathogenic processes that lead to chronic disease (Chen & Miller, 2012).

Developmental Origins of Shift-and-Persist

Developmentally, we propose that one route by which shift-and-persist characteristics emerge is when in the midst of adversity, children find positive role models. Role models refer to important figures who have a significant influence on a child's life (Greenberger, Chen, & Beam, 1998). Role models serve a number of functions related to support and inspiration (Greenberger et al., 1998; Hurd & Zimmerman, 2010; Yancey, Siegel, & McDaniel, 2002).

Role models help to promote shifting-and-persisting in part by facilitating beliefs that others can be trustworthy and dependable, which in turn help shape children's reappraisals of stressful situations. Role models also help orient youth toward their futures, promoting optimism and the discovery of meaning in one's life. In particular, role models can help promote shift-and-persist strategies in youth by modeling the use of shift-and-persist strategies themselves and by coaching youth in the use of these strategies during stressful situations (Chen & Miller, 2012).

Role models (in particular, parents) help children develop emotion regulation strategies beginning early in childhood (Eisenberg, Cumberland, & Spinrad, 1998). However, when it comes to shift-and-persist strategies, we postulate that its development occurs later, typically in adolescence. This is because the abilities required to engage in shift-and-persist (cognitively reframing stressful situations and focusing on one's future in order to maintain hope and optimism) are known to be ones that develop later in childhood (Heckhausen & Schulz, 1995; Nurmi, 1991). For example, 12-year-olds report engaging in significantly more secondary control coping strategies (i.e., adjusting the self) during uncontrollable stressors (medical procedures) compared to 6- and 9-year-olds (Band & Weisz, 1988). Children who had reached the formal operations stage of cognitive development (average age of 14) engaged in significantly more secondary control coping during medical stressors compared

to those who were still in the preformal operations stage (average age of 8; Band, 1990). Among children ranging in age from 5 to 11, those who were older were more likely to engage in cognitive distraction strategies and cognitive restructuring (reframing a stressful event in a more positive way) during uncontrollable situations (Altshuler & Ruble, 1989; Curry & Russ, 1985). Taken together, the studies suggest that "shifting" becomes a more widely used coping strategy with increasing age during childhood.

Similarly, with respect to persisting and maintaining hope and optimism by focusing on one's future, older adolescents have been found to be more future oriented than younger adolescents (Nurmi, 1991). They are more likely to articulate goals related to future aspirations such as education, whereas younger adolescents are more likely to describe goals related to leisure activities (Nurmi, Poole, & Kalakoski, 1994). They are also more likely to engage in future planning (Nurmi, 1991). Hence, in this study, we focused on adolescence as an important period for testing the contribution of role models and shift-and-persist to physiological profiles.

Empirical Evidence for Shift-and-Persist

Previous empirical research provides support for the shift-and-persist theory. For example, lifespan theories of control that postulate that when primary control (being able to change the environment so that it fits one's needs and desires) is not possible, secondary control efforts (attempts to bring oneself in line with one's environment) are beneficial (Heckhausen & Schulz, 1995; Heckhausen, Wrosch, & Schulz, 2010). And in fact, active efforts to cope with stressors and being given control over the parameters of a stressor are not beneficial to cardiovascular risk profiles among low-SES individuals (James, Keenan, Strogatz, Browning, & Garrett, 1992; James, Strogatz, Wing, & Ramsey, 1987). Furthermore, finding meaning in life is thought to help individuals cope with traumatic or life-threatening events (Bonanno, Wortman, & Nesse, 2004; Taylor, 1983; Updegraff et al., 2008), and low-SES may represent one circumstance in which broader perspectives on life, such as meaning making and a future orientation are beneficial. Consistent with this notion, low-SES adults who reported greater purpose in life showed lower levels of the inflammatory marker IL-6 (Morozink, Friedman, Coe, & Ryff, 2010).

Two recent empirical studies demonstrated disease-related benefits specific to shift-and-persist. In the first study, the childhood circumstances of a national sample of adults were assessed, and an index of cumulative physiological risk (allostatic load) was obtained. Shift-and-persist scores interacted to predict allostatic load among adults who came from low childhood SES backgrounds. Within this group, the combination of high shift and high persist was associated with the lowest allostatic load scores. In contrast, there was no association between shift-and-persist and allostatic load among those from high childhood SES backgrounds (Chen, Miller, Lachman, Gruenewald, & Seeman, 2012).

Second, in a clinical sample of children diagnosed with asthma, among those low in SES, higher shift-and-persist scores were associated with lower levels of asthma inflammation. In addition, among low-SES children, higher shift-and-persist scores prospectively predicted less asthma impairment (fewer school absences, less rescue inhaler use) 6 months later, controlling for baseline asthma impairment. In contrast, shift-and-persist did not benefit high-SES children with asthma (Chen, Miller, Kobor, & Cole, 2011).

The Present Study

However, no previous studies have yet tested hypotheses about the importance of role models in promoting shift-and-persist, and the implications for physiological risk markers. In addition, indicators of cardiovascular risk have not been examined in the context of shift-and-persist in a younger sample, to document whether the physiological effects of shift-and-persist emerge in adolescence. This study sought to address these two questions in a healthy sample of adolescents from a range of SES backgrounds. We assessed indicators of cardiovascular risk, including two markers of systemic inflammation, CRP and IL-6, high levels of which have been linked to a greater risk of CVD (Ridker, Hennekens, Buring, & Rifai, 2000; Ridker, Rifai, Stampfer, & Hennekens, 2000), as well as total cholesterol, high levels of which also confer risk for CVD (Pekkanen et al., 1990; Ridker, Rifai, Cook, Bradwin, & Buring, 2005). We hypothesized that SES would interact with role model characteristics to predict CRP, IL-6, and cholesterol levels in youth, such that low-SES youth who reported supportive role models would be buffered from elevated inflammatory and metabolic outcomes, whereas role models would not be critical to high-SES youth. We also hypothesized, consistent with

previous research, that shift-and-persist strategies would be beneficial to low-SES, but not high-SES, youth in terms of inflammatory and metabolic outcomes. Finally, we hypothesized that the reason why role models would be associated with inflammatory and metabolic outcomes would be because of engagement in shift-and-persist strategies, but only among low-SES youth (a mediated moderation hypothesis).

Method

Participants

A total of 163 families were recruited from Vancouver, British Columbia, Canada from newspaper and transit advertisements. Eligibility criteria included: (a) youth ranging in age from 13 to 16 (all attending secondary school) plus one parent, (b) no chronic illnesses for either parent or youth, (c) free of acute respiratory illness at the time of visit (by parent and youth report), and (d) fluent in English. See Table 1 for descriptive information.

Table 1
Descriptive Sample Information (N = *163)*

	Range	%	*M*	*SD*
Age	13–16		14.53	1.03
Gender (% male)		52		
Ethnicity				
Caucasian		47		
Asian		37		
Other		16		
Pubertal stage				
Pre		1		
Early		2		
Mid		25		
Late		59		
Post		13		
Divorced or single (%)		25		
Ever smoked past 6 months (% yes)		9		
Role model (% yes)		83		
Waist:hip ratio	.65–1.15		0.82	0.08
Family savings	0–500,000		19,000	
Shift strategies	3–12		8.06	2.12
Persist strategies	5–24		14.93	3.66
C-reactive protein (mg/L)	.20–8.60		1.12	3.16
IL-6 (pg/ml)	.02–8.32		0.83	1.22
Cholesterol (mg/dl)	8–249	147	34	

Note. Family savings was coded in categories from 1 to 9 (range listed above). On the categorical scale, $M = 4.90$ and $SD = 2.62$; this mean was translated into dollars above to make the number more meaningful in the table.

Procedures

Interested families contacted the lab and were screened for eligibility. Thirty-seven percent of families who called were not eligible, 16% of those who called were not interested in the laboratory visit, and the remainder were scheduled for a lab visit, where consent was obtained from parents and assent for youth. One youth and one caregiver came in for each family. Parents and youth were placed in separate rooms where they completed questionnaires and interviews, described below. A trained phlebotomist drew 50 cc of blood from an antecubital vein in the youth in the same room. Visits typically occurred in the afternoons, and lasted approximately 3 hr (including other interviews that were not relevant to this study), and children and parents each received $75. The protocol was approved by the University of British Columbia Research Ethics Board.

Measures

SES. Socioeconomic resources were measured by asking parents about the amount of assets that their family could easily convert to liquid cash in an emergency (family savings). This measure is recommended by the MacArthur Research Network on Socioeconomic Status and Health (www.macses.ucsf.edu) and is widely used in SES research (Juster, Smith, & Stafford, 1999). In a number of previous studies, we found that resource-based measures of SES such as this one have more robust associations with health-related outcomes in childhood than prestige-based measures (e.g., education), and hence we focused on this construct in this study. Our measure is identical to that used in previous studies (Chen, Cohen, & Miller, 2010).

Shift-and-persist. The tendency to shift oneself in response to stressors was measured in youth using the Positive Thinking scale of the Responses to Stress questionnaire (Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000). Three items (e.g., "I told myself that everything would be all right") were queried on a 4-point scale (ranging from *not at all* to *a lot*). These items tap the extent to which individuals try to deal with stressful situations by thinking about them in more positive ways. Items were coded such that higher scores indicated a higher tendency to positively appraise

stressful situations (see Table 2). Cronbach's alpha in this sample was .66. This measure has been validated in children and linked to mental health outcomes such as depression (Connor-Smith et al., 2000).

As an indicator of future persistence, a measure of positive thinking about the future was included for youth. The Life Orientation Test taps the extent to which individuals have positive expectations for their future (e.g., "I'm always optimistic about my future"; Scheier, Carver, & Bridges, 1994). This measure consists of six items rated on a 5-point scale (from *strongly disagree* to *strongly agree*). Items were coded such that higher scores indicated higher optimism (see Table 2). Cronbach's alpha in this sample was .73. This measure has been used in children (Chang & Sanna, 2003) and has established links with disease outcomes in adults (Scheier et al., 1999).

To create a total shift-and-persist score, responses to the shift-and-persist measures were first standardized (because they are on different scales), and then summed, as done in our previous study (Chen et al., 2011). Thus, higher scores indicate using a higher combination of both shift-and-persist strategies.

Role models. Youth were interviewed about whether they had a role model, that is, someone in their life whom they looked up to and might want to be like. If youth identified a role model, they were asked what qualities that person possessed that made them a good role model for the participant. Participants responded in an open-ended fashion, with follow-up probes utilized as necessary to clarify the meaning of their responses. Responses regarding the qualities of a good role model were coded by raters who were blind to SES as to whether the role model served a support function, allowing us to focus on one of the critical dimensions of role models identified in previous work (Greenberger et al., 1998; Hurd & Zimmerman, 2010). Specifically, coders were given numerous examples of support statements, and if participants verbalized any type of support function to their role model (e.g., "He helps me with my problems"), then support was coded as yes, with those youth who named other qualities or who did not identify a role model being coded as no. Twenty percent of tapes were coded by two raters for reliability purposes, with a kappa of .84.

Table 2
Shift-and-Persist Items

Shift
1. I told myself that I could get through it, or that I would do better next time.
2. I told myself that everything would be all right.
3. I thought of ways to laugh about it so it wouldn't seem so bad.
Persist
4. In uncertain times, I usually expect the best.
5. If something can go wrong for me, it will.
6. I'm always optimistic about my future.
7. I hardly ever expect things to go my way.
8. I rarely count on good things happening to me.
9. Overall, I expect more good things to happen to me than bad.

Note. Items 1–3 come from the secondary control coping scale of Connor-Smith, Compas, Wadsworth, Thomsen, and Saltzman (2000). Items 4–9 come from Scheier, Carver, and Bridges (1994).

Metabolic and inflammatory measures. Blood was collected through antecubital venipuncture into serum separator tubes. *Total cholesterol* was measured using standard enzymatic techniques using a Hitachi 911 (Kyowa Medex, Japan; interassay coefficient of variance, CV = 0.9%). *IL-6* was measured using a high-sensitivity enzyme-linked immunosorbent assay (ELISA) kit (intraassay CV < 10%; detection threshold = .04 pg/ml; R&D Systems, Minneapolis, MN). *CRP* was measured using a high-sensitivity, chemiluminescent technique on an IMMULITE 2000 (interassay CV = 2.2%; detection threshold = .20 mg/L; Diagnostic Products Corporation, Los Angeles, CA). CRP values were log transformed to normalize their distribution.

Covariates. Covariates were chosen a priori based on variables that are standard for inclusion in psychosocial studies of biological risk markers. These included demographic variables of youth gender and ethnicity, pubertal stage (based on the Peterson Pubertal Development Scale, $\alpha = .77$), a self-report questionnaire that has been validated against the Tanner physical examination evaluation for determining pubertal stage (Petersen, Crockett, Richards, & Boxer, 1988), health behaviors related to smoking (yes or no), and an indicator of obesity, waist–hip ratio. Pubertal stage was used in lieu of age, given the potential impact of pubertal status on metabolic and inflammatory measures that might not be captured solely by including chronological age. Both pubertal stage and waist–hip ratio were standardized within gender, given differences between girls and boys on these measures.

Statistical Analyses

To test associations among SES, role models, shift-and-persist, and metabolic and inflammatory measures, we conducted tests of mediated

moderation, as recommended by Muller, Judd, and Yzerbyt (2005). First, we tested whether the effect of role models on metabolic and inflammatory measures was moderated by SES. To do this, multiple regression analyses were conducted in which metabolic or inflammatory scores were predicted from (a) covariates described above, (b) main effect of SES (family savings) and main effect of role model score, and (c) the interaction between SES and role models. Including the interaction term allowed us to test the hypothesis that role models would predict metabolic and inflammatory outcomes only among low-SES youth. Tests of interactions were conducted according to the recommendations of Aiken and West (1991).

Second, we tested whether the potential mediator of this effect (shift-and-persist) also was moderated (i.e., being related in low-SES but not high-SES youth). Analyses were conducted in a parallel fashion to that described above, with metabolic and inflammatory scores predicted from (a) covariates, (b) main effect of SES and main effect of shift-and-persist, and (c) the interaction between SES and shift-and-persist.

Finally, we tested for mediated moderation. Mediated moderation refers to an overall moderation effect (i.e., the effect of role models on metabolic and inflammatory measures being moderated by SES) that is mediated by another variable (i.e., shift-and-persist). That is, we are testing the hypothesis that among low-SES youth, the reason why role models will be associated with better metabolic and inflammatory profiles is because role models facilitate a shift-and-persist approach that has benefits biologically. To test this, we entered the potential mediator into the regression equation simultaneously with SES and the moderator variable (role models). In mediated moderation, the initial moderated effect is reduced when the mediator is included. Thus, our third step was to include the mediator in the first moderator equation described above and to examine any reductions in path coefficients (Muller et al., 2005).

Results

Preliminary Analyses

Descriptive information about the sample is provided in Table 1. SES was not associated with shift-and-persist scores ($p > .2$), the likelihood of having a role model ($p > .2$), the likelihood of having a supportive role model ($p > .6$), age ($p > .6$), pubertal stage ($p > .7$), sex ($p > .3$), ethnicity ($p > .2$), the likelihood of having smoked ($p > .4$), or waist–hip ratio ($p > .2$).

Eighty-three percent of youth identified a role model. The most commonly identified role model was a parent (41%), with the other commonly named types of role models including other family members (20%), celebrities (12%), adult friend (7%), and teacher or coach (6%). Of youth who identified a role model, 25% articulated a support function to their role model. This percentage is somewhat low in part because some participants named role models whom they did not personally know, and in part because our interviews required youth to spontaneously describe their role model as supportive (rather than being asked whether or not their role model was supportive).

In terms of associations of demographic and health behavior variables with other measures, older children had higher levels of CRP ($r = .17$, $p < .05$). Girls were more likely to report a role model and also more likely to report a supportive role model, than boys (χ^2s = 5.24 and 4.54, ps < .05). No other associations were significant.

SES, Supportive Role Models, and Metabolic and Inflammatory Measures

After controlling for covariates, there was a significant main effect of SES on IL-6 ($\beta = -.37$, $p < .001$), such that lower SES was associated with greater IL-6 levels. There was no main effect of supportive role models ($\beta = -.13$, $p = .13$). There was, however, a significant interaction of SES with supportive role models ($\beta = .18$, $p < .05$). Figure 1 depicts this interaction graphically. As can be seen in the figure, a supportive role model buffered low-SES youth, but not high-SES youth, from elevated IL-6 levels. No effects were found for cholesterol or CRP (all ps > .2).

SES, Shift-and-Persist, and Metabolic and Inflammatory Profiles

We next tested whether shift-and-persist scores were also moderated by SES in their associations with metabolic and inflammatory profiles. After controlling for covariates, there was a significant main effect of SES on IL-6 ($\beta = -.18$, $p < .05$), such that lower SES was associated with greater IL-6 levels. There was no main effect of shift-and-persist ($\beta = -.13$, $p = .14$). There was, however, a significant interaction of SES with shift-and-persist ($\beta = .17$, $p = .05$). Figure 2 depicts this interaction graphically, with lines plotted at ± 1 *SD* of SES. As

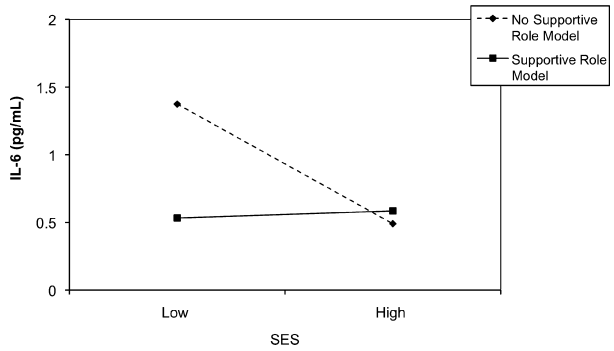

Figure 1. Interaction of socioeconomic status (SES; family savings) by role model characteristics predicting IL-6.

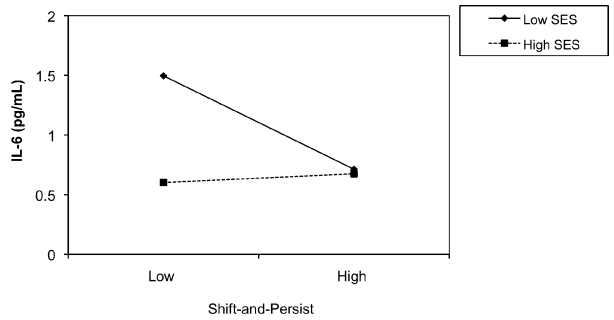

Figure 2. Interaction of socioeconomic status (SES; family savings) by shift-and-persist strategies predicting IL-6. *Note*. Estimated regression lines are plotted at ± 1 *SD* of SES.

can be seen in the figure, the lower the SES, the steeper the association of shift-and-persist with IL-6. That is, among low-SES youth, higher shift-and-persist scores were associated with lower IL-6 levels. Among high-SES youth, there was no relation between shift-and-persist and IL-6. No effects were found for cholesterol or CRP (all *p*s > .4).

Mediated Moderation

Given that we found that SES moderated the relation between supportive role models and IL-6, and that the potential mediator of this relation (shift-and-persist) also was moderated by SES, we tested for mediated moderation by including shift-and-persist in regression equations that tested the effects of SES, supportive role models, and the SES × Role Models interaction on IL-6. After statistically controlling for shift-and-persist, the moderator effect of SES × Role Models became nonsignificant, $\beta = .13$, $p = .17$ (compared to its originally significant value of $\beta = .18$, $p < .05$ with no controls for shift-and-persist). The fact that this moderated relation becomes nonsignificant after controlling for the potential mediator suggests that the tendency to engage in shift-and-persist partially explains why having a supportive role model predicts IL-6 levels among low-SES youth. In addition, we compared the percentage of variance accounted for by the SES × Role Models interaction term with and without shift-and-persist included in the equation. When shift-and-persist was included, the percent variance that the SES × Role Models interaction term accounted for in IL-6 levels was reduced by 48%, suggesting that shift-and-persist explains a substantial proportion of the association between SES × Role Models and IL-6.

Is the Support Function of Role Models Necessary?

We repeated the above analyses utilizing the variable of presence or absence of a role model (regardless of the function the role model serves) to test whether the mere presence of a role model is sufficient to produce these effects. None of the interactions of role model presence or absence with SES was significantly associated with any metabolic or inflammatory measure (*p*s ranging from .26 to .81), suggesting that the support function of role models is an important component for low-SES youth.

Is the Combination of Shift-and-Persist Necessary?

We repeated the above analyses using just shift scores, as well as just persist scores to test whether high levels of either one alone is sufficient to produce a buffering effect among low-SES youth. None of the interactions of shift scores with SES was significantly associated with any metabolic or inflammatory measures (*p*s ranging from .12 to .57). Likewise, none of the interactions of persist scores with SES was significantly associated with any metabolic or inflammatory measures (*p*s ranging from .11 to .51). This suggests that it is the combination of shift-and-persist that is important for predicting metabolic and immune measures in low-SES youth.

Discussion

Our results demonstrate that among low-SES youth, those who had supportive role models exhibited reduced levels of IL-6. Low-SES youth who engaged in shift-and-persist strategies also showed lower levels of IL-6. Shift-and-persist strategies partially mediated the moderated effect of SES by role models on IL-6. In contrast, high-SES youth did not

show any physiological benefits of either role models or of engaging in shift-and-persist strategies.

This study is novel in documenting the benefits of role models among low-SES youth in a physical health context, in terms of inflammatory markers. Previous research has revealed beneficial effects of role models primarily within the academic and behavioral contexts. For example, random assignment to formal mentoring programs such as Big Brother Big Sister produced teacher-reported gains in academic performance among a national sample of 9- to 16-year-old youth (Herrera, Grossman, Kauh, & McMaken, 2011). Similarly, other intervention trials that involve mentoring also improve emotional and behavioral, as well as academic outcomes in youth (see DuBois, Holloway, Valentine, & Cooper, 2002, for a review). Observational studies find that natural mentoring relationships (relationships between youth and nonparental adults that are not part of formal programs), or role models, are also associated with fewer behavioral problems, depressive symptoms, and less delinquency, in addition to better grades academically in at-risk youth (Hurd & Zimmerman, 2010; Hurd et al., 2009; Yancey et al., 2002). A few studies have investigated health-related outcomes, primarily in terms of health behaviors, finding that mentors or role models are associated with less substance use and higher levels of physical activity in youth (Beier, Rosenfeld, Spitalny, Zansky, & Bontempo, 2000; DuBois & Silverthorn, 2005; Oman et al., 2004; although associations with substance use have not been found in other studies: Hurd & Zimmerman, 2010; Yancey et al., 2002). However, this study is novel in linking role models to how physiological systems respond to stress among low-SES youth.

The findings in this study linking SES, shift-and-persist, and cardiovascular risk profiles in youth are consistent with previous research on shift-and-persist in children with asthma, as well as in adults (Chen et al., 2011; Chen et al., 2012). These studies all consistently show that there are no main effects of shift-and-persist, only an interaction with SES, indicating that shift-and-persist strategies are not uniformly beneficial, but rather specifically helpful to those who come from low-SES backgrounds. Moreover, in an earlier study, we documented the importance of both shift and persist via a three-way interaction between SES, shift, and persist in predicting cumulative physiological risk in an adult sample (Chen et al., 2012). That is, there was a two-way interaction between shift and persist found in low-SES, but not in high-SES, participants. The two-way interaction was such that the lowest physiological risk was found among those low-SES participants who were high on both shifting and persisting (Chen et al., 2012). Because low-SES individuals on average live under circumstances consisting of more frequent stressors that are more uncontrollable (Brady & Matthews, 2002), an approach that emphasizes shifting oneself (reframing stressors more positively) may be beneficial for slowing down the physiological responses to stressors that over the long term contribute to chronic diseases such as CVD. In addition, maintaining optimism about the future may help provide meaning in life that also mitigates the accumulation of pathogenic processes contributing to chronic disease. Thus, this work suggests the importance of considering context-specific psychological profiles—that is, the notion that certain psychological qualities may not be universally beneficial, but rather are uniquely beneficial, for example, in a low-SES, but not high-SES, context.

Our findings are also more generally consistent with adult studies that have examined psychological characteristics that moderate the effects of SES on health outcomes. For example, low-SES African American adults who are high on John Henryism (the tendency to use active coping efforts for dealing with stressors that are largely uncontrollable) show higher blood pressure and increased risk of hypertension compared to those who are low in SES and low in active coping (James et al., 1987). Among those low in SES, low optimism is associated with higher ambulatory blood pressure and a higher likelihood of hypertension compared to those who were low in SES and high in optimism, or those who were high in SES (Grewen et al., 2000). Similarly, high purpose in life buffered a community sample of adults who were low in SES from high levels of IL-6 (Morozink et al., 2010).

In addition, our findings are consistent with other studies that have examined the benefits of positive relationships with others during childhood among those low in SES. For example, maternal warmth can buffer low-SES individuals from adverse physiological and inflammatory risk profiles in both childhood and adulthood (Chen, Miller, et al., 2011; Evans, Kim, Ting, Tesher, & Shannis, 2007; Miller, Lachman, Chen, Gruenewald, & Seeman, 2011). Also, relevant are studies that have investigated the benefits of social capital (neighborhood connections) in terms of buffering low-SES children from smoking and obesity (Evans & Kutcher, 2011). This study extends this work by specifically focusing on the function of role models for physiological profiles, particularly among low-SES youth.

Because of the cognitive skills required to engage in shift-and-persist, we had hypothesized that these strategies would emerge during adolescence, and hence tested our hypotheses in a sample of 13- to 16-year-olds. We observed in this age group that there were effects of role models among low-SES youth and that the effects of role models were partially mediated by engagement in shift-and-persist strategies. We note that the patterns reported above did not vary by age in our sample (no interactions with age, data not shown); however, the sample did include a fairly restricted age range. Now that this phenomenon has been documented, future research should conduct tests across different development periods to determine at what ages these associations emerge—that is, at what ages it would be most beneficial to have a supportive role model? Also, longitudinal research could test whether role models at earlier ages might facilitate the later development of shift-and-persist. That is, we know that children engage in emotion regulation and coping strategies from a very young age (Eisenberg et al., 1998), that role models can help teach effective strategies to young children (Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997), and that adult influences early in life, including maternal sensitivity and harshness, predict later developmental outcomes such as externalizing behavior problems in older children (Bradley & Corwyn, 2007). Thus, could role models who are present at a young age promote shift-and-persist strategies once children become cognitively able to engage in them? Finally, future research should also explore whether there could be effects of negative role models. For example, we know that low-SES parents on average engage in less adaptive parenting behaviors, and that these behaviors in turn can be modeled by children and affect their own well-being outcomes (Conger & Donnellan, 2007). Hence, to what extent are youth susceptible to imitating others who engage in adverse approaches to handling life stressors (thus developing adverse coping strategies from negative role models), and is this susceptibility different for low- versus high-SES adolescents?

We note that this study found evidence of mediated moderation for IL-6, but not for the other physiological markers of CRP or cholesterol. The lack of findings with CRP may have been due in part to CRP levels being quite low during childhood (increasing with age; Ford et al., 2003), and hence there may not have been enough variability in CRP in our age group to find a mediated moderation effect. With respect to cholesterol, it may be the case that markers such as cholesterol are more affected by health behaviors such as diet; in contrast, inflammatory markers such as IL-6 may be more strongly related to psychological pathways such as stress (Segerstrom & Miller, 2004).

Limitations of this study include the cross-sectional design of this study. This is the first study to investigate the contribution of role models to relations among SES, shift-and-persist, and cardiovascular risk, and hence all assessments occurred at one point in time. Thus, we cannot draw any conclusions about causality or directionality. For example, it is possible that those who are already engaging in shift-and-persist strategies are more likely to perceive adults as supportive role models. Future studies that investigate longitudinal associations will allow researchers to better assess the directionality of these relations. Or intervention studies that test the effects of mentoring programs on coping profiles as well as physiological risk profiles would provide stronger conclusions about causality. Second, this study had limited information about role models. The information obtained in this study is in line with questions included in other studies of mentoring or role models (Hurd & Zimmerman, 2010; Hurd et al., 2009); however, given the importance demonstrated in this study of role models, future studies that conduct more in depth assessments of role model characteristics and relationships with youth will be important for ascertaining the critical components, from a health perspective, of youth's relationships with their role models. Third, this study drew on existing measures to derive a shift-and-persist score. While these measures were all psychometrically validated, they were not designed specifically to assess shift-and-persist hypotheses. We are currently in the process of validating a specific shift-and-persist measure, and of testing whether additional components (e.g., future orientation) would better capture this construct. Finally, we point out that our sample in this study may not be that generalizable, given that the study was conducted in Canada and given that the sample was a healthy one with few covariates being associated with inflammatory or metabolic measures.

In sum, among youth who came from low-SES backgrounds, those who had supportive role models showed lower levels of the inflammatory marker IL-6. Low-SES youth who engaged in shift-and-persist strategies also showed lower levels of IL-6, and shift-and-persist partially mediated the relation between role models and IL-6 in low-SES youth. Understanding the specific psychosocial

qualities that contribute to physiological resilience among low-SES youth represents one important approach toward interventions to reduce health disparities. The results from this study suggest that it is important to promote shifting-and-persisting in tandem, that is, that neither shifting nor persisting on its own is sufficient to produce physiological benefits, but if the combination can successfully be promoted among low-SES youth, there could be potential benefits for long-term physiological and ultimately, health trajectories in this group. Furthermore, if these are characteristics that some low-SES individuals already possess naturally, they may be ones that would be more plausible to alter through intervention in other low-SES individuals. While there are various approaches that society could take toward reducing health disparities, the ones related to shift-and-persist focus around efforts to help individuals develop self-strategies for dealing with adversity. Alternative approaches might include providing low-SES individuals with basic resources to improve health. Given that no one approach is likely to eliminate the health disparities that are so pervasive in our society, efforts to promote shift-and-persist in conjunction with societal efforts to provide basic economic resources and health services could begin to make a difference in improving the health of children facing adversity early in life.

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