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Interaction of adolescent aspirations and self-control on wellbeing in old age: Evidence from a six-decade longitudinal UK birth cohort

Syudo Yamasaki^{a*}, Atsushi Nishida^{a*}, Shuntaro Ando^b, Kou Murayama^c, Mariko Hiraiwa-Hasegawa^d, Kiyoto Kasai^b,
^e and Marcus Richards^f

^aResearch Center for Social Science & Medicine, Tokyo Metropolitan Institute of Medical Science, Tokyo, Japan; ^bDepartment of Neuropsychiatry, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan; ^cDepartment of Psychology, University of Reading, Reading, UK; ^dSchool of Advanced Science, SOKENDAI (The Graduate University for Advanced Studies), Kanagawa, Japan; ^eThe International Research Center for Neurointelligence (WPI-IRCN), The University of Tokyo Institutes for Advanced Study (UTIAS), Tokyo, Japan; ^fMRC Unit for Lifelong Health and Ageing at UCL, University College London, London, UK

ABSTRACT

Adolescent self-control is important for the pursuit of long-term goals and predicts later outcomes, but motivating self-control is essential for subjective wellbeing throughout life. We investigated long-term implications of the interaction between adolescent aspirations and self-control on subjective wellbeing in early old age. We analysed longitudinal population-based birth cohort data spanning 60 years. Data from 1,727 participants, which were drawn from the 1946 British birth cohort, were analysed. Teachers assessed self-control and mental health in participants aged 13–15, and participants prioritised their intrinsic and extrinsic aspirations at 16. At age 60–64 years, subjective wellbeing was self-reported using the Satisfaction with Life Scale. Results revealed a significant interaction between adolescent aspirations and self-control on life satisfaction in early old age. Among adolescents with self-control problems, higher intrinsic aspirations predicted better life satisfaction. Thus, for adolescents with self-control problems, intrinsic aspirations-oriented educational and psychological approaches may improve later life satisfaction.

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Adolescents; aspirations; life satisfaction; self-control; wellbeing

Introduction

Adolescent self-control is a significant predictor of social achievement (Caspi et al., 1998; Duckworth et al., 2015) and physical and mental health across the life course (Fergusson et al., 2013; Moffitt et al., 2011). Self-control has been defined as the ‘effortful regulation of the self by the self’ (Duckworth, 2011) and is needed to prioritize tasks, internalize conflicting values, and pursue long-term goals at the expense of short-term attractions (Deci & Ryan, 2008; Elliot et al., 2012).

Life satisfaction, which is a distinct construct of subjective wellbeing, is an important outcome across the human life course. Life satisfaction is a suitable summary of subjective wellbeing (VanderWeele, 2017) that refers to thoughts about one’s quality of life as reflections on one’s own life based on aspirations (Steptoe et al., 2015). Life satisfaction has become increasingly important as a determinant of physical health over the life course and has been the focus of substantial debate in public policy and economics towards a healthy ageing society (Steptoe et al., 2015). Life satisfaction represents a cognitive and global evaluation of one’s own quality

of life as a whole (Pavot & Diener, 2008). Previous research has suggested that life satisfaction is one of three component structures of subjective wellbeing (e.g., positive affect, negative affect, and life satisfaction: Arthaud-Day et al., 2005; Diener, 1984) and is a separate factor from the affective components of subjective wellbeing (Arthaud-Day et al., 2005). Measures of life satisfaction have the advantage of including nonaffective information, such as success at reaching valued life goals (Pavot & Diener, 2008). Life satisfaction is an appropriate outcome measure of subjective wellbeing in life course studies because life satisfaction can reflect a long-term perspective across the life course, whereas the affective component of subjective wellbeing often consists of responses to factors over the short term (Pavot & Diener, 1993).

Previous studies have attempted to demonstrate an association between self-control and life satisfaction; however, these results were inconsistent. Several studies have suggested that self-control is positively correlated with life satisfaction (Cheung et al., 2014; Hofmann et al., 2014; Wiese et al., 2018), but others have argued that excessive self-control leads to mental health problems

CONTACT Syudo Yamasaki  yamasaki-sd@igakuken.or.jp; Atsushi Nishida  nishida-at@igakuken.or.jp

*These authors contributed equally to this work.

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with reduced life satisfaction (Carter et al., 2016; Kitsantas et al., 2003). Our previous birth cohort study, which followed participants for over 60 years, reported that adolescent self-control did not significantly predict life satisfaction in early old age after controlling for cognitive ability, socioeconomic status, and mental health problems in adolescence (Nishida et al., 2016a).

Why were previous results inconsistent? We suggest that one reason for self-control is a potential moderating factor of the link between self-control and life satisfactions. The reasons that motivate and facilitate self-control are important for life satisfaction (Deci & Ryan, 2000). Motivation and aspiration for achieving intrinsic goals refer to undertaking an activity for its inherent satisfaction (interesting, enjoyable). Intrinsic motivation and aspiration are critical elements in cognitive, social, and physical development because it is through acting on inherent interests that growth in knowledge and skills occurs (Ryan & Deci, 2000). On the other hand, extrinsic motivation and aspiration refers to doing something because it leads to a separable outcome (reward, punishment, social demands) (Ryan & Deci, 2000). When people try to achieve goals based on extrinsic aspirations (e.g., rewards or social praise), their self-control capacity is more easily exhausted than when goals are based on intrinsic aspirations (e.g., psychological needs related to self-determination) (Inzlicht et al., 2014). Specifically, cross-sectional and short-term longitudinal studies have shown that self-control based on intrinsic aspirations positively correlate with life satisfaction, while self-control based on extrinsic aspirations negatively correlates with this outcome (Sheldon & Elliot, 1999; Sheldon & Kasser, 1995). Furthermore, intrinsic and extrinsic aspirations (respectively) positively and negatively predict life satisfaction (Dittmar et al., 2014; Georgellis et al., 2009; Vansteenkiste et al., 2007; Wright & Larsen, 1993), from adolescence to young adulthood (Nickerson et al., 2003). However, to our knowledge, long-term associations and effects of interactions between aspirations and self-control from adolescence to old age have not been investigated in a large, population-based birth cohort study. Revealing these longitudinal associations can contribute to an understanding of how self-control can lead to positive psychological well-being across the life course and help to develop a way of promoting life satisfaction in older people, which is important for positive ageing.

The present study therefore investigated whether self-control modifies the association between adolescent aspirations and life satisfaction in early older adulthood, using data from the MRC National Survey of Health and Development (NSHD; the 1946 British birth cohort). The NSHD is one of the world's longest,

continuously running studies of the human life course (Kuh et al., 2011). In this cohort, self-control at age 13–15, aspirations at age 16, and life satisfaction at age 60–64 were captured.

Materials and methods

Participants

The NSHD initially consisted of a sample of 5,362 singleton children (girls: $n = 2,547$, 47.5%) born during a week in March 1946 in mainland Britain, who received regular follow-ups throughout their lives (Kuh et al., 2011). Information was provided by mothers, schoolteachers, and the participants during the surveys. This study used outcome data from the 2006–2010 follow-up when participants were 60–64 years old. Altogether, 2,856 eligible participants were recruited for an assessment at one of six clinical research facilities (CRFs) or visited at home by a research nurse. Not assessed were those who were known to have died ($n = 778$), were living abroad ($n = 570$), had previously dropped from the study ($n = 594$), or had been lost during follow-ups ($n = 564$). A total of 2,229 of the 2,856 participants (78.0%, age range 60.3–65.0 years, mean = 63.4, SD = 1.1) were recruited and assessed (1,690 attended a CRF, and 539 were visited at home) (Stafford et al., 2013). A total of 229 were part of a feasibility study, during which the outcome measures were not administered. We analysed data from 1,727 participants (915 women: $n = 53.0\%$) who provided the main predictors and outcome variables. The current study protocol was approved by the Greater Manchester Local Research Ethics Committee for the four English sites, and the Scotland A Research Ethics Committee approved the data collection in Edinburgh. All participants provided written informed consent.

Measures

Life satisfaction

Life satisfaction is a term that denotes an aspect of subjective wellbeing (VanderWeele, 2017), specifically, thoughts about quality of life in terms of original aspirations (Steptoe et al., 2015). Life satisfaction was assessed by the participants' self-reports using the Satisfaction with Life Scale (SWLS) (Diener et al., 1985). The scale is validated and can be administered with a lower participant burden and cost for a large-scale survey than is needed for an in-depth measure of wellbeing. The scale comprises five items: 1) 'In most ways, my life is close to my ideal,' 2) 'The conditions of my life are excellent,' 3) 'I am satisfied with my life,' 4) 'So far I have got the important things I want in life,' and 5) 'If I could live my life again, I would change almost nothing.'

Participants answered each item on a 7-point Likert scale (1: *strongly disagree* to 7: *strongly agree*). Answers were summed to derive a total score ranging from 5 to 35, with a higher score indicating a higher level of satisfaction with life. The scale showed high internal consistency (Cronbach's $\alpha = 0.90$ for the NSHD).

Adolescent aspirations

Participants were asked to rank the importance of six alternatives according to the relative importance of their aspirations at age 15 and age 16. The alternatives could be distinguished as three extrinsic future aspirations (A: *Good Pay*, B: *Security*, C: *Good Prospects*) and three intrinsic aspirations (D: *Being Able to Take Pride in One's Work*, E: *Interesting Work*, F: *Being One's Own Boss or Working Alone*) based on previous studies (Malka & Chatman, 2003; Ryan & Deci, 2000; Schwartz, 1999). Intrinsic motivation refers to doing something because it is inherently interesting (E: *Interesting*) or enjoyable (D: *Pride in work*), and extrinsic motivation refers to doing something because it leads to an outcome separable from the behaviour itself (A: *Good Pay*, B: *Security*, C: *Good Prospects*) (Ryan & Deci, 2000). In addition, based on Self-Determination Theory, intrinsic motivation is enhanced by a sense of individual autonomy (F: *Being One's Own Boss or Working Alone*) (Ryan & Deci, 2000). Participants ranked each according to their importance (first choice = 6 to sixth choice = 1). Scores were calculated as the differences between the sum scores of the three intrinsic aspirations from the three extrinsic aspirations (range: -9 to 9 ; higher scores represent having more intrinsic aspirations).

Adolescent self-control problems and other mental health problems

Full details of the measure of adolescent self-control and other mental health problems are presented elsewhere (Xu et al., 2013). Teachers rated participants' behaviours on a 3-category scale where teachers compared each participant's behaviour to that of 'a normal child' with 28 items at age 13 (see Table 1 in Xu et al., 2013 for descriptions of factor loadings and item wording). These items were forerunners for those included in the Rutter A scale (Elander & Rutter, 1996; Rutter et al., 1970). These data were analysed with separate exploratory factor analyses using item response theory methods in the Mplus 6.1 (Muthén & Muthén, 2010). Data were modelled as ordinal variables using weighted least-square means and variance adjusted estimators through the probit link. A 3-factor solution was suggested after examining the scree plots, eigenvalues, and model fit indices: *Self-Control Problems*, *Conduct Problems*, and *Emotional Problems* (see Table 1 in Xu et al., 2013). Self-control problems were defined by items relating to schoolwork

Table 1. Characteristics of participants.

	Males (N = 812)	Females (N = 915)	All (N = 1727)
Life satisfaction (SWLS), mean (SD) (range = 5 to 35)	26.94 (5.69)	26.48 (6.24)	26.70 (5.99)
Adolescent intrinsic aspiration, mean (SD) (range = -9 to 9)	-2.82 (4.38)	-1.27 (4.12)	-2.00 (4.31)
Adolescent mental health problems (top quartile, n (%))			
Self-control problems	247 (30.4)	184 (20.1)	-
Conduct problems	222 (27.3)	209 (22.8)	-
Emotional problems	174 (21.4)	258 (28.2)	-
Father's socioeconomic position at age 11, n (%)			
Professional	64 (7.9)	64 (7.0)	128 (7.4)
Intermediate	168 (20.7)	187 (20.4)	355 (20.6)
Non-manually skilled	129 (15.9)	161 (17.6)	290 (16.8)
Manually skilled	248 (30.5)	283 (30.9)	531 (30.7)
Partly skilled	144 (17.7)	169 (18.5)	313 (18.1)
Unskilled	48 (5.9)	41 (4.5)	89 (5.2)
Unknown	11 (1.4)	10 (1.1)	21 (1.2)
Educational attainment at age 26, n (%)			
Degree level or equivalent	262 (32.3)	289 (31.6)	551 (31.9)
Advanced (A-level)	13 (1.6)	44 (4.8)	57 (3.3)
Ordinary (O-level)	147 (18.1)	280 (30.6)	427 (24.7)
Vocational	241 (29.7)	230 (25.1)	471 (27.3)
No qualifications	131 (16.1)	54 (5.9)	185 (10.7)
Unknown	18 (2.2)	18 (2.0)	36 (2.1)

attitudes, concentration, neatness with work, and not daydreaming in class. Self-control problems were identified as a dimension separate from conduct problems (e.g., disobedience, evading the truth to keep out of trouble) and emotional problems (e.g., gloomy and sad, extremely fearful). In the previous studies, adolescent self-control scores independently predicted educational attainment (Xu et al., 2013), mental health (Nishida et al., 2014), and tobacco consumption (Nishida et al., 2016b) in adulthood, which is consistent with theoretical and empirical implications of the self-control construct (Moffitt et al., 2011). Factor scores were exported for each factor at age 13 and 15. These were summed to make overall scores for these dimensions. A higher score indicated lower self-control and worse emotional and conduct problems. The combined scales were standardized to form z-scores to facilitate interpretation.

Interaction between adolescent self-control problems and aspirations

To examine the effect of the interaction between self-control problems and aspirations on life satisfaction, we

derived an interaction term, which was a product of the mean deviation of self-control and that of the aspirations variable.

Covariates

We adjusted for adolescent conduct and emotional problems mentioned above as covariates. Longitudinal studies have demonstrated that adolescent conduct and emotional problems are correlated with the risk of psychiatric disorders in later life (Colman et al., 2009; Colman, Wadsworth et al., 2007), which in turn could lead to worse life satisfaction in older age. We also adjusted for gender, childhood socioeconomic position, and educational attainment. Previous studies have suggested that these are associated with life satisfaction in old age (Deindl, 2013; Piquart & Sörensen, 2001) as well as with adolescent job aspirations (Schoon & Parsons, 2002). Childhood socioeconomic position was determined according to the occupational social class of the father when participants were aged 11 years (or, if this was unknown, at 4 or 15 years), which was classified as 1: unskilled, 2: partly skilled, 3: manually skilled, 4: non-manually skilled, 5: intermediate level, 6: professional. The educational attainment of the participant was based on the highest educational qualifications and training equivalents attained by 26 years of age and was classified as 1: none, 2: vocational only, 3: ordinary secondary (O levels), 4: advanced secondary (A levels), or 5: degree level or equivalent.

Statistical analyses

We conducted regression analyses to test for associations between adolescent self-control, adolescent aspirations, and life satisfaction at age 60–64 years. We initially conducted univariate regression analyses to test for simple associations between the outcome and the independent variables (unadjusted model). We then conducted multiple regressions with mutually adjusted independent variables, (aspirations, self-control, and adolescent emotional and conduct problems), the interaction between aspirations and self-control problems, and the other covariates (gender, father's social class, and educational attainment) (adjusted model). To identify the interaction effect, ANOVAs and Tukey's test for multiple comparisons were conducted to test for differences in life satisfaction between four groups divided by the mean of the self-control and aspirations scores (e.g., high/low self-control and high/low aspirations). The significance level was set at .05 (two-tailed tests). All statistical analyses were conducted using IBM SPSS Statistics for Windows, version 24.0 (IBM Corp., New York, USA).

Role of funding sources

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing the manuscript. The corresponding authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Data statement

Data are available on request to the NSHD Data Sharing Committee. NSHD data sharing policies and processes meet the requirements and expectations of the MRC policy on the sharing of data from population and patient cohorts: <http://www.mrc.ac.uk/research/research-policy-ethics/data-sharing/data-sharing-population-and-patient-studies/>. Data requests should be submitted to mrclha.swiftinfo@ucl.ac.uk; further details can be found at <http://www.nshd.mrc.ac.uk/data.aspx>. These policies and processes are in place to ensure that the use of data from this 69-year-old birth cohort study is within the bounds of consent given previously by study members, complies with MRC guidance on ethics and research governance, and meets rigorous MRC data security standards.

Results

Analyses were conducted on a 50-year longitudinal dataset that included adolescent self-control, adolescent intrinsic aspirations, and life satisfaction at age 60–64. A total of 1,727 (812 men and 915 women) participants had no missing data on these measures (Table 1). Compared to those without missing data, participants with missing data included more males, more adolescents with mental health problems (more conduct and emotional problems, and lower self-control), and more with lower educational attainment by age 26 and lower father's social class (all $p < .01$). Of the aspirations investigated, the largest group of adolescents aspired to have an interesting job as their first-choice intrinsic aspiration, while the smallest number of adolescents aspired to work alone (Table 2).

Adolescent aspirations, self-control, and life satisfaction in old age

We examined correlations between adolescent self-control, intrinsic aspirations, and other covariates (Table 3). Self-control problems at age 13–15 were positively correlated with conduct problems ($r = .588$, $p < .001$) and emotional problems ($r = .260$, $p < .001$) at the same age. Self-control problems and conduct

Table 2. Descriptive statistics of aspirations at age 15–16 ($N = 1,727$).

<i>N</i> (%)	Extrinsic aspirations			Intrinsic aspirations		
	A: Good pay	B: Security	C: Good prospects	D: Pride in work	E: Interesting work	F: Working alone
1 st choice	83 (4.8)	420 (24.3)	220 (12.7)	118 (6.8)	766 (44.4)	45 (2.6)
2 nd	322 (18.6)	363 (21.0)	370 (21.4)	586 (33.9)	355 (20.6)	45 (2.6)
3 rd	424 (24.6)	357 (20.7)	398 (23.0)	321 (18.6)	208 (12.0)	51 (3.0)
4 th	463 (26.8)	302 (17.5)	365 (21.1)	252 (14.6)	228 (13.2)	80 (4.6)
5 th	301 (17.4)	227 (13.1)	311 (18.0)	303 (17.5)	127 (7.4)	147 (8.5)
6 th	134 (7.8)	58 (3.4)	63 (3.6)	147 (8.5)	43 (2.5)	1,359 (78.7)

Data are *n*(%) from participants with complete data for self-control problems at age 13, future aspiration at age 15–16, and life satisfaction at age 60–64, reflecting the relative importance of adolescents' aspirations. Participants ranked six alternatives according to their importance.

problems at age 13–15 were negatively correlated with intrinsic aspirations at age 16 ($r = -.103$, $p < .001$; $r = -.079$, $p < .001$, respectively). Female participants had higher intrinsic aspiration and emotional problem scores, as well as lower scores for self-control problems and conduct problems, than male participants (all $ps < .001$). Participants with higher father's socioeconomic position had fewer mental health problems (self-control problems: $r = -.211$, conduct problems: $r = -.130$, emotional problems: $r = -.055$; all $ps < .001$) and more intrinsic aspirations ($r = .105$, $p < .001$). Participants with higher educational attainment at age 26 had fewer mental health problems (self-control problems: $r = -.423$, conduct problems: $r = -.277$, emotional problems: $r = -.129$; all $ps < .001$) and more intrinsic aspirations ($r = .116$, $p < .001$).

We conducted multivariate regression analyses to test whether adolescent aspirations predicted total SWLS scores (Mean [SD] = 26.70 [5.99]) at age 60–64 (Table 4). In the unadjusted model, there was an interaction between adolescent self-control and intrinsic future aspiration on life satisfaction at 60–64 years ($\beta = 0.054$, $p = 0.025$). This remained significant when the results were adjusted for gender, father's social class, and educational attainment ($\beta = 0.066$, $p = 0.009$, Adjusted model in Table 4). Adolescent intrinsic future aspiration was positively associated with life satisfaction in older age only when the covariates were adjusted for ($\beta = 0.057$, $p = 0.024$, Table 4), while adolescent emotional problems were negatively associated with life satisfaction in older age in the unadjusted and adjusted

models ($\beta = -0.068$, $p = 0.005$; $\beta = -0.056$, $p = 0.045$, respectively, Table 4). Adolescent self-control problems, conduct problems, female gender, father's socioeconomic position, and educational attainment were not significantly associated with SWLS scores (Table 4).

To interpret the self-control $\times$ aspirations interaction, we conducted an ANOVA to test for differences among the four groups divided by the mean self-control and intrinsic aspirations scores. Figure 1 shows that people with high self-control problems and low intrinsic aspirations had significantly lower SWLS scores than the other three groups (high self-control problems and low intrinsic aspirations [Mean {SD} = 25.88 {6.27}] vs. high self-control problems and high intrinsic aspirations [Mean {SD} = 27.17 {6.04}]: $p = .009$; high self-control problems and low intrinsic aspirations vs. low self-control problems and low intrinsic aspirations [Mean {SD} = 26.99 {5.79}]: $p = .022$; high self-control problems and low intrinsic aspirations vs. low self-control problems and high intrinsic aspirations [Mean {SD} = 26.94 {5.74}]: $p = .049$). These results indicate that low adolescent intrinsic aspirations predicted subjective wellbeing in older age only among those with low self-control problems.

Discussion

The present results suggest that adolescent self-control modifies the association between adolescent aspirations and life satisfaction. While adolescent self-control problems alone were not associated with subjective

Table 3. Correlation coefficients among all variables.

		1	2	3	4	5	6	7
1	Life satisfaction at age 60–64	1.00	0.040	–0.036	–0.017	–0.068	** 0.016	0.022
2	Intrinsic future aspirations at age 16		1.00	–0.103	** –0.079	** –0.015	–0.105	** 0.116
3	Self-control problems at age 13–15			1.00	0.588	** 0.260	** 0.211	** –0.423
4	Conduct problems at age 13–15				1.00	–0.168	** 0.130	** –0.277
5	Emotional problems at age 13–15					1.00	0.055	** –0.129
6	Father's socioeconomic position at age 11						1.00	–0.422
7	Educational attainment at age 26							1.00

** $p < .001$

Table 4. Association between life satisfaction at age 60–64 years and scores for intrinsic future aspiration in adolescence.

Independent variables	Unadjusted model					Adjusted model				
	b	SE	95%CI	Std β	p	b	SE	95%CI	Std β	p
Intrinsic future aspiration	0.055	0.033	(–0.010–0.121)	0.040	0.098	0.080	0.036	(0.011–0.150)	0.057	0.024
Self-control problems	–0.225	0.151	(–0.522–0.072)	–0.036	0.137	–0.160	0.227	(–0.605–0.285)	–0.025	0.480
Interaction between self-control and aspiration	0.076	0.034	(0.010–0.143)	0.054	0.025	0.094	0.036	(0.024–0.163)	0.066	0.009
Adolescent mental health problems										
Conduct problems	–0.106	0.149	(–0.399–0.186)	–0.017	0.475	–0.180	0.205	(–0.582–0.222)	–0.029	0.380
Emotional problems	–0.433	0.153	(–0.734 – 0.132)	–0.068	0.005	–0.359	0.179	(–0.711 – 0.007)	–0.056	0.045
Covariates										
Gender						–0.503	0.309	(–1.109–0.104)	–0.042	0.104
Father's social class at age 11						0.146	0.121	(–0.091–0.384)	0.033	0.226
Educational attainment by age 26						0.042	0.126	(–0.204–0.289)	0.010	0.735

Coefficients in the unadjusted model reflect values from the univariate regression slope. Coefficients in the adjusted model reflect values from the multivariate regression slope, including covariates. Intrinsic future aspirations scores were calculated as differences between the sum scores of the three intrinsic aspirations from the three extrinsic aspirations on a scale of –9 to 9. Self-control problems, conduct problems, and emotional problems scores were exported by factor analysis based on teachers' ratings of participant's behaviour. (z-scores: –1 to 1). Interaction between self-control and aspiration was a product of the mean deviation of self-control and the aspiration variables. Father's social class was classified into six categories. Educational attainment was classified into five categories. b: unstandardised regression slope coefficients; Std β : standardised regression slope coefficients; **Bold: $p < .05$**

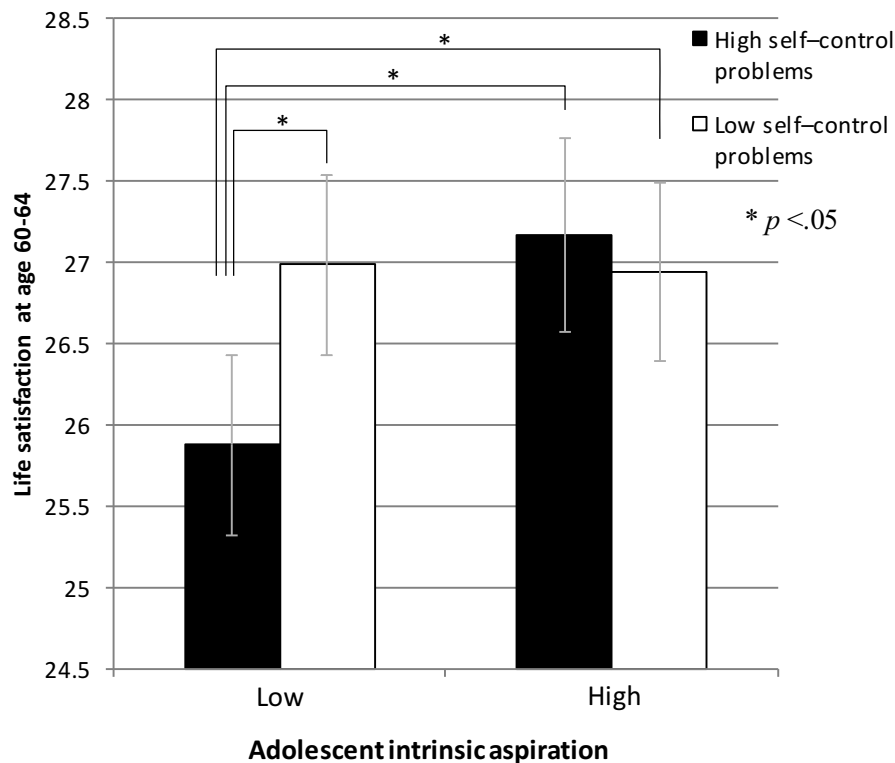


Figure 1. Differences in longitudinal effects of adolescent intrinsic aspirations on older age life satisfaction between adolescents with high and low self-control problems. The four groups were divided by the mean adolescent self-control and intrinsic aspiration scores. Black bars reflect participants with high self-control problems, and white bars reflect participants with low self-control problems. Left bars reflect participants with low adolescent intrinsic aspiration scores, and right bars reflect participants with high adolescent intrinsic aspiration scores. The group with high self-control problems and low intrinsic aspiration was significantly lower than the other three groups. *Significant difference ($p < .05$) from Tukey's test for multiple comparisons.

wellbeing in older age, such problems were associated with lower intrinsic adolescent aspirations at age 16, which in turn were associated with life satisfaction. The association between intrinsic aspirations and subjective wellbeing has been reported previously (Dittmar et al., 2014; Georgellis et al., 2009; Nickerson et al., 2003;

Vansteenkiste et al., 2007; Wright & Larsen, 1993), but our results indicate that this association is more prolonged over the life course than could be seen in previous studies. Furthermore, intrinsic aspirations were significantly associated with life satisfaction only among participants with lower adolescent self-control.

This finding supports self-determination theory, in which self-control processes include the process of internalizing motivations and aspirations (Deci & Ryan, 2008), suggesting that participants with lower self-control may find it difficult to internalize their own motivations when aspirations are extrinsically oriented, leading to lower life satisfaction (Deci & Ryan, 2000, 2008).

Adolescent aspirations were based on personal value priorities that broadly affect life satisfaction, mainly work satisfaction (Sagiv et al., 2017). This result suggests that adolescent aspirations are an important target for increasing positive mental wellbeing in older age, in keeping with findings from a previous longitudinal birth cohort study from adolescence to mid-adulthood (Schoon, 2001). On the other hand, adolescent emotional problems were associated with lower life satisfaction, as has been shown previously in the NSHD (Nishida et al., 2016a). Adolescent emotional problems are associated with risk for future mental health problems, especially depressive symptoms (Colman, Ploubidis et al., 2007; Fergusson & Woodward, 2002; Patton et al., 2014; Rutter et al., 2006), and depressive symptoms in turn significantly affect life satisfaction (Koivumaa-Honkanen et al., 2004).

Aspirations are a significant factor that should be taken into account when supporting adolescents with low self-control, at risk for mental health problems, and/or involved with criminal activities (Fergusson et al., 2013; Moffitt et al., 2011). Previous longitudinal twin studies have revealed that low self-control is relatively stable during the life course, and could be robustly explained by genetic factors (Beaver et al., 2009, 2008; Willems et al., 2019). It is not easy to enhance self-control among adolescents with low intrinsic aspirations; however, enhancing intrinsic aspirations could effectively promote later life satisfaction. Educational and psychological approaches to enhancing intrinsic motivation could be useful for adolescents with self-control problems. For instance, the effect of Acceptance and Commitment Therapy (ACT), a new cognitive-behavioural approach to improving mental health problems based on clients' intrinsic values (Hayes, 2004), was originally developed for adults and has recently been adapted for children and adolescents (Halliburton & Cooper, 2015; Swain et al., 2015). During the ACT process, the client and the therapist interact to clarify the client's intrinsic values before adopting psychological techniques toward improving mental health problems. In addition, improving life satisfaction among older people is also important because this might mitigate the impact of adolescent self-control and aspirations. Recent community-based group interventions based on a positive psychology approach are

a promising way to improve the life satisfaction among older people (Lighten UP! Program: Friedman et al., 2017). Future studies should examine the long-term effects of intrinsic value-based interventions as well as establish interventions for older people to improve life satisfaction.

The strengths of the present study include the use of a national population-based birth cohort sample and the availability of six-decade longitudinal follow-up data in order to examine prospective associations. We also had access to independently rated (by teachers) measures of adolescent mental health and a range of potential covariates. Nevertheless, a few limitations should also be noted. First, during the 60-year follow-up period, there was considerable participant attrition; such attrition was higher among those at low socioeconomic and education levels, as well as individuals noted as having poorer adolescent mental health. However, although attrition may have led us to underestimate the associations, we have no reason to consider that this would have affected the pattern of the associations. Second, we could not control the autoregressive effect of life satisfaction because the NSHD contained no data on adolescent life satisfaction, which cannot be inferred from the ratings of adolescent emotional problems. Third, measures of adolescent mental health were based on teacher ratings; thus, no data were gathered on evaluations by parents or the adolescents themselves. However, teachers can make a significant contribution to identify adolescent behavioural problems, which are sometimes missed by parents and children (Ford et al., 2003). Fourth, life satisfaction is just one aspect of subjective wellbeing. In this large cohort study, a convenient self-reported measure of life satisfaction was used. Although life satisfaction reflects long-term perspectives of subjective wellbeing and could be an appropriate outcome measure of subjective wellbeing in longitudinal life course studies, assessing other aspects of subjective wellbeing (e.g., positive and negative affect) also could be important to reveal whether adolescent self-control and aspirations are specifically associated with the cognitive aspects of subjective wellbeing or are more generally associated with subjective wellbeing, including affective aspects. Further studies with a detailed and broad assessment of subjective wellbeing would be needed. Fifth, although several cohort studies have suggested the construct validity of the measures of adolescent mental health problems (Nishida et al., 2016b, 2014; Xu et al., 2013), there is still no evidence about its criterion validity. Further testing for establishing this would be needed.

Overall, the present results indicate that targeting adolescent aspirations could be important for enhancing

life satisfaction in older age. Furthermore, intrinsic value-based interventions might have an important effect on adolescents' transitions and navigation through adulthood, particularly those with self-control problems.

Author contributions

SY, AN, SA, and MR designed the research; SY, AN, SA, KM, and MR wrote the manuscript; KK and MHH critically reviewed the manuscript. All authors have approved the final manuscript.

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