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Optimism and Social Support Predict Healthier Adult Behaviors Despite Socially Disadvantaged Childhoods

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Abstract

Background—Studies have shown adverse effects of a disadvantaged childhood on adult health-promoting behaviors and related outcomes. Optimism and social support have been linked to greater likelihood of engaging in healthy behavior, but it is unclear whether these positive psychosocial factors may buffer harmful effects of early adversity. This study aims to determine if optimism and social support in adulthood can modify effects of childhood disadvantage on health behavior-related outcomes.

Methods—Longitudinal data were analyzed from a subset of participants in a US birth cohort established in 1959–1966 (*n*s of 681–840, per outcome). An index of childhood social disadvantage was derived from adverse socioeconomic and family stability factors reported by mothers at child's birth and age 7 years. Health behavior-related outcomes were self-reported when participants were of mean age 47 years. Multivariable adjusted robust Poisson regressions were performed.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Results—Regardless of level of childhood social disadvantage, we found higher levels of optimism and social support were both associated with higher probabilities of being a non-smoker (relative risk $[RR]_{optimism}$ = 1.17, 95% confidence interval [CI] = 1.09–1.26; $RR_{social\ support}$ = 1.24, 95%CI = 1.11–1.39), having a healthy diet ($RR_{optimism}$ = 1.25, 95%CI = 1.10–1.43; $RR_{social\ support}$ = 1.27, 95%CI = 1.04–1.56), and a healthy body mass index ($RR_{optimism}$ = 1.18, 95%CI = 1.00–1.40; $RR_{social\ support}$ = 1.29, 95%CI = 1.00–1.66). Interactions link higher optimism or social support with lower risk of smoking among those with moderate childhood disadvantage.

Conclusions—Overall, these findings are consistent with the possibility that positive psychosocial resources contribute to maintaining a healthy lifestyle in mid-adulthood and may buffer effects of childhood social disadvantage.

Keywords

Health behaviors; Optimism; Social support; Psychosocial factors; Social disadvantage

Introduction

Low childhood socioeconomic status (SES) and other adverse aspects of childhood social environments can profoundly influence adult health and health-related behaviors, such as smoking, diet, and exercise [1]. These behaviors have proven very difficult to change [2] and account for nearly 40% of premature deaths in the USA [3]. Thus, it is imperative to identify factors that motivate health-promoting behaviors in order to target them for intervention. An individual's propensity to engage in any particular behavior is determined by many complex factors, often established early in childhood, including accessibility to resources and personal motivations. Much of the research in this area has focused primarily on risk factors for unhealthy lifestyles, such as harmful health effects of childhood trauma [4]. Less attention has been paid to potential protective effects of positive psychosocial resources throughout the life course, such as optimism or social support, which may buffer the effects of adverse childhood exposures.

Two primary models of resilience have been proposed that consider how psychosocial resources buffer toxic health effects of childhood adversity: "shift and persist" and "reserve capacity." Under the first framework, shifting entails cognitively reappraising stressors to be less threatening, while persisting is maintaining hope or optimism in the face of adversity [5]. The effects of this strategy have primarily been analyzed in relation to buffering of low childhood SES to improve physiological stress responses and chronic diseases. The "reserve capacity" model proposes that individuals develop a reserve of "resilient resources," including social support, self-esteem, and optimism, which mitigate the effects of low SES on health outcomes [6]. Our study similarly focuses on resources of optimism and social support, but is interested in how these factors buffer a broad range of childhood social environmental factors for adult behavior outcomes, using a life course perspective.

Optimism is a positive psychological factor, defined as a generalized expectation of a positive outcome for future events [7]. While optimism can be conceptualized as a stable personality trait [7], it can also be modified in response to experience, or through targeted

interventions, such as writing about the future [8]. Studies consistently suggest that adults with high levels of optimism are more likely to engage in health behavior-related behaviors, including healthier diets, healthier body mass index (BMI), higher rates of physical activity, and are less likely to smoke [9, 10]. While optimism could sometimes lead to riskier behaviors because optimistic people might feel things will turn out well regardless of their current behaviors [11], the bulk of the evidence to date supports a direct association between higher levels of optimism and health-promoting behaviors [12]. Similar to optimism, social support is a positive psychosocial factor, generally defined as support accessible through social ties to individuals, groups, or the larger community [13]. Social support has been prospectively linked with healthy behaviors, including physical activity, healthier diets, and reduced smoking and alcohol intake [14–16]. Social support has also been shown to moderate the relationship between social stressors and psychological well-being while promoting feelings of self-esteem and a sense of belonging [17]. Both optimism and social support levels can be increased through interventions and may in turn lead to changes in behaviors such as physical activity [18, 19].

While both optimism and social support are consistently linked with a healthier lifestyle, little research has evaluated the health-related effects of these factors following a disadvantaged childhood. Consideration of the childhood social environment, such as poverty and related factors, is important because an accumulation of these childhood factors can increase risk of poor adult health behaviors and outcomes [1, 20, 21]. Some studies have considered the role of social support in buffering severe childhood exposures such as sexual or physical abuse on adult health behaviors and health outcomes, but less attention has been given to more common social disadvantage factors, such as poverty [22]. Additionally, while some work has evaluated whether emotion-related factors may either mediate or modify effects of low SES or child disadvantage on health and health behaviors [23, 24], fewer studies have evaluated the role of optimism or social support specifically. Moreover, most studies of potential buffering effects of psychosocial resources have relied on retrospective reporting of childhood circumstances [25], or have not considered whether these adult resources may be independent of, or modify, the effects of childhood disadvantage on adult health behaviors [12].

Using a longitudinal dataset from a prospective US birth cohort followed for over 40 years, this study examined the potential protective effects of two positive psychosocial factors, namely optimism and social support, on adult health behavior-related outcomes in relation to childhood social environments. Prior work in a subset of this sample found child social disadvantage associated with smoking, excess alcohol consumption, and obesity in adulthood [1] and also found trends with diet and physical activity. However, this study did not evaluate the role of optimism or social support in this relationship, nor assess potential independent effects of these hypothesized health assets. In the current study, we evaluated if associations between optimism or social support and health behavior-related outcomes modify effects of childhood environments or if they are independent of childhood social disadvantage, by testing for interactions between these factors.

We hypothesized that individuals with higher levels of these positive psychological factors in adulthood would be protected from the negative health effects of adverse childhoods,

enabling greater likelihood of engaging in healthy lifestyles in adulthood, as characterized by non-smoking, healthy diet, BMI, physical activity, and alcohol consumption.

Methods

Study Population

The sample for this study included a subset of participants involved in the Collaborative Perinatal Project (CPP), a longitudinal nation-wide study of the relationship between pregnancy and perinatal factors on the health of children born to women who were pregnant in 1959–1966 (n = 60,000) and followed until the children were aged 7 years. The New England Family Study (NEFS) is a series of follow-up studies conducted over 40 years later of adult offspring of the women enrolled in the Boston, Massachusetts and Providence, Rhode Island sites of the CPP. Data for the current study were drawn from two projects of the NEFS, the EdHealth study, and the Longitudinal Effects on Aging Perinatal Project (LEAP). All child data (including social disadvantage) was assessed either at birth or age 7, and all adult data (including optimism, social support, and health behavior-related outcomes) were collected when adults were mean aged 47.

EdHealth evaluated education and health outcomes of the adult offspring included in the NEFS. These participants were selected with preference for racial/ethnic minorities and those with either low or high attained education in adulthood as required by the aims of the project. Of the 914 participants selected from the NEFS, 898 were eligible and invited (living, not incarcerated), and 618 participants agreed to participate (69% response rate). Participants completed a 3-h inperson interview (2005–2007) with detailed assessment of adult SES, behaviors, physical, and mental health. LEAP is a subset of the Providence-born offspring, selected randomly from NEFS, but with preference for racial/ethnic minorities. Of the 1400 selected participants, 796 were eligible for follow-up (not adopted, deceased, incarcerated, or too ill, and lived within 100 miles of the clinical site). Of these, 522 (76%) were successfully contacted, and 400 agreed to enroll and participated within the collection period. LEAP participants were assessed in person in 2010–2011 for adult SES, behaviors, and physical and mental health.

After combining data from LEAP and EdHealth, our sample was comprised of 931 participants. For the 87 individuals who participated in both studies, data from the more recent study were used (except for smoking, where those who reported currently smoking in either study were considered to be smokers). We excluded individuals who did not provide sufficient data on childhood social disadvantage, resulting in an analytic sample with 854 individuals (Fig. 1). Analyses were performed separately for each health behavior-related outcome, and separately with each positive psychosocial factor, resulting in sample sizes ranging from 681 to 840 across outcomes (Fig. 1). The 77 participants missing data on social disadvantage did not meaningfully differ from those in the analytical sample except they were more likely to be from Providence rather than Boston (88% vs 64.6%). Institutional review boards at Harvard School of Public Health and Brown University approved the study. All participants provided informed consent.

Independent and Dependent Variables

Following prior research, we created a childhood social disadvantage index (hereafter referred to as social disadvantage) [1, 20]. In prior work in a subset of this sample, this index has been associated with higher cardiometabolic risk and a higher number of chronic diseases in adulthood [20], as well as several behavior-related health outcomes [1]. We also created indices based on self-reported data for adult measures of optimism using the revised Life Orientation Test [26, 27], social support using the Interpersonal Support Evaluation List [28], and all health behavior-related outcomes (non-smoking and healthy diet, BMI, physical activity, and alcohol consumption). Details on the construction of all of these variables are available in Electronic Supplementary Material 1.

Statistical Analyses

Poisson regressions with robust error variance were used to separately model each binary health behavior-related outcome in relation to childhood social disadvantage, along with optimism or social support. Because these outcomes are common (range 27% for healthy BMI to 90% for healthy alcohol consumption in the study population), we employed models that directly estimate relative risk (RR) ratios. Building off prior work that has demonstrated associations of this childhood social disadvantage index with the behavior-related outcomes, we focused our analyses on the role psychosocial factors may play with the outcomes and how they may modify effects of social disadvantage with these outcomes. We fitted four models for each psychosocial factor with each adult health behavior-related outcome. In the first model, the positive psychosocial factor (either optimism or social support) was included as the primary predictor of interest, along with covariates of age, self-identified race, gender, study site, and potential childhood confounders of small for gestational age and childhood chronic diseases. This model provides a primary assessment of the association of each positive psychosocial factor with health behavior-related outcome, accounting for potential childhood confounders. The second model included all covariates from the first model and added childhood social disadvantage, to determine if both the positive psychosocial factor and childhood social disadvantage maintain independent associations with the outcome. To test for potential buffering effects of positive psychosocial factors, the third model added interaction terms between each adult psychosocial factor and each level of child social disadvantage, while including all covariates from the second model. We ran a fourth model to assess the impact of adding educational attainment and adult health status because these variables might attenuate the primary associations of interest either as confounders (e.g., sick adults may be less likely to be optimistic, make social connections, or do vigorous exercise) or because they may lie on the pathway between child social disadvantage and adult health behavior-related outcomes. Social support and optimism were not included in models simultaneously. All continuous variables in these models were mean-centered to aid interpretation and minimize collinearity. Several additional analyses were also conducted, as described in Supplemental Methods, Electronic Supplementary Material 1.

Based on the results of the models described above, we fit new interaction models to calculate the predicted probability of each health behavior-related outcome across levels of optimism or social support for the average aged individual in the dataset; these are displayed in a series of interaction plots to allow visualization of potential trends across

social disadvantage levels. Because we found no evidence for effect modification by gender, race, study site, or childhood health variables, we controlled only for age in these predicted probability models and included an interaction term between optimism or social support and social disadvantage. Using the regression equations, we calculated and plotted the predicted probability of each health behavior-related outcome for the average-aged person with high, moderate, and low disadvantage across levels of optimism or social support.

All main analyses were run with imputed data for missing covariates: race (n = 4 missing), education (n = 12 missing), small for gestational age (n = 6 missing), child chronic disease (n = 2 missing), and adult chronic disease (n = 23) but we did not impute the primary predictors (optimism, social support, social disadvantage) or outcomes, which can often lead to misleading results [29]; instead, we dropped cases missing those primary variables. Forty imputed datasets were created using information from all analyzed variables in the dataset and implemented using the MICE package in R. All data analyses were performed using R, v.3.2.1.

Results

Descriptive statistics are presented on the total analytic sample, and according to level of social disadvantage in Table 1. Among the 854 participants, more were women (59.3%), the mean age at adult follow-up was 47 years (SD = 1.7 years), the majority self-identified as White (75.2%), and more participants were enrolled in the Providence site than the Boston site (64.6%). Additionally, 70% of individuals were non-smokers, 40% were classified to have healthy diets, 27% had a healthy BMI, 37% engaged in healthy vigorous physical activity, and 90% reported healthy alcohol consumption.

When categorized according to level of social disadvantage, 54.6% (n = 466) were classified as low, 32.7% (n = 279) as moderate, and 12.8% (n = 109) as high social disadvantage. Those with high or moderate relative to low social disadvantage were significantly more likely to be ethnic minorities, from Providence versus Boston, and to be born small for gestational age. As adults, those with high or moderate relative to low social disadvantage had significantly lower levels of optimism and achieved fewer years of education. Those with high relative to low social disadvantage also had significantly lower levels of social support, and those with low social disadvantage had the lowest rates of adult health problems (Table 1). In the total sample, optimism and social support were positively correlated with each other (r = 0.36), both were positively correlated with years of education (r = 0.21, r = 0.17, respectively) and inversely correlated with social disadvantage (r = − 0.20, r = − 0.14, respectively).

Optimism and Health Behavior-Related Outcomes

Results from models of optimism adjusting for demographics and potential childhood health confounders demonstrate significant associations between optimism and three of the five health behavior-related outcomes. Specifically, each one unit increase in optimism (on a scale of 1–5) was associated with an estimated higher probability of being a non-smoker by 18% (95%CI = 1.10–1.27), of having a healthy diet by 27% (95%CI = 1.11, 1.44), and of having a healthy BMI by 21% (95%CI 1.02–1.43) (Table 2, Model 1). In models that

additionally included social disadvantage, a high or moderate level of social disadvantage was significantly associated with a lower probability of being a non-smoker or of having a healthy adult BMI, but no other outcomes (Table 2, Model 2). Notably in these models, the effect of optimism was slightly attenuated (1–2% lower) with the addition of social disadvantage but remained significantly associated with the same three outcomes. In the third model, a significant interaction ($p = 0.01$) between moderate (but not high) social disadvantage and optimism was identified for the probability of being a non-smoker, but not for other outcomes. Specifically, for each unit increase in optimism, those with moderate social disadvantage had a 32% higher probability of being a non-smoker (calculated by multiplying the main effect for optimism by the interaction effect with moderate social disadvantage). Effects were similar among those with high social disadvantage, with a 13% greater probability of non-smoking with each unit increase in optimism, though the interaction term with high disadvantage was not statistically significant. These findings suggest some buffering effects of optimism on smoking behavior in the context of childhood social disadvantage. Finally, in models that add adult education or health status, the effect of optimism was attenuated (2–7% lower), but remained significant for models of non-smoking and healthy diet (Table 2, Model 4), indicating that these factors do not fully explain effects of optimism on these behaviors.

Though not all models of health outcomes showed significant interactions (at the $\alpha = 0.05$ level), to assess the trends in more detail, we considered each behavior-related outcome in relation to optimism level across social disadvantage levels. As suggested by the primary models, interaction plots showed higher optimism to be associated with healthier outcomes across levels of social disadvantage, as illustrated by general increases in the predicted probability of each behavior-related outcome with increases in optimism, at every social disadvantage level (Fig. 2). In fact, in some cases, it appears that optimism mitigates effects of a childhood with a moderate (but not high) level of social disadvantage, such that those with more optimism have similar probabilities of engaging in healthy behaviors as those with more advantaged childhoods. For non-smoking behavior in particular, associations with optimism vary significantly across the social disadvantage groups. Specifically, higher levels of optimism increase the probability of being a non-smoker more among those with moderate than either high or low social disadvantage (Fig. 2a). However, this buffering is not seen across most of the outcomes; given complete buffering, you would expect to see a shrinking gap between lines at higher levels of optimism.

Social Support and Health Behavior-Related Outcomes

The associations between social support and health-related behaviors were substantially similar to those with optimism. Social support was significantly associated with higher probabilities of engaging in the same three health-promoting behaviors: (non-smoking, healthy diet quality, and healthy BMI (Table 3, Model 1). Social support remained a significant predictor for non-smoking and diet quality, even after adjusting for childhood social disadvantage, but was reduced to marginal significance as a predictor for maintaining a healthy BMI (Table 3, Model 2). A marginally significant interaction was identified between moderate social disadvantage and social support for smoking behavior ($p = 0.05$),

showing the same trend seen with optimism (Table 3, Model 3). The addition of adult covariates did not attenuate the effect of social support on any outcome (Table 3, Model 4).

The overall trends in the interaction plots for social support were similar as seen for optimism, in that increasing levels of social support tracked with higher probabilities of engaging in nearly all the behavior-related outcomes across social disadvantage groups (Fig. 2). As with optimism, a stronger association (marginally significantly steeper slope) of social support was seen with non-smoking behavior among the moderate relative to the low social disadvantage group (Fig. 2b). In contrast, the probability of healthy alcohol consumption was nearly identical across social disadvantage groups and levels of social support (Fig. 2j).

In an additional set of analyses, we compared models with disadvantage alone with models including optimism or social support. We did not see any significant attenuation of high or moderate social disadvantage with any of the outcomes (Electronic Supplementary Material 2, Table 1), suggesting that in the current sample, these psychosocial factors may not be on the pathway linking social disadvantage and adult behaviors. For results of sensitivity analyses with linear models, or with subscales of social support, see Electronic Supplementary Material 3, 4, and 5, Tables 2 and 3.

Discussion

This study evaluates the influence of two distinct but related positive psychosocial factors, optimism and social support, on adult health-related behaviors, and whether these factors are independent of, or may buffer, the effects of prospectively measured childhood social environments. Our findings are consistent with prior studies in showing that higher levels of both optimism and social support are significantly associated with higher probabilities of engaging in a range of health-promoting behaviors [9, 12, 15]. Our study extends this literature to show that these positive psychosocial factors each remained significant predictors for maintaining a healthy diet, a healthy BMI, and not smoking—*regardless* of the level of social disadvantage in childhood. In cases where the positive psychosocial factors precede the health behavior-related outcomes, these factors may buffer effects of child environments particularly for smoking behavior. These associations persisted even after adjusting for potential child health confounders, and some persisted after adjusting for adult health status and educational attainment, implying effects are not entirely driven by these adult experiences. Despite the fact that individuals with disadvantaged childhoods are at greater risk for unhealthy adult lifestyles [1], these results imply that higher levels of optimism or social support can improve health behavior-related outcomes. One implication of this finding, if it reflects a causal association, is that interventions to increase positive psychosocial factors may improve health behaviors among all adults, not just those who experience relatively advantaged childhoods.

Alternatively, it is possible that the direction of effect is reversed, such that less healthy behaviors such as smoking or unhealthy diets, which are highly stigmatized [30], could lead to decreased optimism and/or social support by damaging self-esteem or social networks. If this is the case, interventions might instead target the health-related behaviors themselves.

Because the psychosocial factors in our study were measured concurrently with the health-related outcomes, we cannot determine the causal direction, and future studies are needed to address this question. However, we note that most prior prospective studies are consistent with the first interpretation, in that they find consistent but small effects of positive psychosocial factors on healthy behaviors (e.g., avoiding smoking, physical activity, and healthy eating) [12].

While optimism and social support were generally associated with healthier behaviors for everyone, we detected a significant interaction between optimism and child social disadvantage (and a marginal interaction for social support) only for non-smoking behavior. The effects of these positive psychosocial factors were significantly stronger among those with moderate (but not high) relative to low levels of social disadvantage. This may be because the association between exposure to a high level of disadvantage during childhood and adult smoking behaviour is due in part to the early initiation and long-term persistence of smoking among highly disadvantaged youth, which may not be overcome by optimism or social support. More generally, our finding that associations of social disadvantage with health behavior-related outcomes are still evident, albeit attenuated, in the presence of higher levels of optimism and social support may suggest that these positive psychosocial factors are beneficial, but not always sufficient, to overcome the harmful effects of a disadvantaged childhood. In addition, we suspect that the difficulty detecting significant interactions for other behavior-related outcomes could be due to over-reporting of some healthy behaviors (e.g., 90% reported healthy alcohol consumption) or because of small sample sizes among some sub-groups.

Individuals with low social disadvantage in childhood had significantly higher levels of optimism and social support (Table 1), supporting the theory that these psychological factors are, at least in part, patterned by childhood experience [31]. For example, very few children with high levels of social disadvantage grew up to become highly optimistic adults (n = 15/854, < 2% in top 20% of optimism range) or to have more social connections (25/854, < 3%, top 20% of social support range). These patterns support one of the explanations for the influences of early disadvantage on adult health: that disadvantaged children grow up to have fewer psychosocial resources, or less “reserve capacity,” and subsequently worse health behaviors. In fact, the lack of attenuation of associations between social disadvantage and health behaviors upon the addition of these positive psychosocial factors to the models supports this explanation, although we did not formally test mediation in our sample (see Electronic Supplementary Material 2, Table 1). It remains an open question as to whether high levels of positive resources are sufficiently prevalent among individuals who experience high levels of disadvantage in childhood that one could test the mediation hypothesis effectively. However, given our findings that higher optimism and social support are beneficial across the spectrum of social disadvantage, we posit that interventions to increase optimism or social support may be especially important for disadvantaged children, who may be less likely to develop these resources on their own. In addition to childhood factors, the level or effect of these positive psychological factors could also be influenced by adult socioeconomic or health-related factors. We note that adding these adult factors to our models only minimally attenuated associations with optimism or social support, suggesting

that these variables do not fully explain the associations we are seeing and are likely not confounding these associations.

Though our analyses of adult psychosocial resources and health behaviors were cross-sectional, the interaction we found with child social disadvantage for smoking is consistent with the interpretation of a potential buffering effect. Some investigators have examined related questions in a cohort followed through adolescence, using a “shift and persist” approach to dealing with childhood adversity [5]. They found low (but not high) SES adolescents who maintained a shift and persist, coping style, or who had social support in the form of supportive role models in their lives showed reduced physiological responses to stress, such as lower levels of the proinflammatory marker IL6 [32]. Unlike the present study, which examined a broad spectrum of childhood disadvantage factors, their work largely examined how psychosocial resources can buffer effects of low childhood SES specifically and has not evaluated effects on behavior-related outcomes. Our work is also consistent with the reserve capacity model, where factors such as optimism and social support have mitigated effects of stressful events on cardiovascular outcomes [6]. Together, these findings support the possibility that psychological resources can reduce negative impacts of social adversity in childhood even among those who are experiencing relatively higher adversity levels. Given optimism and social support are modifiable and shaped by social circumstances [33, 34], such findings suggest processes by which individuals may develop capacity for optimism and social support into adulthood.

Some benefits of optimism and social support may be that they provide effective strategies for coping with adversity or stress that contribute to healthier lifestyles. For example, more optimistic individuals faced with difficulties in life may develop a coping style that is more problem-focused or engaged (e.g., exercising) versus an avoidance coping style often observed among more pessimist individuals (e.g., resort to unhealthy comfort foods) [35]. More generally, individuals with higher versus less optimism may have a more energized, proactive, or goal-oriented approach to maintaining good health potentially because they feel their efforts will be successful [36]. This positive and problem-solving orientation may also benefit them in other ways as well, such as being more likely to obtain higher educational degrees [37], earn higher incomes [38], and maintain higher-quality social relationships [36], all factors that are also positively associated with higher engagement in health-promoting behaviors.

Similarly, those with higher levels of social support may resolve problems by seeking material or emotional aid from friends and family rather than harmful coping mechanisms such as substance abuse or overeating. More broadly, social support may lead to greater likelihood of health-promoting behaviors by enhancing access to material resources (e.g., enabling access to gyms, healthier foods), through the influence of peer pressure and social norms [39], or by generally improving psychological states that motivate such behaviors [40].

Some limitations of this study are important to consider. Generalizability is limited to urban centers in New England. While our sample size was relatively large, we may still be underpowered to detect some interactions and were unable to test for gender interactions

as some gendered subsets became too small. Since all data on health-promoting behaviors (besides BMI) were self-reported, our findings may be influenced by the common problem of over-reporting of healthy behaviors [41], and because these variables were measured only at a single time point in mid-adulthood. Over-reporting may also explain why some health behaviors (such as healthy alcohol consumption or exercise) did not significantly associate with our predictors. The possibility of over-reporting for these two variables is also supported by the fact they did not associate with chronic disease in a prior study of this dataset [20], despite being well-known risk factors. While we lack data between childhood and adulthood, other research suggests that early life factors often predict later life social environments [42], so addition of this information would not likely change findings substantively. There is also risk of healthy survivor bias, given such a lengthy longitudinal study. Finally, because health behavior-related outcomes and positive psychosocial factors were measured concurrently in this observational study, these analyses cannot establish direction of effect or causality.

Strengths of this study include testing hypotheses within a sample from a large prospective population-based birth cohort with detailed and well-characterized prospectively assessed measures of childhood disadvantage, free of recall bias, along with validated and widely used measures of optimism and social support. We were able to explore interactions as well as main effects across a wide range of health behavior-related outcomes up to four decades later into mid-adulthood. Additionally, we uniquely focused our study on *positive* factors, including both the psychosocial factors and health promoting behaviors, which are generally under-studied relative to risk factors and harmful behaviors. We were also able to control for a range of key covariates and potential confounders in childhood and adulthood. Finally, while we could not examine severe forms of child adversity, such as abuse or neglect, we examined the benefits of positive psychosocial factors in the context of more common childhood social exposures.

Our results contribute to the literature on resilience, as optimism and social support represent two positive factors that can prepare individuals to maintain health in the face of adversity [43]. While more longitudinal and experimental studies are needed to establish temporality and ultimately causal effects, our findings are consistent with the interpretation that enhancing optimism and social support could lead to more health-promoting behaviors. Our findings are relevant for interventions, as these psychosocial factors are not fixed at birth but clearly patterned by experiences throughout life [44]. In fact, interventions have led to increases in these psychosocial factors and to more consistent engagement in health-promoting behaviors such as physical activity and healthy diets [45, 46]. Given the persistently high levels of unhealthy behaviors in the USA, and the limited success of traditional behavior change interventions, particularly in disadvantaged children [2, 47], incorporating optimism or social support into future interventions may be a useful strategy to motivate and influence a range of health behaviors.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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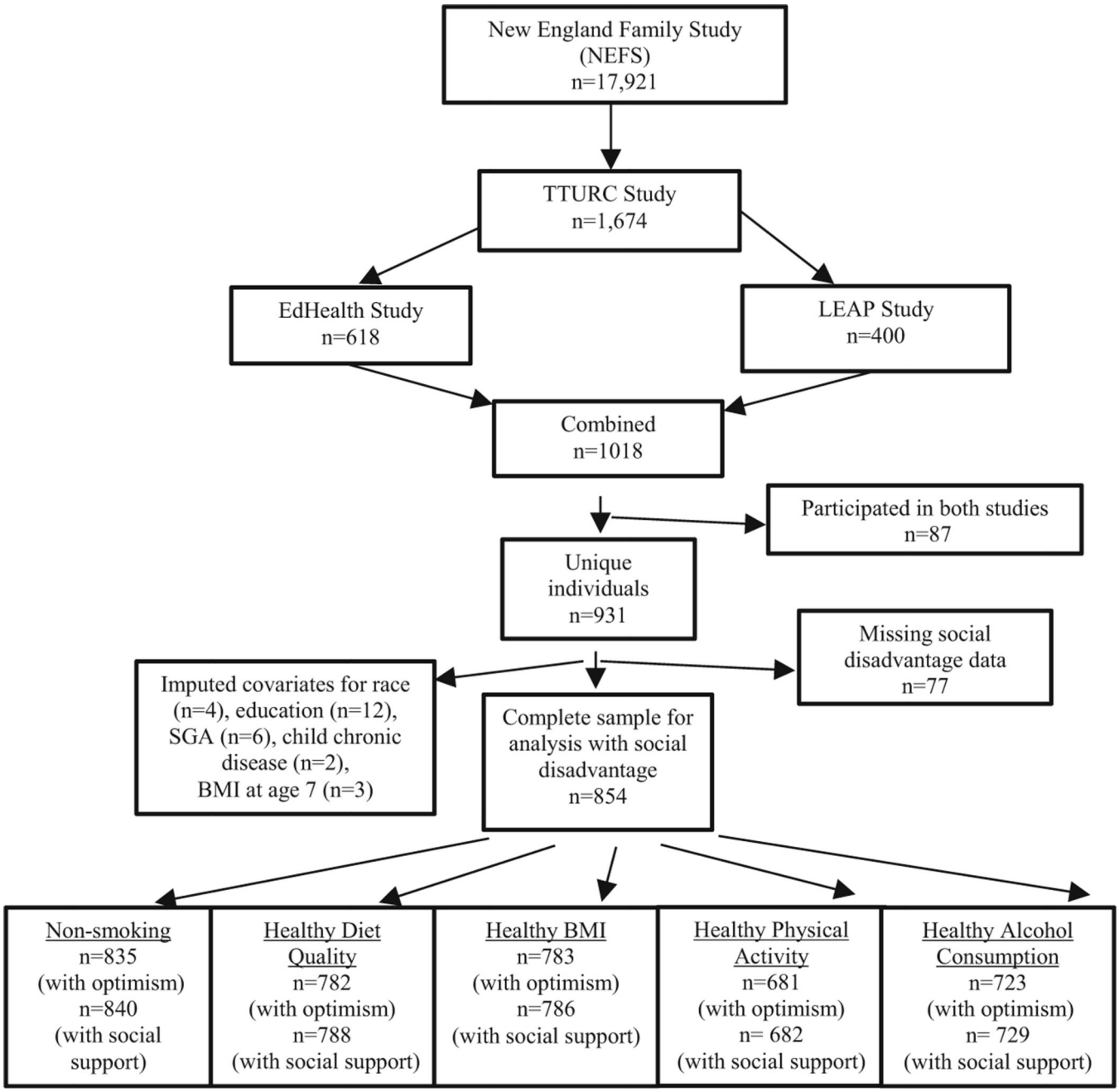

Fig. 1.
Flowchart of study participants

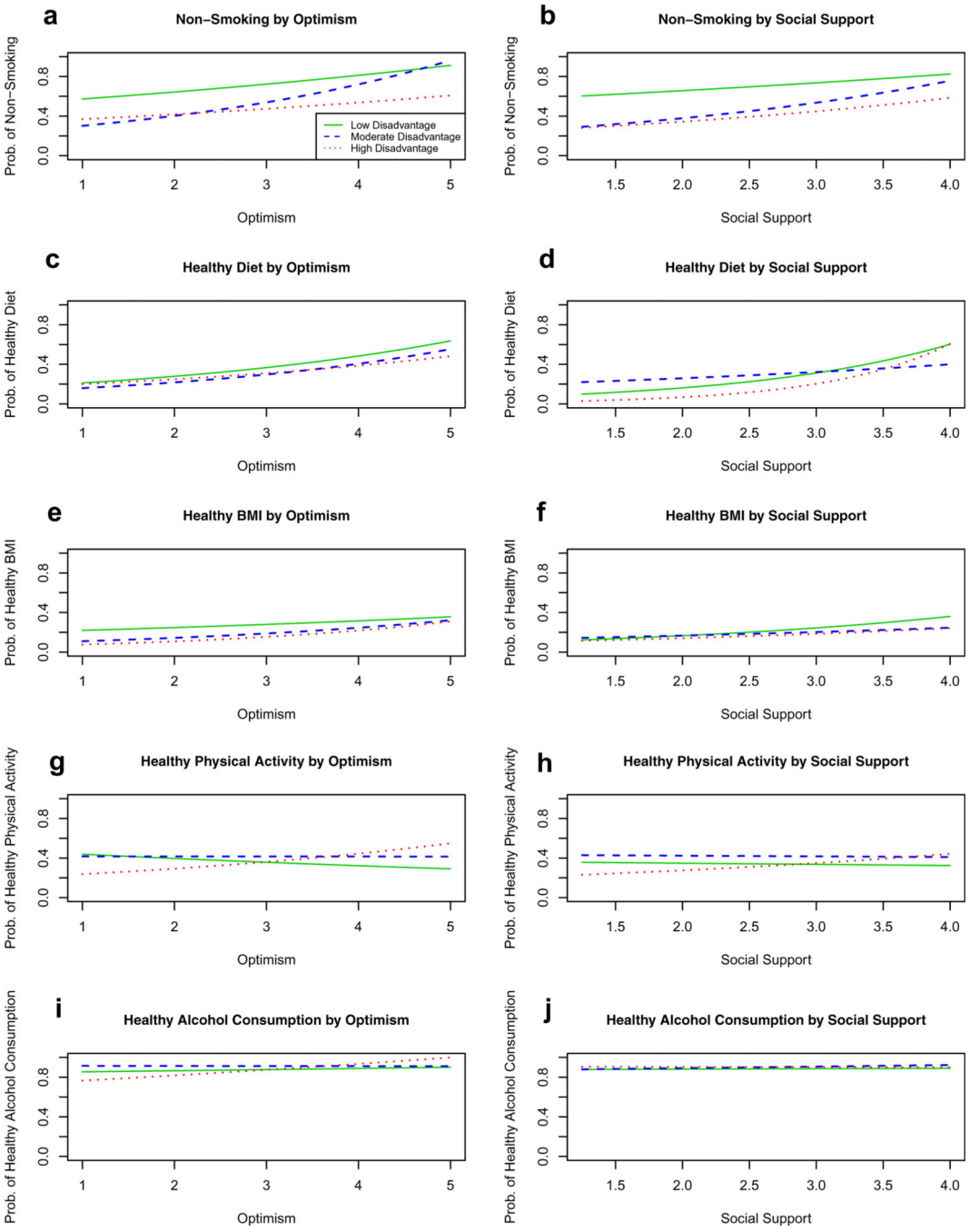

Fig. 2.

Predicted probability of each health behavior-related outcome across levels of social disadvantage. Each plot demonstrates separate curves derived from robust Poisson regressions across levels of social disadvantage (green solid line = low social disadvantage, blue dashed line = moderate social disadvantage, red dotted line = high social disadvantage). Curves represent the predicted probability of each health behavior-related outcome for the average-aged individual in the dataset, across levels of optimism (left side of figure) and across levels of social support (right side of figure)Probabilities of non-smoking behavior are

shown in panels **a** and **b**, healthy diet in **c** and **d**, healthy BMI in **e** and **f**, healthy physical activity in **g** and **h**, and healthy alcohol consumption in **i** and **j**

Table 1

Characteristics stratified by childhood social disadvantage

	Low social disadvantage (*n* = 466)	Moderate social disadvantage (*n* = 279)	High social disadvantage (*n* = 109)	Total sample (*n* = 854)
Positive Psychosocial Attributes				
Mean Optimism (SD) *	3.72 (0.74)[a]	3.50 (0.69)[b]	3.37 (0.72)[b]	3.60 (0.73)
Mean Social Supp. (SD) *	3.50 (0.44)[a]	3.44 (0.50)[a]	3.28 (0.62)[b]	3.45 (0.49)
Child covariates				
Small for gestational age *	33 (7.1%)[a]	44 (15.9%)[b]	18 (16.8%)[b]	95 (11.2%)
≥ 1 chronic disease in childhood	89 (19.1%)	57 (20.4%)	26 (24.3%)	172 (20.2%)
Mean BMI at age 7 (SD)	16.17 (1.63)	16.21 (2.18)	16.26 (2.44)	16.20 (1.94)
Study site *				
Boston	239 (51.3%)[a]	54 (19.4%)[b]	9 (8.3%)[c]	302 (35.4%)
Providence	227 (48.7%)[a]	225 (80.6%)[b]	100 (91.7%)[c]	552 (64.6%)
Adult covariates				
Mean age, years (SD)	43.81 (2.63)	44.96 (3.04)	45.16 (2.74)	46.94 (1.70)
Gender (% Female)	274 (58.8%)	159 (57%)	73 (67%)	506 (59.3%)
Race/ethnicity (% white) *	390 (84.1%)[a]	183 (66.1%)[b]	66 (60.6%)[b]	639 (75.2%)
Mean years of education (SD) *	14.27 (2.79)[a]	12.76 (2.34)[b]	12.29 (2.49)[b]	13.53 (2.74)
Adult Health Problems *	207 (45.1%)[a]	155 (57.8%)[b]	54 (51.9%)[a,b]	416 (50.1%)

Adult health problems include diagnosis of hypertension, high cholesterol, or diabetes. Lowercase superscript letters indicate which variables differed significantly between social disadvantage levels (e.g., same letters indicate no significant difference between groups). Some percentages are not calculated from column totals due to missing data for some variables.

SD is standard deviation

* Significant differences between groups at $p < 0.001$, as assessed via two sample tests of proportions for categorical variables, and with ANOVA and Tukey tests for continuous variables

Table 2

Robust Poisson regression results for associations between childhood social disadvantage, optimism, and adult health behaviors

	Model 1 **RR (95% CI)**	**Model 2** **RR (95% CI)**	**Model 3** **RR (95% CI)**	**Model 4** **RR (95% CI)**
Not smoking (*n* = 835)				
Optimism	1.18(1.10–1.27) **	1.17(1.09–1.26) **	1.12 (1.04–1.21) **	1.10 (1.02–1.18) *
High disadvantage	-	0.69 (0.56–0.84) **	0.67 (0.55–0.83) **	0.73 (0.59–0.89) **
Mod. disadvantage	-	0.85 (0.77–0.94) **	0.84 (0.75–0.93) **	0.89 (0.80–0.99) *
Low disadvantage	-	Reference	Reference	Reference
Optimism *High Dis.	-	-	1.01 (0.76–1.33)	0.99 (0.75–1.30)
Optimism *Mod. Dis.	-	-	1.18 (1.02–1.36) **	1.17 (1.01–1.35) *
Optimism *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.04 (1.03–1.06) **
Adult health status	-	-	-	1.00 (0.92–1.10)
Healthy diet (*n* = 782)				
Optimism	1.27(1.11–1.44) **	1.25 (1.10–1.43) **	1.23 (1.04–1.44) *	1.18 (1.01–1.38) *
High disadvantage	-	0.81 (0.60–1.09)	0.81 (0.60–1.08)	0.95 (0.70–1.23)
Mod. disadvantage	-	0.86(0.70–1.04)	0.85 (0.70–1.04)	0.98 (0.80–1.21)
Low disadvantage	-	Reference	Reference	Reference
Optimism *High Dis.	-	-	1.04 (0.69–1.57)	1.00 (0.67–1.50)
Optimism *Mod. Dis.	-	-	1.07 (0.82–1.40)	1.04 (0.79–1.36)
Optimism *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.08 (1.05–1.12) **
Adult health status	-	-	-	0.93 (0.79–1.10)
Healthy BMI (*n* = 783)				
Optimism	1.21 (1.02–1.43) *	1.18(1.00–1.40) *	1.10 (0.91–1.33)	1.11 (0.91–1.35)
High disadvantage	-	0.58 (0.36–0.94) *	0.59 (0.37–0.95) *	0.65 (0.40–1.05)
Mod. disadvantage	-	0.75 (0.57–0.98) *	0.73 (0.56–0.96) *	0.83 (0.64–1.07)

	Model 1 RR (95% CI)	Model 2 RR (95% CI)	Model 3 RR (95% CI)	Model 4 RR (95% CI)
Low disadvantage	-	Reference	Reference	Reference
Optimism *High Dis.	-	-	1.38 (0.75–2.51)	1.34 (0.71–2.54)
Optimism *Mod. Dis.	-	-	1.21 (0.83–1.76)	1.09 (0.76–1.56)
Optimism *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.02 (0.97–1.06)
Adult health status	-	-	-	0.44 (0.33–0.58)**
Healthy physical activity (n = 681)				
Optimism	0.97 (0.83–1.12)	0.97(0.84–1.13)	0.92 (0.76–1.12)	0.94 (0.78–1.13)
High disadvantage	-	1.24(0.91–1.68)	1.27 (0.95–1.71)	1.14 (0.84–1.53)
Mod. disadvantage	-	1.25 (1.00–1.56)≠	1.24 (1.00–1.55)≠	1.17 (0.93–1.45)
Low disadvantage	-	Reference	Reference	Reference
Optimism *High Dis.	-	-	1.33 (0.86–2.01)	1.39 (0.92–2.10)
Optimism *Mod. Dis.	-	-	1.06 (0.78–1.42)	1.09 (0.81–1.46)
Optimism *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	0.94 (0.91–0.98)**
Adult Health Status	-	-	-	0.77 (0.63–0.95)*
Healthy alcohol consumption (n = 723)				
Optimism	1.01 (0.97–1.06)	1.01 (0.97–1.06)	1.01 (0.95–1.07)	1.01 (0.95–1.07)
High disadvantage	-	1.01 (0.93–1.10)	1.02 (0.94–1.11)	1.02 (0.94–1.11)
Mod. disadvantage	-	1.03 (0.98–1.09)	1.03 (0.98–1.09)	1.03 (0.97–1.09)
Low disadvantage	-	Reference	Reference	Reference
Optimism *High Dis.	-	-	1.07 (0.95–1.20)	1.07 (0.95–1.20)
Optimism *Mod. Dis.	-	-	0.99 (0.91–1.08)	0.99 (0.91–1.08)
Optimism *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.00 (0.99–1.01)
Adult Health Status	-	-	-	1.01 (0.96–1.07)

RR represents the probability of having a healthy behavior-related outcome. Model 1 includes optimism, childhood health covariates, and demographics; model 2 adds childhood social disadvantage to model 1, model 3 adds an interaction between optimism and childhood social disadvantage to model 2; model 4 adds adult variables of educational attainment and health status to model 3.

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Mod. moderate, *Dis*. disadvantage

* Significant at $p < 0.05$;

** Significant at $p < 0.01$;

‡ Marginal significance at $p < 0.10$

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Table 3

Robust Poisson regression results for associations between childhood social disadvantage, social support, and adult health behaviors

	Model 1 **RR (95% CI)**	**Model 2** **RR (95% CI)**	**Model 3** **RR (95%)**	**Model 4** **RR (95%)**
Not smoking (n = 840)				
Social support	1.27 (1.14–1.42) **	1.24 (1.11–1.39) **	1.13 (1.00–1.29)ǂ	1.12 (0.99–1.27)ǂ
High disadvantage	-	0.69 (0.56–0.84) **	0.68 (0.56–0.84) **	0.74 (0.60–0.90) **
Mod. disadvantage	-	0.85 (0.76–0.94) **	0.83 (0.75–0.93) **	0.89 (0.79–0.99) *
Low disadvantage	-	Reference	Reference	Reference
Soc. Supp. *High Dis.	-	-	1.15 (0.79–1.68)	1.11 (0.76–1.61)
Soc. Supp. *Mod. Dis.	-	-	1.25 (0.96–1.62)ǂ	1.20 (0.92–1.55)
Soc. Supp. *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.04 (1.03–1.06) **
Adult health status	-	-	-	1.00 (0.91–1.09)
Healthy diet (n = 788)				
Social support	1.30 (1.06–1.58) *	1.27 (1.04–1.56) *	1.20 (0.91–1.59)	1.19 (0.90–1.56)
High disadvantage	-	0.79 (0.59–1.08)	0.79 (0.59–1.07)	0.99 (0.80–1.22)
Mod. disadvantage	-	0.85 (0.70–1.03)ǂ	0.85 (0.69–1.04)	1.04 (0.84–1.29)
Low disadvantage	-	Reference	Reference	Reference
Soc. Supp. *High Dis.	-	-	1.57 (0.85–2.89)	1.44 (0.78–2.64)
Soc. Supp. *Mod. Dis.	-	-	0.96 (0.62–1.49)	0.88 (0.57–1.37)
Soc. Supp. *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.09 (1.05–1.12) **
Adult health status	-	-	-	0.92 (0.78–1.09)
Healthy BMI (n = 786)				
Social supp.	1.34 (1.04–1.73) *	1.29 (1.00–1.66)ǂ	1.32 (0.95–1.83)ǂ	1.37 (1.00–1.89)ǂ
High disadvantage	-	0.66(0.42–1.04)ǂ	0.66 (0.42–1.05)ǂ	0.72 (0.45–1.13)
Mod. disadvantage	-	0.77(0.58–1.00) *	0.77 (0.58–1.01)ǂ	0.86 (0.67–1.12)

	Model 1 RR (95% CI)	Model 2 RR (95% CI)	Model 3 RR (95%)	Model 4 RR (95%)
Low disadvantage	-	Reference	Reference	Reference
Soc. Supp. *High Dis.	-	-	1.01 (0.44–2.31)	0.80 (0.35–1.83)
Soc. Supp. *Mod. Dis.	-	-	0.92 (0.52–1.63)	0.77 (0.44–1.36)
Soc. Supp. *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.02 (0.98–1.07)
Adult health status	-	-	-	0.45 (0.34–0.59) **
Healthy physical activity (n = 682)				
Social support	1.03 (0.84–1.27)	1.04 (0.85–1.28)	1.03 (0.74–1.43)	1.05 (0.76–1.44)
High disadvantage	-	1.22(0.89–1.67)	1.23 (0.90–1.68)	1.09 (0.79–1.50)
Mod. disadvantage	-	1.24 (1.00–1.55) ǂ	1.24 (1.00–1.55)ǂ	1.17 (0.93–1.46)
Low disadvantage	-	Reference	Reference	Reference
Soc. Supp. *High Dis.	-	-	1.20 (0.66–2.18)	1.20 (0.67–2.15)
Soc. Supp. *Mod. Dis.	-	-	0.95 (0.60–1.48)	0.98 (0.62–1.53)
Soc. Supp. *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	0.94 (0.91–0.98) **
Adult health status	-	-	-	0.76 (0.63–0.95) *
Healthy alcohol consumption (n = 729)				
Social support	1.01 (0.96–1.06)	1.01 (0.96–1.06)	1.00 (0.92–1.08)	1.00 (0.92–1.08)
High disadvantage	-	1.01 (0.92–1.10)	1.00 (0.91–1.09)	1.01 (0.93–1.10)
Mod. disadvantage	-	1.03 (0.97–1.09)	1.03 (0.97–1.09)	1.03 (0.97–1.09)
Low disadvantage	-	Reference	Reference	Reference
Soc. Supp. *High Dis.	-	-	1.00 (0.88–1.14)	1.00 (0.88–1.14)
Soc. Supp. *Mod. Dis.	-	-	1.03 (0.91–1.15)	1.02 (0.91–1.15)
Soc. Supp. *Low Dis.	-	-	Reference	Reference
Years of education	-	-	-	1.00 (0.99–1.01)
Adult health status	-	-	-	1.01 (0.96–1.07)

RR represents the probability of having a healthy behavior-related outcome. Model 1 includes social support, childhood health covariates, and demographics; model 2 adds childhood social disadvantage to model 1; model 3 adds an interaction between social support and childhood social disadvantage to model 2; model 4 adds adult covariates of educational attainment and adult health status to model 3.

Mod. moderate, *Dis.* disadvantage, *Soc. Supp.* social support

*Significant at $p < 0.05$;

**Significant at $p < 0.01$;

‡Marginal significance at $p < 0.10$