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Comments

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Child Psychological Well-Being and Adult Health Behavior and Body Mass Index

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Abstract

Objective: Psychological well-being (PWB) is linked with health behaviors among adults, but it is unclear if childhood PWB prospectively predicts healthy adulthood biobehavioral profiles. Such evidence may identify developmental windows for establishing positive health trajectories across the lifespan. Using data spanning 30 years, we investigated whether PWB at age 11 was associated with health behaviors and body mass index (BMI) at ages 33 and 42. We hypothesized children with higher versus lower PWB would engage in healthier behaviors, have lower BMI in adulthood, and be more likely to maintain optimal levels over time.

Methods: Data were from 4,728 participants of the 1958 National Child Development Study. At age 11, participants wrote an essay about how they imagined their lives at age 25. Two judges rated each essay for multiple facets of PWB, which were combined into a summary score (Cronbach's α=.91). At ages 33 and 42, participants reported on cigarette smoking, physical activity, and diet; BMI was also assessed. Regression models evaluated PWB's association with adult outcomes at each follow-up, and with patterns over time.

Results: Child PWB was unassociated with smoking in adulthood. However, greater child PWB was associated with healthier adult physical activity, diet, and BMI when adjusting for sex. Child PWB was associated with the likelihood of maintaining optimal BMI in adulthood, but not with maintaining healthy behaviors. Some associations were not independent of other childhood covariates.

Conclusions: Early life lays the foundation for lifelong health. Childhood PWB may contribute to healthier behaviors and BMI in adulthood.

Keywords: body mass index, health behaviors, biobehavioral profiles, psychological well-being, youth

Introduction

Although cardiovascular disease (CVD) does not typically manifest until adulthood, biobehavioral outcomes such as unhealthy behaviors and obesity may be evident much earlier in life (Pool et al., 2021). Indeed, biobehavioral profiles are often established in childhood and track into adulthood (Craigie et al., 2011; Simmonds et al., 2016). Furthermore, once unhealthy biobehavioral profiles are established, they can be challenging to improve and sustain in improved form over substantial periods of time (Fjeldsoe et al., 2011; Mann et al., 2007). These challenges further contribute to increasing an individual's likelihood of developing CVD over the lifespan, making it essential to identify factors that protect health early in life.

Childhood risk factors that are associated with increased likelihood of engaging in poor health behaviors and having elevated body weight among youth have been identified (Kalkhoran et al., 2018; Stierlin et al., 2015; Weihrauch-Blüher & Wiegand, 2018), but it is less clear whether there are protective factors that promote or preserve healthier biobehavioral profiles across time. Identifying protective factors early in life is critical given the difficulty in reversing unhealthy biobehavioral profiles once they are established. Recent work indicates that psychological well-being (PWB) – or regularly experiencing positive thoughts and feelings (Boehm & Kubzansky, 2012) – is a childhood resource that reduces cardiovascular risk in adulthood (as measured by clinically-assessed biological markers; Boehm et al., 2022). Evidence from adults suggests PWB may be protective because it can motivate individuals to engage in healthy behaviors that in turn build other resources (e.g., social connections), as well as mitigate negative or stressful feelings that lead to unhealthy behaviors (e.g., cigarette smoking, sedentary behavior) or physiological dysregulation (Kubzansky et al., 2018; Van Cappellen et al., 2018). Given that PWB in early life predicts PWB in adulthood (Coffey et al., 2015), some of these processes may have their origins in early life. However, childhood PWB has not been rigorously studied in relation to adult biobehavioral profiles. This study examines if PWB in childhood is associated with four biobehavioral outcomes in adulthood: cigarette smoking, physical activity, diet, and body mass index (BMI).

PWB is a multidimensional concept exemplified by attributes such as optimism, purpose in life, life satisfaction, and positive emotions (Boehm & Kubzansky, 2012). In adulthood, facets of PWB are associated with healthier weight status and behaviors including being a non-smoker, engaging in physical activity, and consuming healthy foods such as fruits and vegetables (Boehm, Chen, et al., 2018; Kushlev et al., 2019). Although most evidence regarding PWB's association with biobehavioral outcomes in adulthood is cross-sectional, some longitudinal studies indicate that PWB contributes to healthier behaviors and weight status over time (Kim et al., 2020; Serlachius et al., 2017). For example, among older adults, higher baseline PWB levels were associated with slower declines in physical activity and fruit and vegetable consumption across 7-11 years (Boehm, Soo, et al., 2018; Kim et al., 2017).

Limited work has evaluated if PWB in childhood is associated with biobehavioral outcomes. Cross-sectional evidence from early adolescents indicates that higher PWB levels are associated with higher likelihood of exercising and eating fruits and vegetables (Gireesh et al., 2018; Hayhoe et al., 2021). Several longitudinal studies have also reported associations between childhood PWB and adolescent engagement in healthier behaviors. For example, two longitudinal studies of U.S. adolescents found that children with lower baseline optimism or positive affect were more likely to report increased cigarette smoking or use of tobacco products across 1-3 years of follow-up (Carvajal et al., 2000; Mantey et al., 2021). Similarly, another longitudinal study of early adolescents in the U.S. found those with higher versus lower baseline optimism levels had healthier diets and engaged in more physical activity 18 months later (Carvajal, 2012). On the other hand, findings with physical activity have been less consistent. In a prospective study of Norwegian adolescents, 13-15 year old boys with lower versus higher life satisfaction levels were more likely to maintain physical inactivity or become inactive across 4 years (Rangul et al., 2011). In contrast, higher life satisfaction levels were not associated with higher likelihood of becoming physically active over the follow-up (Rangul et al., 2011).

Taken together, this preliminary evidence suggests childhood PWB may be associated with subsequently having healthier biobehavioral profiles in the short-term. However, the transition to adulthood represents a major developmental shift accompanied by significant changes (Daw et al., 2017). As such, it is unclear whether effects of childhood PWB on biobehavioral profiles persist across the life course. One long-term study across 15 years investigated PWB in youth and behavioral patterns later in life. Higher levels of positive emotions during adolescence were associated with lower odds of engaging in risky health behaviors (i.e., physical inactivity, fast food consumption, binge drinking, cigarette smoking, and drug use) in young adulthood (Hoyt et al., 2012). Additional evidence that childhood PWB can predict healthy biobehavioral profiles across substantially longer periods of time and into adulthood could suggest a potential target for intervention that might offer new strategies for establishing salubrious health trajectories starting early in life. Such strategies may ultimately help to increase the prevalence of adults who attain and maintain healthy biobehavioral profiles.

Building on the study by Hoyt and colleagues (2012), we used data from the 1958 National Child Development Study (NCDS) to investigate whether PWB at age 11 was associated with healthier biobehavioral profiles at ages 33 and 42, as characterized by key health behaviors (cigarette smoking, physical activity, and dietary consumption) and BMI. To identify associations with health trajectories over time, we also examined patterns in these biobehavioral outcomes during adulthood (i.e., maintaining healthy status and rate of change). To avoid potentially biased retrospective assessments or parent reports, we assessed childhood PWB from essays that 11-year-old participants wrote about their future lives. Given that emotion-related word use parallels emotional experiences (Vine et al., 2020), this innovative approach provides the opportunity to assess children's psychological functioning without requiring personal insight. We hypothesized individuals with higher PWB levels in childhood would subsequently have and maintain healthier behaviors and BMI in adulthood. We expected these associations to be independent of childhood sociodemographic characteristics and cognitive ability, which have demonstrated links with both PWB and health-related outcomes (Dobson et al., 2017; Hanson & Chen, 2007; Heinonen et al., 2006).

Methods

Participants

Data were from the 1958 NCDS, a longitudinal study of children born in England, Wales, or Scotland during one week in March 1958 (Atherton et al., 2008; Power & Elliott, 2006). The study was originally designed to investigate birth outcomes, but also examined health, education, and social factors, among others. Available in-depth assessments occurred at birth and ages 7, 11, 16, 23, 33, 42, 44, 46, 50, and 55 (Power & Elliott, 2006). The current study used data from participant-written essays, questionnaires, and clinical exams to assess childhood PWB and covariates at age 11 (1969), as well as health behaviors and BMI at ages 33 and 42 (1991 and 2000). We focused on assessments at ages 33 and 42 because all four outcomes were assessed during those ages using comparable methods across time.

Essays were written by 13,732 11-year-old NCDS participants while in their regular school classroom. Participants had 30 minutes to write in response to the prompt: "Imagine that you are now 25 years old. Write about the life you are leading, your interests, your home life and your work at the age of 25" (Elliott, 2007). The original essays are stored on microfiche at the Centre for Longitudinal Studies at the University of College London. In 2016-2017, 10,511 essays were transcribed and digitized for researchers. Because the current study was part of a larger study investigating cardiovascular risk in midlife (Boehm et al., 2022), only essays written by children who also had adult cardiovascular and biobehavioral assessments through age 42 were selected and coded by research assistants (n = 5,463). Individuals missing data on childhood PWB (because there was not enough information to code it; $n_{\text{missing}} = 282$) and adulthood health behaviors at either ages 33 or 42 ($n_{\text{missing}} = 453$) were further excluded from the analytic sample, resulting in 4,728 participants available for analysis (Supplemental Figure S1). Relative to participants included in the analytic sample, those in the original NCDS cohort who were excluded from our analyses tended to be male, have a father in a manual labor job, and had lower levels of cognitive ability. However, individuals included versus excluded in the analytic sample did not differ by age 11 BMI.

Participants and their parents (when necessary) provided consent. The UK Data Archive provided access to the relevant data and analytic code is available upon request from the first author. Given that this research used de-identified secondary data, an Institutional Review Board determined it did not involve human subjects and thus approval was not necessary. The study and analysis plan were not preregistered.

Psychological Well-Being

Drawing on prior theory and empirical work, we identified seven facets of PWB (positive affect, optimism, purpose in life, life satisfaction, personal growth, mastery, and pleasant experiences) likely to be relevant for health over the life course (Boehm & Kubzansky, 2012; Trudel-Fitzgerald et al., 2019; VanderWeele et al., 2020). Given that word use can parallel emotional experience and relates to health and well-being (Vine et al., 2020), we used the essays written by 11-year-old participants about their future to assess facets of PWB (Heyman et al., 2014; Lee & Peterson, 1997). Using face-valid questions (e.g., "To what extent is the author optimistic about his or her future?") and a scale ranging from 1 (*not at all*) to 7 (*very*), trained research assistants rated the extent to which each PWB facet was reflected in the essay (Boehm et al., 2022). Two items measured optimism and two items measured purpose in life but single items measured all other facets, for a total of nine rated items. Two judges evaluated each essay. When disagreements occurred, ratings from a third person replaced the ratings from the judge with the most discrepant set of ratings. As noted elsewhere, interrater agreement for each PWB item was excellent (Boehm et al., 2022).

Ratings for each item were first averaged across the two judges; each of the two items for optimism and purpose in life were then averaged together and an overall PWB score was computed by taking the mean of the seven facets of PWB (possible range 1-7; $\alpha = 0.91$). Mean PWB scores were standardized ($M = 0$, $SD = 1$) for ease of interpretation; higher scores represented greater well-being. To examine participant characteristics across PWB levels, tertiles were also created based on the distribution of raw scores in the analytic sample (low: <5 [34.9%]; moderate: 5-5.5 [33.2%]; and high: >5.5 [31.9%]).

Although a direct approach to assessing the validity of the PWB score was not possible because participants did not self-report their own PWB as children, the overall PWB score showed modest correlations with informant-reported childhood mental health and social status in the expected directions (Boehm et al., 2022). In addition, other research indicates that positive characteristics derived from the essays are correlated with self-reported well-being assessed at age 50 (Coffey et al., 2022). This converging evidence suggests the current approach to assess PWB is valid.

Health Behaviors and Body Mass Index

In an interviewer-based assessment at age 33 and a computer-aided interview at age 42, participants self-reported their engagement in three key health behaviors relevant for CVD: cigarette smoking, physical activity, and dietary patterns. Although alcohol consumption is considered an important behavior with implications for morbidity and mortality (GBD 2016 Alcohol Collaborators, 2018), we did not include it in analyses due to interviewer errors documented at the age 42 assessment (Staff et al., 2014).

Cigarette Smoking

Cigarette smoking was defined using a binary variable (non-smoker or current smoker) at ages 33 and 42. We also derived a binary variable to indicate if participants maintained non-smoking status between ages 33 and 42.

Physical Activity

Physical activity at both ages 33 and 42 was assessed by asking how often participants engaged in sports or exercise with four ordered categorial responses: 2-3 times a month or less often; once a week; 2-3 days per week; and 4-5 days per week or most days (Parsons et al., 2006). We also derived a binary variable to indicate if participants maintained regular physical activity (defined as 2-3 days a week or more) at both ages 33 and 42.

Diet

Diet was based on participants' reported frequency of eating fried food, fruits, vegetables, chips, sweets, and biscuits. For each food type, participants reported frequency of consumption in one of 7 categories (>once a day; once a day; 3-6 days a week; 1-2 days a week; and <once a week, occasionally [an option only at age 42], or never). To make responses comparable across ages 33 and 42, responses of <once a week and never were combined at age 33, and responses of <once a week, occasionally, and never were combined at age 42 (Parsons et al., 2006). The resulting five ordinal categories were assigned numerical values 1-5 with more frequent consumption reflecting higher values. After reversing scores for unhealthy food types (e.g., fried food, sweets), values were summed to create a continuous score of healthy diet ranging from 0-24 at both age 33 and 42. We also derived a binary variable to represent maintenance of healthy diets (defined as being in the top 40^{th} percentile of diet scores (Winning et al., 2018)) between ages 33 and 42.

Body Mass Index

BMI values (kg/m^2) were calculated from height and weight assessments by NCDS interviewers using standardized protocols at age 33. Participants self-reported height and weight at age 42, which were used to calculate BMI. Maintaining a healthy BMI (between 18.5 kg/m^2 and 25 kg/m^2) between the ages of 33 and 42 was represented with a binary variable.

Covariates

Potential confounding variables from age 11 were included in analytic models as covariates. These included parent report of child's sex (girl or boy) and father's social class (father absent, father present and employed in non-manual labor, or father present and employed in manual labor). General cognitive ability (continuous) was determined from verbal and non-verbal tests assessed by schoolteachers. BMI (kg/m^2) at age 11 was calculated with height and weight measurements obtained in medical exams. Because all participants were born during one week in 1958 and most were white (98.4%), age and race were not considered as covariates.

Statistical Analyses

The distribution of covariates was examined in the overall sample and differences by PWB tertile were evaluated with χ^2 tests or ANOVA. The prevalence or mean level of each biobehavioral outcome was also examined at ages 33 and 42. Missing covariate data ranged from 0-13.4% (with most missing data for childhood BMI) and was addressed with multiple imputation in 25 datasets via chained equations. The pooled dataset was used for all subsequent hypothesis testing analyses.

Regression models were used to test PWB's association with biobehavioral outcomes at ages 33 and 42. For the binary outcome of cigarette smoking, we used Poisson regression models because of the common outcome. When considering physical activity defined by ordered categories (i.e., 2-3 times a month or less; once a week; 2-3 days per week; or 4-5 days per week or more), we used multinomial regression. For the continuous outcomes of diet and BMI, we used linear regression and, to make full use of available data, linear mixed models with a compound symmetric covariance structure. Next, we used Poisson regression models to examine PWB's association with maintaining healthy status between ages 33 and 42 on each of the four biobehavioral outcomes. In all regression analyses, associations were evaluated in a series of three sequentially adjusted models that were first unadjusted, then adjusted for sex, and finally additionally adjusted for father's social class and childhood cognitive ability. For BMI, we also conducted sensitivity analyses that adjusted for age 11 BMI. Moreover, sensitivity analyses investigated if BMI findings were comparable when excluding underweight individuals (<18.5 kg/m^2) at either follow-up assessment in adulthood (n = 134).

Results

Participant Characteristics

Participant characteristics are shown in Supplemental Table S1. Slightly more than half of participants were female, and the majority had fathers who worked in manual labor. On average, childhood BMI levels were in the healthy range. The mean PWB level in the sample was 5.20 (SD = 0.63; range = 1.57-7.00). Girls, those with fathers in non-manual jobs, and those with higher cognitive ability tended to have higher PWB levels (Supplemental Table S1).

Most participants were non-smokers at ages 33 (70.1%; n = 3,314) and 42 (73.2%; n = 3,460). From ages 33 to 42, 66.0% maintained non-smoking status (n = 3,120). By contrast, fewer participants engaged in regular physical activity at age 33 (47.8%; n = 2,262) and 42 (47.7%; n = 2,257). Moreover, only 28.3% (n = 1,337) maintained regular physical activity between the ages of 33 and 42. The mean healthy diet score was 14.98 (SD = 2.32) at age 33 and 15.92 (SD = 3.45) at age 42. Only 28.8% (n = 1,361) maintained healthy diets between the ages of 33 and 42. Mean BMI was 24.86 (SD = 4.41) at age 33 and 25.76 (SD = 4.52) at age 42; 41.6% of participants (n = 1,966) maintained healthy BMI levels from ages 33 to 42.

Psychological Well-Being's Association with Health Behaviors and Body Mass Index

Cigarette Smoking

In unadjusted Poisson regression models, childhood PWB was not associated with being a nonsmoker at age 33 (Incidence Rate Ratio [IRR] = 1.01, 95% Confidence Interval [CI] = 1.00, 1.04, $p = .14$) or age 42 (IRR = 1.01, 95% CI = 1.00, 1.03, $p = .14$). Associations were not different in sex adjusted (age 33: IRR = 1.02, 95% CI = 1.00, 1.03, $p = .12$; age 42: IRR = 1.01, 95% CI = 1.00, 1.03, $p = .12$) or fully adjusted models (age 33: IRR = 1.00, 95% CI = 0.98, 1.02, $p = .91$; age 42: IRR = 1.00, 95% CI = 0.98, 1.02, $p = .90$). Moreover, childhood PWB was not associated with the likelihood of maintaining non-smoking status from ages 33 to 42 in unadjusted (IRR = 1.01, 95% CI = 0.99, 1.03, p = .20), sex adjusted (IRR = 1.01, 95% CI = 0.99, 1.04, p = .19), or fully adjusted models (IRR = 1.00, 95% CI = 0.98, 1.02, p = .74).

Physical Activity

Multinomial regression models shown in Table 1 indicated people with higher childhood PWB levels were more likely to engage in physical activity 2-3 times a week versus being inactive at both ages 33 and 42. Results were inconsistent or null for engaging in physical activity once a week or 4-7 days a week. Moreover, although point estimates were in the hypothesized direction, PWB in childhood was not associated with greater likelihood of maintaining regular physical activity from ages 33 to 42 in unadjusted (IRR = 1.05, 95% CI = 1.00, 1.10, p = .06), sex adjusted (IRR = 1.05, 95% CI = 1.00, 1.09, p = .06), or fully adjusted models (IRR = 1.03, 95% CI = 0.99, 1.08, p = .17).

Diet

Linear regression analyses indicated that higher childhood PWB levels were associated with healthier diet scores at age 33 in unadjusted (β = 0.22, 95% CI = 0.12, 0.31, p < .001), sex adjusted (β = 0.16, 95% CI = 0.07, 0.25, p < .001), and fully adjusted models (β = 0.10, 95% CI = 0.01, 0.19, p = .04). Similar findings were evident at age 42 in unadjusted (β = 0.19, 95% CI = 0.09, 0.28, p < .001), sex adjusted (β = 0.13, 95% CI = 0.04, 0.23, p = .007), and fully adjusted models (β = 0.09, 95% CI = 0.00, 0.19, p = .06). Linear mixed models examining change in the continuous healthy diet scores over time indicated that diets generally became healthier over the follow-up period (i.e., healthy diet scores increased; Table 2). Although each standard deviation increase in child PWB was associated with healthier diet scores at age 33 across all three models, no associations were noted between child PWB and rate of change in healthy diet scores over time (Table 2). Poisson regression models found no evidence of an association between child PWB and maintenance of healthy dietary patterns from ages 33 to 42 in unadjusted (IRR = 1.04, 95% CI = 0.99, 1.09, p = .11), sex adjusted (IRR = 1.01, 95% CI = 0.97, 1.06, p = .54), or fully adjusted models (IRR = 0.99, 95% CI = 0.95, 1.04, p = .71).

Body Mass Index

Linear regression analyses indicated that higher childhood PWB levels were associated with lower BMI at age 33 (β = -0.15, 95% CI = -0.28, -0.03, p = .02) and age 42 (β = -0.20, 95% CI = -0.33, -0.09, p = .002) in unadjusted models. Associations at age 33 were no longer statistically significant in sex adjusted (β = -0.11, 95% CI = -0.24, 0.01, p = .08) and fully adjusted models (β = -0.05, 95% CI = -0.17, 0.08, p = .48). Associations at age 42 were evident when adjusting for sex (β = -0.17, 95% CI = -0.29, -.04, p = .01) but not in fully adjusted models (β = -.10, 95% CI = -0.23, 0.03, p = .14). Unadjusted linear mixed models showed each standard deviation higher in child PWB was associated with 0.15 kg/m^2 lower BMI at age 33 (Table 3). These associations were no longer statistically significant after adjusting for other childhood covariates. Although participants' BMI levels tended to increase over follow-up, no associations were evident between child PWB and rate of change in adult BMI over time (Table 3). Conclusions from the linear mixed models were the same when underweight participants (BMI <18.5 kg/m^2) were excluded (data not shown). However, Poisson regression models suggested that higher childhood PWB levels were associated with greater likelihood of maintaining healthy BMI between ages 33 and 42 in unadjusted (IRR = 1.05, 95% CI = 1.02, 1.09, p = .004) and sex adjusted models (IRR = 1.04, 95% CI = 1.00, 1.07, p = .03), but not in fully adjusted models (IRR = 1.02, 95% CI = 0.99, 1.06, p = .19). Adding age 11 BMI into fully adjusted BMI models yielded nearly identical findings as those already presented (data not shown).

Discussion

Health behaviors and BMI are proximal predictors of CVD and other adverse health conditions, making them important outcomes that provide insight into trajectories of health that begin early in life, before disease manifests (Winning et al., 2018). Understanding factors in childhood that set the stage for subsequent cardiovascular risk or resilience is a critical next step for researchers (Suglia et al., 2018). This study is one of the first of its kind to examine if higher childhood PWB is related to healthier behaviors and BMI 20-30 years later. Findings indicated that greater childhood PWB was associated with healthier levels of physical activity, diet, and BMI in adulthood. However, childhood PWB was not associated with smoking status, nor with maintaining healthy status on cigarette smoking, physical activity, or diet from ages 33 to 42. Childhood PWB was associated with maintaining healthy BMI between the ages of 33 and 42 in unadjusted or sex adjusted analyses, but the association was no longer evident after adjusting for childhood covariates. Moreover, we found no evidence that child PWB was associated with rate of change in adult BMI or healthy diet levels. In sum, childhood PWB was associated with three out of four adulthood biobehavioral outcomes in minimally adjusted models but not necessarily with their profiles across time or consistently in fully adjusted models.

Findings from this study are consistent with and extend conclusions from previous work. Cross-sectional and longitudinal studies spanning a year or two have similarly reported that youth with higher levels of PWB engage in more physical activity, eat healthier diets, and have healthier BMIs (Carvajal, 2012; Khullar et al., 2011). Although one longitudinal study reported higher PWB levels in U.S. adolescents predicted an index score of fewer risky behaviors six years later, it did not examine PWB’s unique relationship with individual biobehavioral outcomes or their patterns across time (Hoyt et al., 2012). Moreover, a separate longitudinal study of U.S. women reported that well-being in adolescence was not associated with physical activity adherence across time in adulthood (Sun et al., 2017). It is notable that our findings from U.K. children were consistent with these previous findings from U.S. adolescents. Studies among adults have been more likely than studies among youth to examine and find PWB is associated with physical activity (Kim et al., 2017; Kim et al., 2020; Progovac et al., 2017; Sutin et al., 2021), dietary intake (Ait-Hadad et al., 2020; Boehm, Soo, et al., 2018; Stenlund et al., 2021), and BMI (Kim et al., 2020). Past research has also reported null associations for PWB and smoking in adults (Kim et al., 2020).

Given prior evidence from adolescents suggesting PWB may protect against the escalation of cigarette smoking (Carvajal et al., 2000), it is unclear why associations were not evident with smoking in the current study. Some researchers posit that facets of PWB may be especially pertinent for health-promoting behaviors (e.g., physical activity) rather than health-diminishing behaviors (e.g., cigarette smoking) because the pleasant feelings activated in the former cultivate other resources (e.g., social relations, mindfulness) that serve to maintain the behavior (Van Cappellen et al., 2018). Although health-diminishing behaviors may also be associated with pleasure, they do not have the same resource-building mechanisms, and feelings of pleasure may make it more difficult to disengage from the behavior. In addition, most people in the analytic sample were non-smokers across the follow-up period, which may make it difficult to detect associations with PWB if behavioral changes are not expected. Other work with this cohort has similarly reported little change in physical activity and diet between ages 33 and 42 (Parsons et al., 2006), which could further explain the null findings in the present study.

Health behaviors are also unique in that the correlates of initiating a behavior (both health-promoting and health-diminishing alike) may be different from the correlates of sustaining a behavior or suspending a behavior. Indeed, past evidence among youth has shown that associations may differ with PWB when initiating or maintaining a healthy behavior or stopping an unhealthy behavior (Rangul et al., 2011). Relatedly, conceptualizing patterns of health behaviors across time can be challenging in empirical studies. If no changes are expected during a given period, as may have been the case between the ages of 33 and 42 in this study, then prior behavioral status may be the best predictor of future behavioral status, which could leave little variance to be explained by factors like PWB (Boehm, Chen, et al., 2018).

Limitations and Strengths

This study has both limitations and strengths. First, apart from nurse-assessed BMI when participants were 33 years old, the biobehavioral outcomes were self-reported. This may introduce error into the data if participants are not self-aware or accurate in their reporting. Second, attrition in the larger NCDS cohort was evident across time, although no more than what is seen in other comparable epidemiological cohorts (Power & Elliott, 2006). Third, the cohort was comprised mainly of White participants, which does not reflect the racial and ethnic composition of the British population today and limits the generalizability of findings to individuals of other backgrounds. Finally, in observational studies of this kind, unmeasured third variables could explain the reported associations and there is always the possibility of residual confounding. To address this, we statistically adjusted for childhood factors known to be related to PWB and/or biobehavioral outcomes, including age 11 BMI. Future work should also consider childhood health behaviors as potential covariates, which we were not able to do because cigarette smoking, physical activity, and diet were not assessed at age 11.

These limitations are balanced by strengths including a follow-up period across 31 years that reveals how childhood factors may have enduring effects into adulthood. We also capitalized on a novel way to assess PWB through the words 11-year-old children used when reflecting on their future. This approach has been found to be reliable and valid (Boehm et al., 2022; Coffey et al., 2022) and the composite measure of PWB in this study was internally consistent. Such an approach highlights the child's perspective rather than a parent's or a teacher's, and reduces concerns about shared method variance with self-reported outcomes. However, future research should continue exploring the reliability and validity of assessing PWB in this way.

Concluding Remarks

Childhood has been described as a "window of opportunity" for CVD prevention (Fernandez-Jimenez et al., 2018). Identifying health-promoting factors early in life may serve to establish not only longer lives free from CVD, but also healthier lives without potentially debilitating risk factors. This study indicates that PWB may be one such health-promoting factor. Children who showed higher levels of PWB may be more likely to have healthier physical activity, dietary consumption, and BMI in adulthood. If these associations reflect a causal relationship, then interventions designed to foster PWB in children may have long-term impacts on adult health. Evidence suggests school-based interventions lead to improvements in PWB for children (Tejada-Gallardo et al., 2020). Furthermore, interventions in adults show promise with regard to promoting both PWB and subsequent healthier behaviors (Celano, Albanese, et al., 2018; Celano, Freedman, et al., 2018; Huffman et al., 2019). However, it remains to be seen whether interventions in youth would translate into improved biobehavioral outcomes and, if so, how long such effects would persist. Additional research is needed to examine whether PWB interventions in childhood can promote both high levels of PWB as well as healthy behaviors and BMI in early life, which could help establish a strong foundation for life course health.

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Table 1

Associations Between Standardized Psychological Well-Being and Physical Activity Levels at Ages 33 and 42 (N=4,728)[a]

	Prevalence	Model 1		Model 2		Model 3	
	n (%)	RRR (95% CI)	*p*	RRR (95% CI)	*p*	RRR (95% CI)	*p*
Age 33							
≤3 times per month	1,393 (29.5)	Reference	--	Reference	--	Reference	--
Once a week	1,073 (22.7)	1.01 (0.93, 1.09)	0.79	1.01 (0.93, 1.09)	0.80	0.98 (0.91, 1.06)	0.65
2-3 times a week	1,076 (22.8)	1.11 (1.03, 1.21)	0.01	1.12 (1.03, 1.21)	0.007	1.08 (1.00, 1.18)	0.06
4-7 days a week	1,186 (25.1)	1.05 (0.97, 1.13)	0.25	1.04 (0.96, 1.12)	0.32	1.03 (0.95, 1.11)	0.48
Age 42							
≤3 times per month	1,561 (33.0)	Reference	--	Reference	--	Reference	--
Once a week	910 (19.3)	1.08 (1.00, 1.18)	0.06	1.09 (1.00, 1.18)	0.04	1.06 (0.98, 1.15)	0.17
2-3 times a week	1,068 (22.6)	1.10 (1.02, 1.19)	0.02	1.10 (1.02, 1.19)	0.02	1.07 (0.99, 1.16)	0.08
4-7 days a week	1,189 (25.2)	1.00 (0.93, 1.08)	0.91	1.00 (0.93, 1.08)	0.98	0.99 (0.92, 1.07)	0.83

[a] Values are relative risk ratios (RRR) and 95% confidence intervals (CI) from multinomial regression models. Model 1 was unadjusted. Model 2 adjusted for sex only. Model 3 adjusted for sex, father's social class, and cognitive ability at age 11.

Table 2

Associations Between Standardized Psychological Well-Being and Rate of Change in Healthy Diet Scores from Ages 33 to 42 (N=4,728)[a]

	Model 1		Model 2		Model 3	
	ß (95% CI)	*p*	ß (95% CI)	*p*	ß (95% CI)	*p*
Psychological Well-Being, *Per 1-SD*	0.22 (0.12, 0.31)	<0.001	0.16 (0.069, 0.26)	0.001	0.11 (0.017, 0.21)	0.02
Time, *Age 33 to Age 42*	0.93 (0.84, 1.02)	<0.001	0.93 (0.84, 1.02)	<0.001	0.93 (0.84, 1.02)	<0.001
Psychological Well-Being*Time[b]	-0.031 (-0.13, 0.062)	0.51	-0.031 (-0.13, 0.062)	0.51	-0.031 (-0.13, 0.062)	0.51

[a] Model 1 was unadjusted. Model 2 adjusted for sex only. Model 3 adjusted for sex, father's social class, and cognitive ability at age 11.

[b] The interaction term provides the test for an association between psychological well-being and the rate of change in healthy diet.

Table 3

Associations Between Standardized Psychological Well-Being and Rate of Change in BMI from Ages 33 to 42 (N=4,728)[a]

	Model 1		Model 2		Model 3	
	ß (95% CI)	*p*	ß (95% CI)	*p*	ß (95% CI)	*p*
Psychological Well-Being, *Per 1-SD*	-0.15 (-0.28, -0.022)	0.02	-0.11 (-0.24, 0.015)	0.085	-0.05 (-0.17, 0.08)	0.43
Time, *Age 33 to 42*	0.90 (0.81, 0.99)	<0.001	0.90 (0.81, 0.99)	<0.001	0.90 (0.81, 0.99)	<0.001
Psychological Well-Being*Time[b]	-0.05 (-0.14, 0.04)	0.25	-0.05 (-0.14, 0.04)	0.25	-0.05 (-0.14, 0.04)	0.25

[a] Model 1 was unadjusted. Model 2 adjusted for sex only. Model 3 adjusted for sex, father's social class, and cognitive ability at age 11.

[b] The interaction term provides the test for an association between psychological well-being and the rate of change in BMI.