

RESEARCH ARTICLE

Cross-national and longitudinal evidence for a rapid decline in life satisfaction in adolescence

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Email: Michael.A.Daly@mu.ie**Abstract**

Introduction: While several studies have documented a declining-with-age trend in life satisfaction in adolescence, cross-national and nationally representative longitudinal evidence is needed to establish the normative trajectory of life satisfaction during this critical developmental period.

Methods: The Health Behaviour in School-Aged Children (HBSC) study of 10–16-year-olds included the Cantril Ladder life satisfaction measure in surveys of 43 countries between 2001 and 2014 ($N = 752,620$, 51% females). The UK Household Longitudinal Study (UKHLS) was used to assess within-person changes in life satisfaction from age 10 to 15 years among young people sampled between 2009 and 2018 ($N = 8952$, Obs. = 30,278).

Results: Life satisfaction decreased by 0.61 SDs on average from ages 10 to 16 in the HBSC sample. A statistically significant decreasing-with-age trend was observed in each of the 43 countries examined. Females experienced a more pronounced decline in life satisfaction than males (0.75 SD vs. 0.46) on average, and a significantly larger decrease in life satisfaction among females was identified in 38 of 43 countries examined. Longitudinal analysis of adolescents from the UKHLS sample replicated this pattern: life satisfaction declined significantly by 0.5 SD between the ages of 10 and 15 and this decline was found to be steeper for females (0.76 SD) than for males (0.23SD).

Conclusions: The study findings enhance our understanding of the lifespan dynamics of life satisfaction and point to a potential universal decline in life satisfaction in adolescence. Understanding the developmental processes underlying this phenomenon will now be crucial.

KEYWORDS

age trends, gender differences, life satisfaction, lifespan development, subjective well-being

1 | INTRODUCTION

Prominent intergovernmental agencies (e.g., The Organisation for Economic Cooperation and Development, World Health Organization, United Nation) have advocated for the use of subjective well-being indicators to gauge societal progress and inform public policy priorities (Stiglitz et al., 2018). Following this advice, many nations now measure subjective well-being to monitor how citizens cognitively evaluate and emotionally experience their lives, and global well-being reports are routinely compiled (e.g., Helliwell et al., 2020). The rapid growth in interest in subjective well-being among policymakers, researchers, and the public has been underpinned by an extensive empirical literature examining how well-being evolves over the lifecycle (Blanchflower & Oswald, 2008; Deaton, 2008; Dolan et al., 2008).

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However, large-scale efforts to measure and monitor the well-being of nations have focused almost exclusively on adults, neglecting the perspectives of children and adolescents (Marquez & Long, 2021). This is an important omission because developmental changes in the well-being of young people form the foundation for adult life satisfaction (Bradshaw et al., 2011; Layard et al., 2014). Further, life satisfaction is a key predictor of subsequent life outcomes including higher earnings, better health, and longevity (De Neve et al., 2013; Willroth et al., 2020). Despite the long-term significance of adolescent well-being for adult outcomes, current understanding of the dynamics of adolescent well-being remains limited. In particular, the main measure of subjective well-being, life satisfaction (De Neve et al., 2020), warrants exploration given the paucity of evidence on how this key aspect of well-being develops throughout adolescence.

Adolescence is characterized by rapid changes in life conditions, and dramatic physical growth and biological changes. For example, the transition from childhood to adolescence is marked by an increased emphasis on time spent in social groups outside the family, an exploration of interests, extracurricular activities, and romantic relationships (Furman & Wehner, 1997; Smetana et al., 2006). While these activities have the potential to enhance life satisfaction, the advent of puberty also brings an array of changes that may adversely affect well-being. Rapid physiological changes and weight gain can detrimentally affect how adolescents view their bodies (Bucchianeri et al., 2013). The pressures of schoolwork and parental expectations tend to grow throughout adolescence which may influence life satisfaction (Moksnes et al., 2016). Indeed, extensive evidence indicates that school-related factors and school satisfaction are important predictors of life satisfaction in adolescence (Huebner & Diener, 2008; Suldo et al., 2008).

Theoretical models of life satisfaction have tended to focus on understanding individual differences in life satisfaction among adults by highlighting the role of personality factors (e.g., neuroticism and extraversion) and external situational factors such as life stressors (Diener et al., 1999; Evans, 1994). In adolescence, internalizing problems have been shown to mediate the relationship between personality and environmental variables and life satisfaction (Lyons et al., 2013). Further, there is evidence that internalizing problems increase throughout adolescence (Graber & Sontag, 2009), which is a time when many adolescents experience mental health difficulties including depression and anxiety for the first time (Beesdo-Baum & Knappe, 2012; Costello et al., 2011; Layard et al., 2014). The increased incidence of disturbances of emotion and mood throughout adolescence may therefore represent a major threat to life satisfaction.

Considering these trends, it is perhaps surprising that evidence is mixed on whether life satisfaction shows an increasing, decreasing, or stable trend throughout adolescence. A declining-with-age trend is perhaps the dominant finding in the literature, and has been reported in early cross-sectional studies from Israel (Ullman & Tatar, 2001), South Korea (Park, 2005), Romania and Spain (Casas et al., 2013), and Germany (Goldbeck et al., 2007) and recent longitudinal studies from Spain (Aymerich et al., 2021; González-Carrasco et al., 2017, 2020), Hong Kong (Shek & Liang, 2018), and Algeria (Tiliouine et al., 2019). However, a cross-sectional study in the United States did not find a change in life satisfaction across grades 9–12 (Huebner et al., 2004). Similarly, a recent longitudinal study of Mexican-origin adolescents in the United States found no change in satisfaction from age 14 to 17 years (Willroth et al., 2021). Further, life satisfaction was found to increase throughout adolescence in a large longitudinal study of Korean adolescents (Yoo et al., 2017) and a longitudinal study of Finnish adolescents (Salmela-Aro & Tuominen-Soini, 2010).

Whether trajectories of adolescent life satisfaction differ between males and females is also unclear. Similar levels of life satisfaction (Casas et al., 2013; Park, 2005) and patterns of change in life satisfaction throughout adolescence (Goldbeck et al., 2007) have been found in males and females. A longitudinal study from Hong Kong found that males experienced a faster decline in life satisfaction than females in adolescence (Shek & Liang, 2018). In contrast, it has been suggested that biological (e.g., hormonal influences) and sociocultural influences (e.g., gender standards, expectations and stereotypes) may lead to a greater emotional vulnerability and more rapid decline in life satisfaction among girls than boys (Aymerich et al., 2021; Goldbeck et al., 2007). Recent longitudinal studies of Spanish adolescents (Aymerich et al., 2021; González-Carrasco et al., 2020) have found that females experience sharper decreases in life satisfaction throughout adolescence than males.

However, despite a growing body of research examining changes in life satisfaction throughout adolescence, a clear picture of developmental trajectories of satisfaction has yet to emerge. Understanding the direction and magnitude of life satisfaction trajectories requires a systematic examination of a set of nationally representative samples examined over multiple time points. This is because the developmental course of life satisfaction may vary markedly based on the unique experiences and exposures encountered by a specific generation or nation. Whether social, historical, and cultural events unique to a specific cohort influence the development of adolescent life satisfaction is currently unclear. For this reason, in this study age trends in life satisfaction were examined across multiple years of data collection and across a large set of countries. This allowed the possibility that there may be a normative trajectory of adolescent life satisfaction to be evaluated. Further, to date, evidence from existing longitudinal studies examining life satisfaction in adolescence is inconclusive. Large-scale nationally representative data from adolescents followed up for several years are needed to clarify whether *within-person* life satisfaction trajectories align with *between-person* estimates from cross-sectional samples.

1.1 | Current research

The present research aims to address key gaps in the literature by testing for the presence of changes in life satisfaction during adolescence in 43 countries across four time periods from 2001 to 2014. Importantly, the data this study draws upon are nationally representative and have been collected using standardized sampling and measurement protocols to ensure comparability across nations and time. This study also draws on a large-scale nationally representative longitudinal study of UK adolescents to estimate age trajectories of life satisfaction when the same participants are tracked over time. Finally, sex differences were estimated in each data set to evaluate whether males and females differed systematically in their life satisfaction trajectories in the nations and studies examined.

2 | STUDY 1

2.1 | Methods

2.1.1 | Study participants and design

For this study, data from the Health Behaviour in School-Aged Children (HBSC) study were used. The HBSC is a large-scale international World Health Organization cross-sectional school-based survey carried out every 4 years a (<http://www.hbsc.org>). The study focuses on the assessment of the well-being, health, and health behaviors of European and North American adolescents. This study draws on four successive waves of the HBSC study conducted in 2001/2002, 2005/2006, 2009/2010, and 2013/2014. In total, 43 countries provided self-reported data in at least one study wave. French- and Flemish-speaking regions in Belgium were sampled separately. Each country collected nationally representative data for 11-, 13-, and 15-year-old adolescents following a standardized study protocol to ensure the study sampling, measures, and data collection procedures were consistent across countries. The study used a cluster probability sampling design with schools or classes within schools selected to produce a representative sample for each country. Each country obtained appropriate ethical approval for the survey and consent to participate was sought from school administrators, parents, and children/adolescents. Detailed information on the sampling methodology and study administration and protocol can be found elsewhere (Currie et al., 2014).

This study sample consisted of 752,620 adolescents from 43 countries (average country sample size = 17,503; min. = 2124, max = 37,616). Participants were included if they were aged from 10 to 16 years and had available data on their age, sex, life satisfaction, of survey completion, and survey weights. The HBSC sampling strategy aims to sample groups with a mean age of 11.5, 13.5, and 15.5 in each country. For this reason, most participants ($N = 614,797$; 81.7%) sampled were aged either 11, 13, or 15 at the time of the survey. However, a substantial portion of the sample ($N = 137,823$; 18.3%) were aged 10 ($N = 8997$), 12 ($N = 50,230$), 14 ($N = 46,538$), or 16 years ($N = 32,058$) enabling life satisfaction trends to be estimated from age 10 to 16 years.

2.2 | Measures

2.2.1 | Life satisfaction

Study participants reported their life satisfaction using the Cantril Self-Anchoring Ladder of Life Satisfaction (Cantril, 1965). Participants were presented with a picture of a ladder and instructed that the bottom step (labeled “0”) represents the worst possible life and the top of the ladder (labeled “10”) the best possible life. The Cantril Ladder has shown good test–retest reliability and convergent validity with other well-being measures in adolescent samples aged 11–15 (Levin & Currie, 2014).

2.2.2 | Age

Participants reported their age in years and months at the time of the survey. For the regression analyses age in years was examined as the main predictor variable.

2.2.3 | Covariates

Full sample estimates adjusted for participant sex, survey wave, and country of residence.

2.3 | Statistical analysis

Life satisfaction was standardized across all participants and time-points to have a mean of 0 and an SD of 1. This was done to enhance the comparability of estimates derived from the two studies presented in this article. The relationship between age in years and life satisfaction was estimated using pooled OLS regressions in Stata 17 with standard errors clustered at the country level. The regression coefficient for age can be interpreted as the change in life satisfaction in SD units associated with a 1-year change in age. All analyses were weighted to ensure estimates are representative of the population. The main regression model was adjusted for participant sex and included survey wave and country fixed effects (i.e., a dummy variable for each survey wave and each country of residence) to account for differences in life satisfaction between survey time-points and countries.

The relationship between age and life satisfaction in adolescence was modeled as linear in the main analyses because preliminary analyses showed that including higher-order age polynomials did not meaningfully improve the variance in life satisfaction explained (e.g., 2.89% of variance uniquely explained by the linear effect of age, 2.92% explained when the squared effect of age was introduced into the model, and 2.93% when the cubic effect of age was added). To estimate age associations by sex an interaction between age and sex was added to the model. Analyses were conducted first on the full sample/all waves and then repeated separately for each study wave (2001/2002, 2005/2006, 2009/2010, 2013/2014) and for each of the 43 countries examined.

3 | RESULTS

3.1 | Descriptive statistics

The average age of the sample was 13.58 years (SD = 1.64) and 51.1% was females, as shown in Table 1. Life satisfaction levels were high on average with an average level of 7.59 on the 0–10 scale (SD = 1.93). There was clear evidence of a decline in life satisfaction across age groups, as shown in Table 1. Life satisfaction was 8.17 (SD = 1.93) among those aged 10 years and 7.15 (SD = 1.90) among those aged 16 years. Males reported higher life satisfaction ($M = 7.70$, $SD = 1.88$) than females ($M = 7.48$, $SD = 1.98$) ($p < .001$ for difference). There was a slight increase in life satisfaction from the 2001/2002 wave ($M = 7.55$, $SD = 1.92$) to the 2013/2014 wave ($M = 7.63$, $SD = 1.95$) ($p < .001$ for difference).

TABLE 1 Descriptive statistics and life satisfaction levels for the Health Behaviour in School-Aged Children (HBSC) study sample ($N = 752,620$) assessed between 2001 and 2014

| | Sample characteristics | | Life satisfaction <i>M</i> (SD) |
|----------------|------------------------|-------|------------------------------------|
| | <i>N</i> | % | |
| Overall sample | 752,620 | – | 7.59 (1.93) |
| Age 10 | 8997 | 1.20 | 8.17 (1.93) |
| Age 11 | 196,894 | 26.20 | 8.03 (1.91) |
| Age 12 | 50,230 | 6.67 | 7.88 (1.94) |
| Age 13 | 212,429 | 28.23 | 7.55 (1.91) |
| Age 14 | 46,538 | 6.18 | 7.41 (1.92) |
| Age 15 | 205,474 | 27.30 | 7.21 (1.88) |
| Age 16 | 32,058 | 4.26 | 7.15 (1.90) |
| Sex | | | |
| Male | 367,219 | 48.90 | 7.70 (1.88) |
| Female | 385,401 | 51.10 | 7.48 (1.98) |
| Survey wave | | | |
| 2001/2002 wave | 148,031 | 19.66 | 7.55 (1.92) |
| 2005/2006 wave | 194,319 | 25.82 | 7.57 (1.93) |
| 2009/2010 wave | 205,827 | 27.35 | 7.59 (1.92) |
| 2011/2014 wave | 204,443 | 27.16 | 7.63 (1.95) |

Note: Life satisfaction was measured on scale ranging from 0 (worst possible life) to 10 (best possible life).

3.2 | Regression estimates

An examination of the relationship between age in years (using age dummies for each year) and life satisfaction showed that this relationship followed a linear declining pattern across survey waves (see Figure 1). Regression analysis, with age was treated as a linear variable, identified a negative association between age and life satisfaction ($b = -0.101$, 95% CI $[-0.111$ to $-0.092]$, $p < .001$) in a model that adjusted for participant sex, survey wave, and country of residence (see Table 2). Between age 10 and 16 life satisfaction was predicted to decline by 1.18 points (95% CI $[-1.28$ to $-1.07]$, $p < .001$) or -0.61 SDs (95% CI $[-0.67$ to $-0.55]$, $p < .001$) on average. A negative association between age and life satisfaction was observed across all study waves and 43 country samples ($p < .001$ in each analysis) and ranged in magnitude from a 0.052 SD decline per year in Denmark to a 0.157 SD decline per year in Greece, as shown in Table 2.

The interaction between participant age and sex (where male = 0, female = 1) was significant and negative ($b = -0.048$, 95% CI $[-0.054$ to $-0.042]$, $p < .001$), indicating that the decline in life satisfaction with age was more pronounced among females ($b = -0.125$, 95% CI $[-0.136$ to $-0.114]$, $p < .001$) than males ($b = -0.077$, 95% CI $[-0.085$ to $-0.068]$, $p < .001$), as shown in Figure 2. On average, the estimated decline in life satisfaction between age 10 and 16 was 1.45 points on the Cantril scale (95% CI $[-1.58$ to $-1.33]$, $p < .001$) or -0.75 SD (95% CI $[-0.82$ to $-0.68]$, $p < .001$) for females and 0.89 points (95% CI $[-0.99$ to $-0.79]$, $p < .001$) or -0.46 SD (95% CI $[-0.51$ to $-0.41]$, $p < .001$) for males.

Statistically significant interactions between age and sex were observed in all study waves and in 38 of the 43 country samples examined, as outlined in Table 2. In all instances where statistically significant interactions were identified the decline in life satisfaction throughout adolescence was larger for females than for males. Between the ages of 10 and 16 declines in life satisfaction of over 1 SD (or 1.93 points on the Cantril scale) were observed among females in Bulgaria (1.03 SD), Greece (1.06 SD), Ireland (1.06 SD), Malta (1.09 SD), Spain (1.07 SD), and Sweden (1.12 SD).

4 | STUDY 2

4.1 | Methods

4.1.1 | Study participants and design

To examine the relationship between age and life satisfaction using within-person, rather than between-person, models this study drew on data from nine waves of the UK Household Longitudinal Study (UKHLS or *Understanding Society*) completed between 2009 and 2018 (Buck & McFall, 2011). The UKHLS is a large-scale nationally representative panel study of British adults and includes a youth panel of adolescents aged 10–15. Children enter the youth panel at age 10 and exit the panel at age 16 at which point they move onto the adult survey. The sample included 8951 participants aged 10–15 who took part in at least two study waves between 2009 and 2018 and provided life satisfaction data. Participants took part in 3.4 study waves on average and provided 30,278 observations in total.

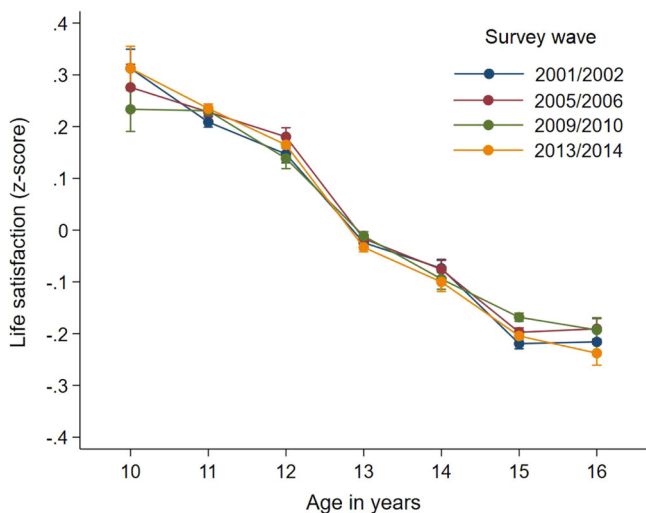


FIGURE 1 Estimated standardized life satisfaction scores by age group for 752,620 participants across 43 countries assessed in four waves of the Health Behaviour in School-Aged Children (HBSC) survey conducted between 2001 and 2014 [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 2 Estimates of the association between age in years and life satisfaction in the Health Behaviour in School-Aged Children (HBSC) study sample (2001–2014), in each study wave (2001/2002, 2005/2006, 2009/2010, 2011/2014) and in each of 43 countries examined

| | Life satisfaction (z-score) | | | | | | Gender diff. ^a <i>p</i> |
|---------------------|-----------------------------|-------|----------|-------|----------|-------|---------------------------------------|
| | All participants | | Males | | Females | | |
| | <i>b</i> | SE | <i>b</i> | SE | <i>b</i> | SE | |
| Age (total sample) | -0.101 | 0.005 | -0.077 | 0.004 | -0.125 | 0.005 | <.001 |
| Age association in: | | | | | | | |
| 2001/2002 wave | -0.101 | 0.014 | -0.080 | 0.014 | -0.121 | 0.015 | <.001 |
| 2005/2006 wave | -0.101 | 0.011 | -0.076 | 0.011 | -0.126 | 0.012 | <.001 |
| 2009/2010 wave | -0.096 | 0.010 | -0.077 | 0.009 | -0.114 | 0.011 | <.001 |
| 2011/2014 wave | -0.107 | 0.011 | -0.075 | 0.011 | -0.137 | 0.012 | <.001 |
| Age association in: | | | | | | | |
| Albania | -0.120 | 0.009 | -0.111 | 0.014 | -0.128 | 0.012 | .357 |
| Austria | -0.116 | 0.004 | -0.091 | 0.006 | -0.140 | 0.006 | <.001 |
| Armenia | -0.118 | 0.008 | -0.091 | 0.011 | -0.140 | 0.010 | .001 |
| Belgium (Flemish) | -0.089 | 0.004 | -0.063 | 0.006 | -0.117 | 0.006 | <.001 |
| Belgium (French) | -0.097 | 0.006 | -0.063 | 0.008 | -0.129 | 0.009 | <.001 |
| Bulgaria | -0.146 | 0.006 | -0.121 | 0.008 | -0.171 | 0.009 | <.001 |
| Canada | -0.058 | 0.004 | -0.037 | 0.006 | -0.078 | 0.006 | <.001 |
| Croatia | -0.121 | 0.004 | -0.085 | 0.006 | -0.156 | 0.006 | <.001 |
| Czech Republic | -0.0690 | .004 | -0.047 | 0.006 | -0.091 | 0.006 | <.001 |
| Denmark | -0.052 | 0.004 | -0.031 | 0.005 | -0.071 | 0.006 | <.001 |
| Estonia | -0.114 | 0.004 | -0.081 | 0.006 | -0.147 | 0.006 | <.001 |
| Finland | -0.069 | 0.003 | -0.050 | 0.005 | -0.087 | 0.005 | <.001 |
| France | -0.094 | 0.004 | -0.076 | 0.005 | -0.113 | 0.005 | <.001 |
| Germany | -0.074 | 0.004 | -0.050 | 0.005 | -0.097 | 0.005 | <.001 |
| Greece | -0.157 | 0.005 | -0.136 | 0.006 | -0.177 | 0.007 | <.001 |
| Greenland | -0.123 | 0.010 | -0.103 | 0.015 | -0.140 | 0.014 | .077 |
| Hungary | -0.120 | 0.005 | -0.095 | 0.007 | -0.142 | 0.006 | <.001 |
| Iceland | -0.086 | 0.003 | -0.063 | 0.005 | -0.109 | 0.005 | <.001 |
| Ireland | -0.148 | 0.005 | -0.113 | 0.007 | -0.176 | 0.007 | <.001 |
| Israel | -0.104 | 0.005 | -0.099 | 0.007 | -0.107 | 0.006 | .483 |
| Italy | -0.115 | 0.005 | -0.095 | 0.006 | -0.135 | 0.006 | <.001 |
| Latvia | -0.076 | 0.004 | -0.057 | 0.006 | -0.092 | 0.006 | <.001 |
| Lithuania | -0.090 | 0.005 | -0.064 | 0.007 | -0.117 | 0.007 | <.001 |
| Luxembourg | -0.1190 | .006 | -0.082 | 0.008 | -0.155 | 0.008 | <.001 |
| Macedonia | -0.139 | 0.005 | -0.133 | 0.007 | -0.149 | 0.007 | .091 |
| Malta | -0.148 | 0.013 | -0.114 | 0.017 | -0.182 | 0.018 | .006 |
| Rep. of Moldova | -0.102 | 0.008 | -0.069 | 0.011 | -0.134 | 0.011 | <.001 |
| Netherlands | -0.100 | 0.004 | -0.072 | 0.005 | -0.127 | 0.005 | <.001 |
| Norway | -0.103 | 0.004 | -0.068 | 0.006 | -0.139 | 0.006 | <.001 |

(Continues)

TABLE 2 (Continued)

| | Life satisfaction (z-score) | | | | | | Gender diff. ^a <i>p</i> |
|----------------|-----------------------------|-------|----------|-------|----------|-------|---------------------------------------|
| | All participants | | Males | | Females | | |
| | <i>b</i> | SE | <i>b</i> | SE | <i>b</i> | SE | |
| Poland | -0.134 | 0.004 | -0.106 | 0.006 | -0.161 | 0.006 | <.001 |
| Portugal | -0.120 | 0.005 | -0.088 | 0.007 | -0.148 | 0.006 | <.001 |
| Romania | -0.113 | 0.005 | -0.081 | 0.007 | -0.141 | 0.007 | <.001 |
| Russia | -0.075 | 0.004 | -0.053 | 0.006 | -0.093 | 0.006 | <.001 |
| Slovakia | -0.099 | 0.005 | -0.061 | 0.008 | -0.135 | 0.008 | <.001 |
| Slovenia | -0.096 | 0.004 | -0.062 | 0.006 | -0.129 | 0.006 | <.001 |
| Spain | -0.154 | 0.004 | -0.127 | 0.005 | -0.179 | 0.005 | <.001 |
| Sweden | -0.145 | 0.004 | -0.103 | 0.005 | -0.186 | 0.005 | <.001 |
| Switzerland | -0.074 | 0.004 | -0.058 | 0.005 | -0.091 | 0.005 | <.001 |
| Turkey | -0.132 | 0.007 | -0.138 | 0.009 | -0.126 | 0.010 | .359 |
| Ukraine | -0.086 | 0.005 | -0.073 | 0.007 | -0.098 | 0.006 | .005 |
| United Kingdom | | | | | | | |
| England | -0.084 | 0.004 | -0.059 | 0.006 | -0.107 | 0.006 | <.001 |
| Scotland | -0.110 | 0.004 | -0.077 | 0.005 | -0.142 | 0.005 | <.001 |
| Wales | -0.088 | 0.005 | -0.055 | 0.006 | -0.121 | 0.007 | <.001 |
| United States | -0.063 | 0.005 | -0.046 | 0.007 | -0.079 | 0.007 | .001 |

Note: Life satisfaction was standardized to have a mean of 0 and SD of 1. Estimates are from weighted analyses. All estimates of the association between age and life satisfaction are statistically significant at the $p < .001$ level.

^aStatistical significance of the interaction between participant sex and age in predicting life satisfaction.

4.2 | Measures

4.2.1 | Life satisfaction

In the UKHLS young people were asked to tick a box to indicate, “which best describes how you feel about your life as a whole?” Response options were presented on a 7-point scale represented by more or less smiley faces. Participants were instructed that 1 (happiest face) “is completely happy” and 7 (very sad face) is “not at all happy” and asked to mark the scale point that most closely resembles how they currently feel about their life. To enhance comparability with Study 1, this variable was reverse coded so that high scores indicated high levels of life satisfaction. This question has previously been used to examine the relationship between life satisfaction and neighborhood deprivation in the UKHLS (Jonsson et al., 2020).

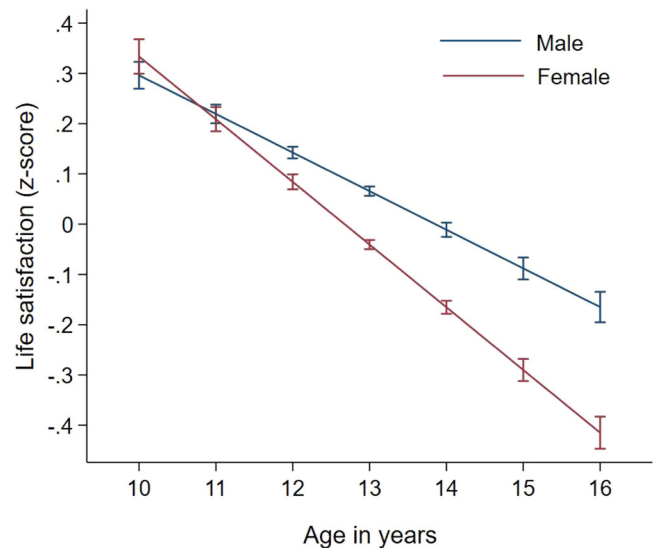
4.2.2 | Age

Age in years was examined as the main predictor variable.

4.3 | Statistical analysis

For comparability with Study 1 life satisfaction was standardized across all participants and survey waves to have a mean of 0 and an SD of 1. The link between changes in age and changes in life satisfaction was estimated using fixed effects regression analysis in Stata 17. The fixed-effects model estimates age effects by comparing life satisfaction at different ages for the same individuals (Kratz & Brüderl, 2021). The inclusion of individual-specific fixed effects (α_i) provides a control for all stable person-specific characteristics (e.g., genetic endowment, background disadvantage) that could influence life satisfaction. As such, time-invariant confounders such as sex and country included in Study 1 are automatically adjusted for. Birth cohort is

FIGURE 2 Estimated linear relationship between participant age and standardized life satisfaction scores for males and females assessed in Health Behaviour in School-Aged Children surveys conducted between 2001 and 2014 ($N = 752,620$) [Color figure can be viewed at wileyonlinelibrary.com]



also time-constant and automatically adjusted for (Brüderl et al., 2019). The fixed-effects model estimates the association between age in years (10/11/12/13/14/15 years) captured using age dummies ($\sum_{k=11}^{15} \beta_k Age_{k,it}$) and life satisfaction ($LifeSat_{it}$) experienced by individuals i across survey waves t . β_k captures the change in life satisfaction between age 10 and age k (Brüderl et al., 2019). The model includes a time-varying error term (ε_{it}) and can be expressed as

$$LifeSat_{it} = \alpha_i + \sum_{k=11}^{15} \beta_k Age_{k,it} + \varepsilon_{it}.$$

A dummy variable was also included to indicate whether the survey wave was after the 2013–2015 survey wave because there was a small decrease in life satisfaction after this point (from 5.92 on average in waves up to the 2013–2015 survey to 5.79 after). Age was modeled first as a categorical variable (using age dummies for each year of adolescence as outlined above) to test for the presence of nonlinearity and then treated as a continuous variable in a linear model when little evidence of nonlinearity was found. Analyses also tested whether the relationship between age and life satisfaction differed between males and females by adding the interaction between age and sex to the model.

5 | RESULTS

5.1 | Descriptive statistics

The average age of the sample was 12.53 years ($SD = 1.63$) and 50% were females. Life satisfaction levels were high on average with an average level of 5.87 on the 1–7 scale ($SD = 1.17$) across survey waves. Life satisfaction scores were 6.06 ($SD = 1.16$) among those aged 10 years and 5.64 ($SD = 1.20$) among those aged 15 years. The life satisfaction of males was higher on average ($M = 5.94$, $SD = 1.12$) than that of females ($M = 5.81$, $SD = 1.21$) ($p < .001$ for difference).

5.2 | Regression analysis

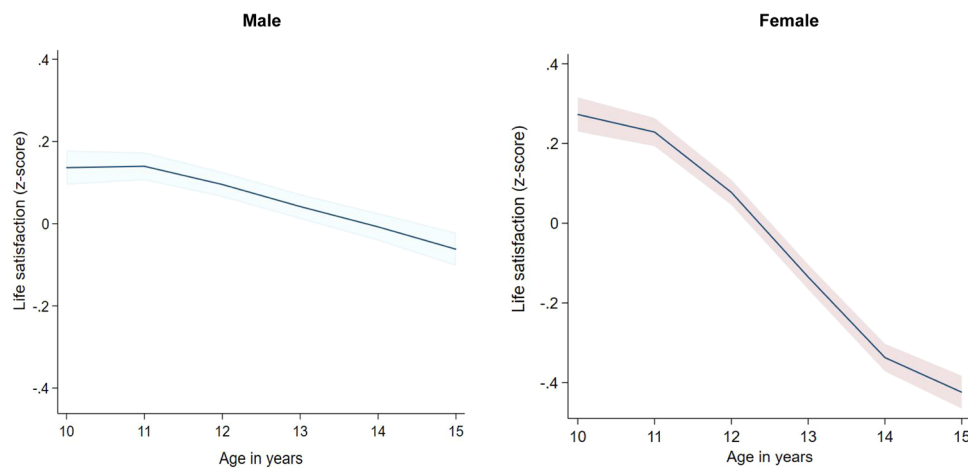
Within-person regression analysis showed that age in years (using age dummies for each year) was associated with an approximately linear decrease in life satisfaction from age 10 to 15 as outlined in Table 3. Life satisfaction declined by -0.45 SD (95% CI $[-0.50$ to $-0.40]$, $p < .001$) between the ages of 10 and 15. This decline was over three times larger for females ($b = -0.70$ 95% CI $[-0.77$ to $-0.63]$, $p < .001$) than males ($b = -0.20$, 95% CI $[-0.27$ to $-0.13]$, $p < .001$), as illustrated in Figure 3.

In a regression model where the relationship between age and life satisfaction was treated as linear, life satisfaction was found to decline by -0.099 SD per year (95% CI $[-0.108$ to $-0.090]$) during adolescence. There was a significant interaction between age and participant sex in predicting life satisfaction ($b = -0.107$, 95% CI $[-0.120$ to $-0.094]$, $p < .001$). The within-person decline in life satisfaction with age was larger for females ($b = -0.152$, 95% CI $[-0.163$ to $-0.141]$, $p < .001$) than males ($b = -0.045$, 95% CI $[-0.056$ to $-0.034]$, $p < .001$), as shown in Table 3. On average the estimated decline in life satisfaction

TABLE 3 Within-person estimates of the association between age groups and age in years (continuous) and life satisfaction in the UK Household Longitudinal Study (UKHLS) study sample between 2009 and 2018 ($N = 8951$, Obs. = 30,278)

| | Life satisfaction (z-score) | | | | | |
|------------------------------------|-----------------------------|-------|-----------|-------|-----------|-------|
| | Overall sample | | Males | | Females | |
| | <i>b</i> | SE | <i>b</i> | SE | <i>b</i> | SE |
| Age group (comparison is 10 years) | | | | | | |
| Age 11 | -0.019 | 0.017 | 0.003 | 0.024 | -0.044 | 0.025 |
| Age 12 | -0.116*** | 0.018 | -0.041 | 0.025 | -0.196*** | 0.026 |
| Age 13 | -0.249*** | 0.020 | -0.095** | 0.028 | -0.408*** | 0.029 |
| Age 14 | -0.376*** | 0.022 | -0.144*** | 0.031 | -0.610*** | 0.032 |
| Age 15 | -0.448*** | 0.025 | -0.199*** | 0.034 | -0.697*** | 0.035 |
| Age in years (continuous) | -0.099*** | 0.005 | -0.045*** | 0.006 | -0.152*** | 0.006 |

Note: Life satisfaction was standardized to have a mean of 0 and SD of 1.

**FIGURE 3** Estimated within-person change in standardized life satisfaction scores as a function of changes in age for males and females assessed in the UKHLS between 2009 and 2018 ($N = 8951$, Obs. = 30,278) [Color figure can be viewed at wileyonlinelibrary.com]

from age 10 to 15 in the linear model was 0.76 SD (95% CI [-0.82 to -0.71], $p < .001$) for females and 0.23 SD (95% CI [-0.28 to -0.17], $p < .001$) for males.

6 | DISCUSSION

In a large cross-sectional sample of over three quarters of a million adolescents, life satisfaction levels declined between age 10 and 16 years in all 43 countries examined. Over this period females experienced a large drop in life satisfaction (0.75 SD) and males experienced a moderate decline (0.46 SD). This pattern where girls experienced a steeper decline in life satisfaction than boys was near universal appearing in 38 of the 43 countries examined. Longitudinal analyses replicated the finding that females experienced a large (0.76 SD) drop in life satisfaction from age 10 to 15 years. A less dramatic drop in life satisfaction was found for males in longitudinal analyses (0.23 SD).

In contrast to the current findings where a sharp drop in life satisfaction was found, studies examining life satisfaction throughout adulthood have found modest declines from young adulthood to midlife (e.g., Blanchflower & Oswald, 2008) and beyond (Jebb et al., 2020). For example, Jebb et al. (2020) examined Cantril ladder scores in 1.7 million adults from 166 countries and found that there was a 0.21 SD decline in life satisfaction over 60 years from age 20 to 80. The largest regional change reported was a 0.53 SD decline in life satisfaction in Eastern Europe from age 20 to 80. In the present study, Cantril ladder scores declined by 0.61 SD over 6 years among adolescents surveyed in 43 countries. The decline in life satisfaction exceeded 1-scale point on the Cantril ladder which has been used as a benchmark for associations of “practical significance” (Jebb et al., 2020). This comparison indicates that adolescence may represent a period of life when life satisfaction is changing at a particularly dramatic and significant rate.

It will now be crucial to examine the factors driving this trend. Adolescence is a critical developmental stage where numerous vulnerabilities emerge and could combine to influence life satisfaction. While investigation into the specific life experience that could detrimentally affect life satisfaction is needed, a set of potential contributors warrant comment. First, research in developmental epidemiology has shown that symptoms of a range of mental health conditions tend to increase from childhood through adolescence with depression and anxiety showing particularly large increases in prevalence (Beesdo-Baum & Knappe, 2012; Costello et al., 2011). Experiencing the emergence of mental health problems, which remain stigmatized (Bharadwaj et al., 2017) and are associated with significant functional impairment, could generate a decline in life satisfaction for those affected (Layard et al., 2014).

Likewise, an increase in schoolwork pressure, educational expectations, and the competitiveness of school environments could lead older adolescents to feel pressured by academic demands and could adversely impact life satisfaction (Curran & Hill, 2019; Moksnes et al., 2016; Wiklund et al., 2012). Body image concerns rise rapidly throughout adolescence and the emergence of dissatisfaction with one's weight and other aspects of appearance could act to markedly reduce life satisfaction (Bucchianeri et al., 2013). Finally, screen time tends to increase during adolescence and has been linked to reduced well-being (Twenge et al., 2018), though the magnitude of the link between screen time and well-being may be too weak (Orben & Przybylski, 2019) to explain the large decline in life satisfaction seen in this study.

Importantly, there is evidence that the rise in mental health symptoms (Beesdo-Baum & Knappe, 2012; Costello et al., 2011), appearance concerns (Ferreiro et al., 2014), and school pressures (Klinger et al., 2015) in adolescence may be more pronounced for girls than boys. Further, screen time and technology usage which increase in adolescence have been associated with larger well-being effects among females than males (Twenge & Martin, 2020). As such, these potential pathways could also explain why females appear to experience larger declines in life satisfaction than males in adolescence.

7 | LIMITATIONS AND FUTURE DIRECTIONS

The current research has several limitations that warrant discussion. First, while notable changes in life satisfaction were observed across countries and in both cross-sectional and longitudinal analyses, findings were restricted to a relatively narrow time window of 6–7 years. It remains unclear how life satisfaction trajectories evolve as adolescents transition into young adulthood and beyond. Existing research suggests that the gender gap in adult life satisfaction is small and may favor women (Joshanloo & Jovanović, 2020; Wood et al., 1989). It may therefore be the case that the large discrepancy in adolescent life satisfaction between males and females at age 15/16 in the current study may begin to close as adolescents enter adulthood. For this reason and to provide a more complete picture of lifespan life satisfaction trajectories, studies following adolescents into adulthood using the same measure of life satisfaction administered repeatedly over time are needed.

Second, this study relied on single-item measures of life satisfaction, and it is possible that more diverse multiple-item measures may yield more valid estimates of age trajectories. Prior research has shown the validity of single- and multiple-item life satisfaction measures to be approximately equal (Jovanović, 2016), suggesting that this threat may be minor. However, a notable drawback of single-item measures is that assessing measurement invariance across age groups is not possible. It, therefore, remains possible that differences in how adolescents interpret or respond to life satisfaction questions over time could have influenced the age trends found in this study. Prior research has shown strong invariance regarding age (Esnaola et al., 2017) and longitudinal measurement invariance (Esnaola et al., 2019) for multiple-item life satisfaction measures administered throughout adolescence. Replicating the current findings using such multiitem measures is, therefore, a priority. Extending the assessment of subjective well-being to assess the affective component of well-being in adolescence (Casas et al., 2020) would also be useful in identifying whether a similar drop is observed in experiences of positive affect in daily life.

Third, while this study drew on nationally representative samples from 43 countries, the samples examined were primarily European and North American in origin. Sampling a broader set of nations would allow the generalizability of the trends identified in this study to be tested. Similarly, examining longitudinal change in life satisfaction across a wider variety of countries would yield insight into whether the sharp decline in satisfaction among females relative to males observed in the United Kingdom tends to occur in other nations.

8 | CONCLUSIONS

To date, the development of life satisfaction throughout adolescence has been largely overlooked in cross-national studies and nationally representative longitudinal research. Drawing on data from 43 nations the present study provided evidence of a widespread steep decline in life satisfaction from the ages of 10 to 16 years. Both cross-national and longitudinal evidence showed that this downward life satisfaction trajectory was particularly dramatic for girls. Given the increasing attention of policymakers and researchers on promoting population well-being, it is crucial that initiatives aiming to support well-being

over the lifespan consider these pronounced developmental changes. It is also critical that the causes of the rapid decline in life satisfaction are understood alongside potential protective factors which could inform the development of intervention efforts and policies targeting adolescents.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

ETHICS STATEMENT

The study utilizes anonymized survey data, and therefore, ethical approval for this study was waived by the Maynooth University Social Research Ethics Sub-Committee.

AUTHOR CONTRIBUTIONS

Michael Daly analyzed data, designed research, performed research, and wrote the paper.

DATA AVAILABILITY STATEMENT

The data that support the current findings are available for research purposes via the HBSC Data Management Centre (<http://www.uib.no/en/hbscdata>) operated through the University of Bergen and the UK Data Service (beta.ukdataservice.ac.uk/datacatalogue/series/series?id=2000053).

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