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**Is social media use associated with children's well-being? Results from the UK Household Longitudinal Study**

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## **Abstract**

**Introduction:** There are concerns about young people's increasing use of social media and the effects this has on overall life satisfaction. Establishing the significance of social media use requires researchers to take simultaneous account of other factors that might be influential and it is essential to adopt a longitudinal perspective to investigate temporal patterns.

**Method:** Measures of happiness for children aged 10-15 from 7 waves of the UK Household Longitudinal Study were examined (n=7596). Multilevel models were used to assess the relative association between these measures, children's social media use and individual, household and community characteristics.

**Results:** High use of social media was found to be significantly associated with change in happiness scores but was not associated with worsening life satisfaction trajectories. The most consistent factor was gender, with girls experiencing the largest decline in happiness between two time points (0.18 points) and being more likely to have a worsening trajectory over time (OR 1.77, 95% CI 1.36 - 2.32). Parental mental health, household support and household income were also important.

**Conclusion:** Moderate use of social media does not play an important role in shaping children's life satisfaction. Higher levels of use is associated with lower levels of happiness, especially for girls but more research is needed to understand how this technology is being used. As well as focusing on high levels of social media use, policy makers should also concentrate on particular demographic groupings and factors affecting the social fabric of the households in which children grow up.

**Key words:** mental health, social media, well-being, household context, mental health inequalities, young people

## **1. Introduction**

Contemporary understandings of mental well-being tend to focus on the Two-Continua Model whereby mental health status is not only characterised by the absence of mental illnesses, such as anxiety and depression, but also includes consideration of psychological or subjective well-being (Greenspoon & Saklofske, 2001). Psychological well-being has become an increasingly important focus of research on children's lives and a key distinction can be made between hedonic and eudaimonic well-being (see Huta (2016) for an overview). Hedonic well-being is defined as the subjective experience of pleasure or happiness, involving both an affective component (i.e. positive and negative emotions) and a cognitive dimension relating to elements of (and overall) quality of life (The Children's Society, 2016). In contrast, eudaimonic definitions are focused on notions relating to self-purpose, self-fulfilment, sense of autonomy and good relations with others. Whilst most elements of eudaimonic well-being may be subjective in nature, the ideas around personal goals and achievements are, arguably, focused on experiences that are objectively good for the person (Kagan, 1992; McMahan & Estes, 2011).

As research on hedonic well-being focuses on subjective lived experience, it brings two key advantages. First, it provides a way to capture children's perspectives on their own lives and frame them as active participants within them (Rees & Main, 2016). Second, it offers the potential to capture something different to more objective and sometimes medical-based concepts of mental (ill-) health. The relationship between subjective well-being and mental health has been conceived in different ways. Although the two terms are sometimes simply conflated or used interchangeably, at other times they are seen as lying on a single continuum such that oppositional definitions of one are used to create measures of the other (Huppert &

So, 2013). More recently, research on children has shown that, although related, they are not straightforwardly synonymous (Patalay & Fitzsimons, 2016). Significant numbers of children displaying symptoms of mental illness do not describe themselves as having their well-being compromised, while children with low subjective well-being often have no symptoms of mental illness. Children's subjective well-being is, therefore, of relevance and importance in its own right.

Much existing research has centred on children's subjective well-being in terms of its cognitive aspects, i.e. personal evaluations of their lives or components of it, rather than its affective aspects, i.e. moods and emotions. One particularly fruitful area of work has focused on life satisfaction - evaluations of life as a whole – as this captures something more stable and enduring, especially compared to fleeting assessments of affect (The Children's Society, 2016).

Alongside the challenges surrounding different ways of understanding children's mental well-being, recent attention and concern has focused on the increasing numbers of children suffering from poor mental health and the rapid escalation in numbers requesting referrals to mental health services (Crenna-Jennings & Hutchinson, 2018). Of importance for the work presented here, and against this backdrop of increasing poor mental health, is the debate surrounding the causal significance of technological change and young people's ever-increasing use of social media (Best, Manktelow, & Taylor, 2014; Przybylski & Weinstein, 2017).

It has been suggested that there are three main ways in which time spent engaging with social media can impact negatively on children's well-being (McDool, Powell, Roberts, & Taylor,

2016). The first involves the detrimental effects of ‘social comparison’ whereby young people become anxious and stressed about their ability to compare favourably with the proliferation of idealised images presented through the many social media platforms. Individual success in this endeavour is measured in terms of the ability to sustain strong levels of online approval (ie ‘likes’) for physical appearance, expression of opinion or for engaging in activities perceived to be ‘cool’. The inability to constantly evidence these traits and remain part of the ‘online gang’ may lead to distress.

Second, increasing social media use can damage subjective well-being via the ‘finite resources’ theory where time spent online displaces beneficial activities such as physical exercise or face-to-face interactions with friends and family (Moreno et al., 2013; Wallsten, 2013). There is also evidence to suggest that negative mood may be due to resultant anxiety relating to a realisation that time has been wasted on a meaningless, non-productive activity (Sagioglou & Greitemeyer, 2014). At the extreme end of the scale, some social media users could be described as addicts whose lives are dependent on interacting with such technology (Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009; Van Rooij & Prause, 2014). Here excessive use is undertaken to modify negative moods and users suffer anxiety or distress if prevented from using social media. More engagement is required to achieve the same level of satisfaction. Although this paper does not focus on the medicalisation or any formal diagnosis of poor mental health relating to extreme or addictive social media use, it is worth noting that medicalisation of such behaviour is not beyond the realms of possibility. The latest revision of the World Health Organisation’s (WHO) International Classification of Diseases (ICD 11), for example, now includes (online) ‘Gaming Disorder’ to describe uncontrolled and health damaging use of digital/online video games (WHO, 2018).

Third, subjective well-being may deteriorate because of children's exposure to more direct forms of on-line harm via social media. Children and young people are especially vulnerable to cyberbullying and recent research evidences a link between exposure to online bullying and subsequent poor mental health (The Children's Society, 2018). Abusive/victimising text or graphic images are shared with groups of peers easily. Unless posts are removed, virtual conversations and images remain online indefinitely.

In summary, much literature concerning the influences of social media on mental health seems to assume a negative effect. However, while some evidence points to a direct association between time spent on social media and mental well-being (Beardsmore, 2015; Kross et al., 2013), the exact nature of the relationship remains contested (Best et al., 2014; Marchant et al., 2017) and there may be more beneficial effects than are often reported. Furthermore, focusing attention on social media has the potential to detract attention from current socio-economic inequalities which persist across mental health differentials. While younger children have been shown to be happier with their lives than older children, relationships for gender and ethnicity are less clear (Rees & Main, 2016). Household factors are significant, though often more in terms of relational characteristics rather than income-based, material ones (Knies, 2012). Neighbourhood influences have also been found to have relevance by structuring access to resources and activities given children's more spatially restricted lives than adults (Fattore, Mason, & Watson, 2009), and young people from poorer households and more deprived areas have been shown to be at greater risk (Elliott, 2016; Marmot et al., 2010). Children whose parents experience poor mental health are more likely to experience symptoms themselves; in fact, having a parent with a mental illness remains the strongest predictor of mental health problems later in life (Manning & Gregoire, 2009). The quality and quantity of support young people receive from parents, guardians and other close family members is also important (Oberle, Schonert-Reichl, & Zumbo, 2011).

The significance of social media use for children's life satisfaction requires researchers to take simultaneous account of the wide range of other factors associated with it so that the relative contribution of each can be properly assessed. At the same time, it is also necessary that a longitudinal perspective is adopted so that temporal patterns and variations in children's life satisfaction, can be taken into account.

Given this background, the present study uses data from the UK Household Longitudinal Study (UKHLS) in conjunction with information about children's area of residence to investigate the association between children's life satisfaction and social media use while simultaneously taking account of a range of individual, household and community characteristics.

## **2. Methods**

### *Data sources*

Data for children and household members came from Understanding Society, the United Kingdom Household Longitudinal Study (UKHLS) (University of Essex. Institute for Social and Economic Research, NatCen Social Research, Kantar Public, 2018). Data relating to the local area of residence for children and family members came from small-area statistics produced by central government. The UKHLS is a multi-focus, multi-topic longitudinal household panel study - i.e. the same individuals are interviewed in each wave of the survey and full information about the origin and content of the survey can be accessed elsewhere (Buck & McFall, 2011). Each wave, children aged 10-15 in sampled households are invited to complete a youth self-completion questionnaire, while household members aged over 16 complete their own detailed interview either face-to-face with an interviewer or through a

self-completion online survey. At the time of this study, seven waves of UKHLS data were available through the UK Data Service.

Data for the local area of residence was derived at lower layer super output area (LSOA) level. LSOAs are a set of stable geographical areas developed to facilitate the dissemination of national census data and range in size from a minimum of 1,000 persons to a maximum of 3,000 persons (Office for National Statistics, 2019). Aggregate measures of neighbourhood deprivation published by the Ministry of Housing, Communities and Local Government were linked to the UKHLS through LSOA identifiers. This linkage was obtained through a special licence dataset provided by the UK Data Service (University of Essex Institute for Social and Economic Research, 2018).

### *Measures*

The outcome variable, life satisfaction, is collected annually in the youth self-completion questionnaire with children being asked to tick the box which *'best describes how they feel about their life as a whole'*. Options range across a 7-point scale running from 1 ('completely happy') to 7 ('not at all happy') and are represented by more or less smiling faces. In contrast to some studies, this variable was not reverse-coded so lower values represent greater satisfaction with life.

In terms of predictor variables, children's self-reported responses for age (in years), gender and ethnicity were included, with 22 ethnic identities for the latter being collapsed, due to small numbers, into two main ethnic categories, white and non-white, together with a third 'missing' category for children for whom this information was not recorded.

Measures of children's social media use were self-reported in response to the question '*how many hours do you spend chatting or interacting with friends through a social web-site like that (Bebo, Facebook or MySpace) on a normal school day*'. There are five options, (none, less than an hour, 1-3 hours, 4-6 hours and 7 or more hours).

Household predictors included measures aimed at gauging relational and financial/material circumstances within the family. In terms of the former, measures of parental mental health status and levels of family support were used. Parents were classified as cases or non-cases for mental ill-health on the basis of responses to the 12 item General Health Questionnaire (GHQ) within the adult interview. Following convention, a total score of 3 or more was used to determine case-ness (Goldberg & Williams, 1998).

An ad-hoc composite measure of family support was derived based on children's responses to five questions in the youth questionnaire which related to this aspect of parenting: "*do you feel supported by your family?*" (Q1), "*how often you talk to your mother/father about things that matter to you?*"(Q2&3), "*my parents are interested in how I do at school*"(Q4) and "*my parents come to parents' evenings*" (Q5). Children giving the most supportive responses (i.e. 'in most or all things' (Q1); 'most days'/'more than once a week' (Q2&3); 'always or nearly always' (Q4&5)) to 4 or 5 of these questions were classified as being in a supportive family.

Household's financial circumstances were measured by responses to a question on the household's gross income in the month before interview, with responses being converted into categories based on quintiles for the study sample. Neighbourhood deprivation was captured via the overall deprivation score (either IMD 2010 for wave 1 and 2 time points or IMD 2015 for all others) based on quintiles for the national distribution of LSOAs (Ministry of Housing

Communities and Local Government, 2015). This overall score is derived from indicators reflecting seven distinct domains of deprivation, namely income; employment; health and disability; education, skills and training; crime; housing and services; and living environment.

### *Statistical Analysis*

To examine the relative association between each predictor variable and children's life satisfaction, two main types of analysis were conducted based on multilevel regression models (Snijders & Bosker, 2011). First, models were developed where life satisfaction scores at a second time point were modelled conditional on life satisfaction scores at the nearest previous time point for those children with scores on more than two occasions across all 7 waves of the UKHLS (number of children =7,596, number of observations = 17,231). As an illustration, a child with scores over three waves (e.g. waves 1, 4 and 5) would provide two observations. The first, based on wave 4 conditional on wave 1, and the second, wave 5 conditional on wave 4. As the dependent variable was normally distributed, these analyses were undertaken using a normal link function. In order to reflect, and take account, of the clustering of these pairs of observations within individuals, and the multistage sampling design adopted in the UKHLS, this change in life satisfaction model was based on a three-level multilevel structure of 17,231 observations within 7,596 children, within 3,279 UKHLS primary sampling unit (PSU). The PSUs used in the UKHLS were postcode sectors, small areas containing approximately 3,000 addresses. In the first wave, 18 addresses were selected from 2,640 sampled sectors (Knies, 2018).

Second, multilevel models were developed based on a classification of trajectories in life satisfaction scores for those children with valid scores on 3, 4 or 5 measurement occasions across all 7 waves of the UKHLS (n=4,476). Children with scores on 6 or 7 (the maximum)

measurement occasions were difficult to classify and small in number (n=346) and were not included. The classification consisted of 4 different trajectory types: same (scores were unchanging across measurement occasions); worsening (scores increased consistently over time); improving (scores reduced consistently over time); fluctuating (scores changed over time with no consistent pattern). These trajectory types were then modelled in two different ways: first, as a dichotomous outcome (coded 1 for those with improving trajectories and 0 for everyone else) with a logit link function and, second, as a 4-fold multichotomous outcome (same; worsening; improving; fluctuating (base category)) with a multinomial link function. In this second set of analyses, models included 4,476 children in 2,437 PSUs. Due to model complexity and associated computing overheads, it was not possible to estimate multilevel multinomial models for the full 4-fold multichotomous classification. Accordingly, only single-level models are reported in this instance.

For the change in life satisfaction models, the predictor variables of age, social media use and parental mental health were entered in relation to their value at the first wave in each pair of observation (ie these items could vary over time). The value for the composite measure of family support, neighbourhood deprivation quintile and household income quintile remained the same across all pairs of life satisfactions scores. All six categories of social media use (including the missing category) were used. For the trajectory models all predictor variables were recorded according to their value at the first wave of each trajectory. Due to the small numbers in the trajectory models, the social media use variable was collapsed into a threefold classification - less than four hours, four hours or more, and missing. In all models, gender and ethnicity variables remained constant over time. As well as models in which all predictors were examined as separate main effects, an additional model was estimated which tested the interaction between gender and social media use.

All models were estimated using Markov chain Monte-Carlo methods (Browne, 2017). Up to 1 million iterations were completed to ensure model stability, achieved when Raftery-Lewis and Brooks-Draper diagnostic conditions were satisfied (Spiegelhalter, Best, Carlin, & Van Der Linde, 2002). Data preparation was carried out using SPSS (SPSS v24, IBM Corp, New York, USA) while all models were estimated using the MLwiN software package (MLwiN v2.22, Centre for Multilevel Modelling, Bristol, UK). Additional information on how the models were constructed in MLwiN is provided in Supplementary Materials 1.

### **3. Results**

#### *Descriptive analysis*

To set the scene, we show trends in life satisfaction scores for boys and girls according to age across all waves of the UKHLS (Figures 1a and 1b) to illustrate two points. First, they indicate that age effects are more marked for girls, with life satisfaction reducing (i.e. higher average scores) as children get older to a greater extent for girls than boys (lines slope upwards more for girls than boys). Second, in terms of birth cohort, the pattern is a little more complex. At later ages, girls have become less happy with their lives (see higher scores for waves 5,6,7 for girls aged 14 and above) while the difference across waves for younger girls is less marked and not so consistent. In contrast, there is no strong cohort effect for boys over the period of the UKHLS (boys' lines are similar for each wave at all ages). One way of seeing children's life satisfaction, therefore, is as the outcome of a complex interaction between age and cohort effects.

<< Figure 1 about here >>

### *Sample description*

A breakdown of the characteristics of the samples used in the two main types of analysis is given in Table 1. The information for change in life satisfaction scores provides characteristics for both the number of unique children in the analysis as well as the number of observations in the model. As can be seen, the distribution of children across the different predictors was broadly similar for both types of analysis apart from age in column 2. Here age is allowed to vary across the different waves in the models. While the youth questionnaire was administered to 10-15 year olds, a small number of 9 year olds were recorded on occasion. At the same time, there are few children over the age of 14 given the way the analyses were conducted (i.e. children aged 14 and over were too old to be surveyed across multiple time points). As can be seen, the level of missing-ness for social media use was higher than might be hoped. We model this missing group (and other missing groups) explicitly in order to maximise sample size. Missing-ness for father's mental health status was also high. In part, this is due to the majority of children living in single-parent households residing with their mother rather than their father.

<< Table 1 about here >>

### *Change in life satisfaction*

Table 2 shows the results for the model of change in life satisfaction. In addition to the predictors described earlier, this model included an additional predictor to take account of initial life satisfaction score. In terms of age, the results showed that life satisfaction decreased as children get older. All values are significant apart from the oldest age category (aged 15 and 16 where response numbers are relatively low) but the effect size was relatively large and in the same direction (0.23 points worse). A detrimental effect was also found for girls whose life satisfaction scores were 0.18 points worse than boys, and for children whose mother was experiencing poor mental health with an effect size of 0.12 points (worse than a non-case mother). There was no significant effect for father's mental health status. High use

of social media was associated with lower levels of life satisfaction with those spending 4-6 hours, or more than 7 hours per day predicted to have scores of 0.22 and 0.29 worse, respectively, than children who reported that they have not used social media. More moderate use of the technology (ie anything less than 3 hours per day), was not related to changes in life satisfaction scores. While the top two quintiles of neighbourhood deprivation indicate positive estimate values (ie suggesting poorer life satisfaction), their credible intervals straddled 0 and were therefore not statistically significant. Living in a household in the highest income quintile returned a negative estimate of -0.09 indicating improvement in life satisfaction scores for children living in such households. Improvements were also estimated for those living in supportive family contexts where the effect size of -0.28 was similar to the effect size (but in the opposite direction) for the highest category of social media use (ie > 7 hours). Improvements in scores were also given for non-white ethnicity (0.11 improvement compared to white ethnicity) and for missing ethnicity (0.10 improvement). It is difficult to say very much about the missing category for the ethnicity variable but non-response is known to be higher amongst respondents from this group and they may be over-represented in this missing category (Watson & Wooden, 2009).

In summary, the results suggested that family context in terms of mother's mental health status was detrimental for changes in life satisfaction scores whereas a supportive family environment may offer some protection against worsening scores. High use of social media was linked to poorer scores. However when the interaction between gender and social media use was entered into the model, there was a significant effect for the interaction between female gender and very high social media use (ie more than 7 hours) with an estimate value of 0.55 points worse than boys in this category of use. In this revised model, none of the main effects for social media use return as significant, suggesting that the main effects of high social media use are, in fact, (female) gender dependent. Revised main effects for social

media use and gender and the interaction of these two variables are shown in Supplementary Table 1.

<< Table 2 about here >>

### *Life satisfaction trajectories*

Of the 4,476 children in the trajectory analysis, over two thirds (n=3,220, 71.9%) had a fluctuating life satisfaction trajectory with the others being distributed across the remaining three trajectory categories as follows:- same: n=792 (17.7%); worsening: n=329 (7.4%); improving: n=135 (3.0%).

Tables 3 and 4 give the results for the models of life satisfaction trajectories based on a dichotomous categorisation (i.e. worsening vs the rest) and the full 4-fold (multichotomous) categorisation, respectively. As Table 3 shows, girls were significantly more likely to have a worsening trajectory compared to boys (OR 1.77, 95% CI 1.36-2.32). The only other significant association was with household income where children living in both quintile 2 (OR 0.61, 95% CI 0.41–0.91) and the highest income quintile (OR 0.50, 95% CI 0.32-0.79) were significantly less likely to have a worsening trajectory (than the lowest income households). Odds below 1 were also given for income quintiles 3 and 4 but these were not significant. Although the OR for 4 hours or more social media use was below 1 (and therefore suggesting less likelihood of a worsening trajectory) it was not significant (OR 0.67, 95% CI 0.26 - 1.54). In contrast to the change in life satisfaction models there were no significant effects for a supportive family or for mother's mental health status. There were no significant interactions between gender and social media use (results not shown).

<< Table 3 about here >>

Table 4 shows the results for the model of life satisfaction trajectories based on the full 4-fold categorisation. The most consistent significant association was again for gender, with girl's life satisfaction being less likely to stay the same (OR 0.72, 95% CI 0.61-0.85), more likely to worsen (OR 1.55, 95% CI 1.22-1.98) and less likely to improve (OR 0.60, 95% CI 0.40-0.90) compared to boys. There was a suggestion that family factors are significant with children whose fathers have poor mental health's life satisfaction being less likely to stay the same (OR 0.71, 95% CI 0.53-0.94) while those living in supportive families were more likely to stay the same (OR 1.28, 95% CI 1.07-1.53). Household income appeared to have an association with a worsening trajectory. While all ORs were below 1, suggesting that all income groups were less likely to have a worsening trajectory than the lowest income group, it is only quintile 2 (OR 0.63, 95% CI 0.43-0.92) and quintile 5 (OR 0.57, 95% CI 0.37-0.86) that were significant. Perhaps counter to expectations, the highest income group was significantly less likely to experience an improving trajectory (OR 0.48, 95% CI 0.24-0.97). Social media use was not found to be significantly associated with any of the contrasting trajectories to fluctuating life satisfaction score, as were age, ethnicity and local area deprivation. Interactions between gender and social media were not significant.

<< Table 4 about here >>

#### **4. Discussion**

Across the different descriptive and statistical modelling analyses reported here, gender appears to be one of the most significant and consistent factors shaping children's life satisfaction. While life satisfaction tends to decline as children get older, the process is most marked for girls. At the same time, reductions in life satisfaction amongst later born cohorts are most marked for older girls. Girls were also found to have the most significant reduction in life satisfaction between two discrete time points and were also found to be most

likely to have a worsening trajectory of life satisfaction scores over more than two time points. The current findings provide further support, therefore, to other recent research highlighting gender as a key dimension of adolescent well-being and mental health (Booker, Kelly, & Sacker, 2018; Fink et al., 2015; Kelly, Zilanawala, Booker, & Sacker, 2018). Several reasons have been used to explain this differential including the idea that girls are exposed to different levels of stress than boys and cope with stress differently. Research has shown that girls may be more self-conscious and worry about negative body image and self-esteem more than boys (Clay, Vignoles, & Dittmar, 2005). Girls also tend to ‘ruminate’ about their mood more than boys and this, in turn, may deepen and worsen mood, hindering the use of successful problem-solving tactics (Nolen-Hoeksema & Girgus, 1994; Ziegert & Kistner, 2002). The additional stress of dealing with body image and self-esteem as a young girl develops through adolescence may be compounded by the increasing use, and exposure to, ideal images online via social media (Woods & Scott, 2016). It is possible that this may play some part in explaining the cohort effects evidenced in the UKHLS but further work is needed to explore these cohort differences.

Household factors in terms of relational characteristics would also appear to have some significance. Being in a supportive family contributes to both significant increases in life satisfaction between two time points and a greater likelihood of stability rather than fluctuation. Poor maternal mental health, meanwhile, is associated with a decline in life satisfaction between two time points while poor paternal mental health is associated with a reduced likelihood of stability rather than fluctuation.

While there is some suggestion that higher levels of household income may lead to greater life satisfaction both in terms of change between two time points and reduced likelihood of a worsening trajectory, material deprivation in the wider community seems to have no bearing on children’s life satisfaction. These results may, therefore, offer support to the view that

children's subjective life quality is structured and patterned in different ways to that of adults and that factors specifically pertinent to children need to be considered (Knies, 2017; Main, 2018; The Children's Society, 2018).

The evidence for the influence of social media use is mixed. Moderate to low use of the technology (ie less than 4 hours per day) does not appear to have any significant association with life satisfaction changes. However heavier use is associated with deteriorating life satisfaction scores over two time points and this negative effect is of a similar magnitude to the positive effect that a supportive family has on life satisfactions scores. Interestingly the interaction results between gender and social media use in the change in life satisfaction model suggest that the detrimental associations between high social media use and life satisfaction are more important for girls than boys. This is similar to a previous study using data from the UKHLS to investigate the between-person and within-person associations between social media use and well-being (Orben, Dienlin, & Przybylski, 2019). While this previous work does not attempt to control for other possible wider influences, the effect for social media (where present) was possibly gender-specific and tended to vary according to how the data were analysed.

Clearly, further research is needed to understand how social media is being used by young people. Although the longitudinal models presented above, attempt to throw some light on causal sequencing, the lack of detail on how social media is being used prevents firm conclusions about the exact nature of its possible influence on mental health status to be made. It may be that young people who are experiencing poor levels of life satisfaction turn to online support groups and friends for several hours a day to help improve their situation. A smartphone, for example, can provide access to over 1000 mental health support online apps and time spent on social media engaging in these supportive technologies may help

attenuate feelings of despair and anxiety. The data from the UKLS does not provide such detail and responses may be biased because of the out-of-date examples of social media used in the question schedule.

There is also lack of detail on the life satisfaction variable. The measure of life satisfaction used here consists only of a single item based on a 7-point scale. Although this measure can be seen as a useful composite, it is important to recognise that children's subjective well-being is likely to be domain-specific (e.g. school, appearance, family) while other overall well-being/'whole life' measures are available based on multiple items (e.g. the measure recorded in The Children Society's annual Good Childhood Reports is based on five items).

Other shortfalls of UKLS data refer to the lack of information on genetic factors. Genetic make-up undoubtedly accounts for some of the between person variation and may be implicated in the positive associations between parental mental health status and children's mental well-being (Brown & Rohrer, 2019). More work is also needed to fully understand the influence of other family factors on mental well-being such as the impact of complex living arrangements and how dynamics of family structures influence children's wellbeing. Further works is also needed to reveal the possible biases contained within the missing categories.

Notwithstanding the difficulties and limitations presented above, the strengths of this study are that it is based on data from a large-scale, multi-topic, nationally-representative longitudinal survey. Accordingly, children's life satisfaction could be assessed in terms of broader factors reflecting individual, household and community characteristics.

Furthermore, the measures of life satisfaction were reported by the children themselves rather

than their parents or teachers. Using the UKHLS also allowed this study to focus on change over time, either between two separate time points or over a series of three or more consecutive time points. In this way, the study was able to throw light on patterns in trends in life satisfaction rather than one-off, cross-sectional snap shots. Using data from different waves of the UKHLS also meant that it was possible to get some handle on the difference between age and cohort effects.

Subjective well-being is increasingly being seen as an important indicator of the quality of children's lives and provides an important alternative to more objective, medical-based measures (The Children's Society, 2018). While the two are not synonymous, it is also the case that subjective well-being can be a powerful predictor of poor mental health outcomes such as self-harm and is therefore valuable not only in its own right but also for how it can alert us to healthcare needs. This study suggests that although children's well-being may be less stable and more in-flux than is sometimes appreciated, it is nevertheless patterned and structured in ways that have policy relevance. Of most significance here, is the role of gender, with girls, especially those older in age, appearing to have reduced life satisfaction. Attempts to improve children's well-being should, therefore, pay close attention to this particular demographic grouping. In terms of social media, the results suggest that high levels of use may be damaging but more research is needed on how the technology is being used, and again especially by girls. Alongside deeper understanding of how social media technology is being used, policy makers should also concentrate on factors affecting the social fabric of the households that children grow up in.

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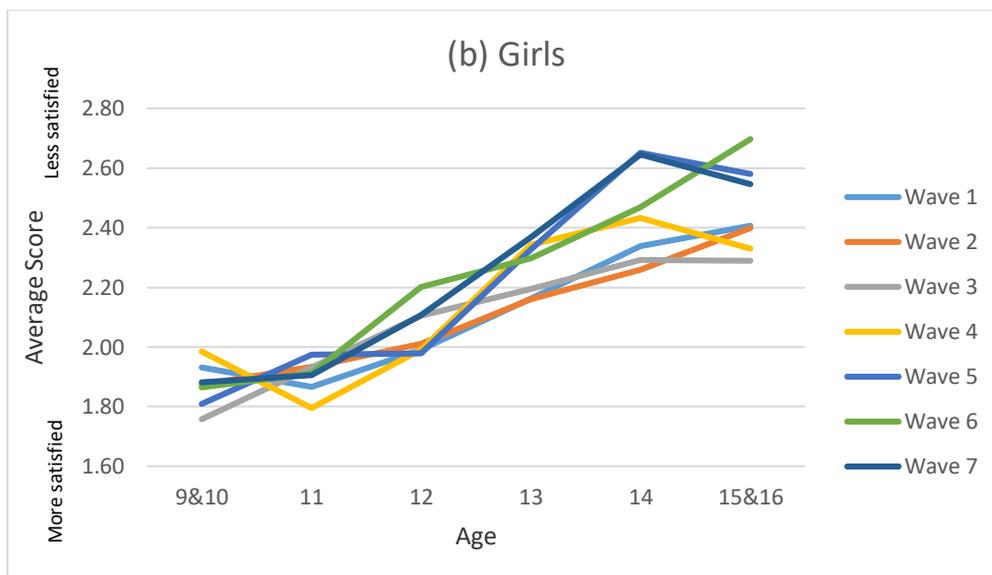
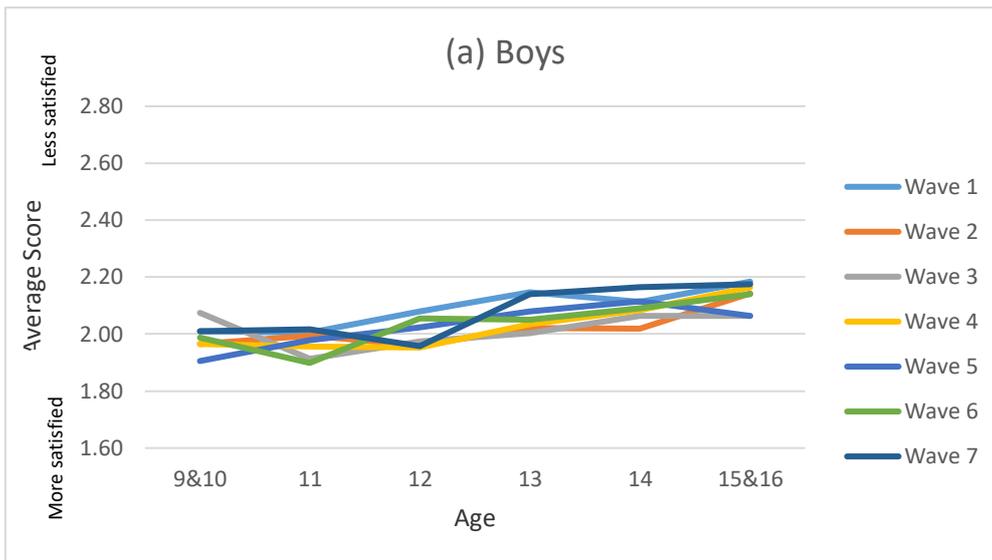
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**Figure 1: Mean life satisfaction scores (0-7) for boys (a) and girls (b) across each wave of the United Kingdom Household Longitudinal Study. NB Higher averages denote worsening life satisfaction**

Predictor	Type of Analysis		
	Change in Life Satisfaction (number of children=7,596)	Change in Life Satisfaction (number of observations = 17,231)	Trajectories of Life Satisfaction (n=4,476)
<b>Age*</b>			
9&10	3,275 (43.1%)	3,357 (19.5%)	2,059 (46.0%)
11	1,440 (19.0%)	3,601 (20.9%)	1,058 (23.6%)
12	1,062 (14.0%)	3,609 (20.9%)	743 (16.6%)
13	1,017 (13.4%)	3,588 (20.8%)	604 (13.5%)
14	786 (10.5%)	2,984 (17.3%)	11 (0.2%)
15&16	16 (0.2%)	92 (0.5%)	1 (<0.1%)
<b>Gender</b>			
Male	3,805 (50.1%)	8,641 (50.1%)	2,252 (50.3%)
Female	3,791 (49.9%)	8,590 (49.9%)	2,224 (49.7%)
<b>Ethnicity</b>			
White	5,344 (70.1%)	12,633 (73.3%)	3,303 (73.8%)
Non-white	1,480 (19.5%)	3,235 (18.8%)	860 (19.2%)
Missing	772 (10.2%)	1,363 (7.9%)	313 (7.0%)
<b>Social Media Use</b>			
None	616 (8.1%)	1,396 (8.1%)	447 (10.0%)
< 1 hour	2,086 (27.5%)	5,494 (31.9%)	1,214 (27.1%)
1-3 hours	1,422 (18.7%)	3,796 (22.0%)	722 (16.1%)
4-6 hours	238 (3.1%)	787 (4.6%)	108 (2.4%)
7+ hours	62 (0.8%)	230 (1.3%)	24 (0.5%)
Missing	3,172 (41.8%)	5,528 (32.1%)	1,961 (43.8%)
<b>Father's Mental Health</b>			
Non-Case	3,294 (43.4%)	7,763 (45.1%)	2,044 (45.7%)
Case	950 (12.5%)	2,079 (12.1%)	544 (12.2%)
Missing	3,352 (44.1%)	7,389 (42.9%)	1,888 (42.2%)
<b>Mother's Mental Health</b>			
Non-Case	4,867 (64.1%)	11,290 (65.5%)	2,924 (65.3%)
Case	1,710 (22.5%)	3,895 (22.6%)	999 (22.3%)
Missing	1,019 (13.4%)	2,046 (11.9%)	553 (12.4%)
<b>Family Support</b>			
Not supportive	3,241 (42.7%)	7,195 (41.8%)	1,872 (41.8%)
Supportive	4,057 (53.4%)	9,451 (54.8%)	2,417 (54.0%)
Missing	298 (3.9%)	585 (3.4%)	187 (4.2%)
<b>Household Income</b>			
1 (Lowest)	1,518 (20.0%)	3,409 (19.8%)	895 (20.0%)
2	1,520 (20.0%)	3,368 (19.5%)	895 (20.0%)
3	1,518 (20.0%)	3,470 (20.1%)	896 (20.0%)
4	1,520 (20.0%)	3,486 (20.3%)	895 (20.0%)
5 (Highest)	1,520 (20.0%)	3,496 (20.3%)	895 (20.0%)
Missing	2 (<0.1%)	2 (<0.1%)	
<b>Neighbourhood Deprivation</b>			
1 (Least deprived)	1,136 (15.0%)	2,784 (16.2%)	718 (16.0%)
2	1,017 (13.4%)	2,359 (13.7%)	600 (13.4%)
3	1,099 (14.5%)	2,523 (14.6%)	667 (14.9%)
4	1,140 (15.0%)	2,512 (14.6%)	650 (14.5%)
5 (Most deprived)	1,597 (21.0%)	3,478 (20.2%)	892 (19.9%)
Missing	1,607 (21.2%)	3,575 (20.7%)	949 (21.2%)

**Table 1: Description of samples used in each analysis**

	<b>Change in Life Satisfaction model</b>
<b>Age (vs 9&amp;10)</b>	
11	0.10 (0.03 – 0.17)
12	0.13 (0.06 – 0.20)
13	0.19 (0.12 – 0.27)
14	0.18 (0.10 – 0.26)
15&16	0.23 (-0.08 – 0.55)
<b>Gender (vs Male)</b>	
Female	0.18 (0.13 – 0.23)
<b>Ethnicity (vs White)</b>	
Non-white	-0.11 (-0.17 - -0.04)
Missing	-0.10 (-0.19 - -0.01)
<b>Social Media Use (vs 0)</b>	
< 1 hour	0.06 (-0.03 – 0.15)
1 – 3 hours	0.08 (-0.01 – 0.18)
4 – 6 hours	0.22 (0.09 – 0.36)
7+ hours	0.29 (0.07 – 0.50)
Missing	0.03 (-0.06 – 0.12)
<b>Father's Mental Health (vs Non-case)</b>	
Case	0.06 (-0.02 – 0.13)
Missing	0.05 (0.00 – 0.11)
<b>Mother's Mental Health (vs Non-case)</b>	
Case	0.12 (0.06 – 0.17)
Missing	0.07 (0.00 – 0.15)
<b>Family Support (vs Not supportive)</b>	
Supportive	-0.28 (-0.32 - -0.23)
Missing	-0.04 (-0.18 – 0.09)
<b>Household Income (vs 1 Lowest income)</b>	
2	-0.03 (-0.11 – 0.04)
3	-0.02 (-0.10 – 0.05)
4	-0.06 (-0.14 – 0.01)
5 (Highest income)	-0.09 (-0.17 - -0.01)
Missing	-0.23 (-2.32 – 1.87)
<b>Neighbourhood Deprivation (vs 1 Least deprived)</b>	
2	-0.04 (-0.12 – 0.05)
3	-0.01 (-0.09 – 0.08)
4	0.05 (-0.04 – 0.14)
5 (Most deprived)	0.04 (-0.05 – 0.13)
Missing	-0.13 (-0.21 - -0.05)
<b>Initial Life Satisfaction</b>	0.21 (0.19 – 0.23)

**Table 2. Results of three level multilevel model of change in life satisfaction using all pairs of adjacent waves (units of life satisfaction score with 95% credible intervals). Positive values indicate worsening scores, negative values indicate improving scores.**

	<b>‘Worsening vs the rest’ life satisfaction</b>
<b>Age (vs 9&amp;10)</b>	
11	0.97 (0.69 - 1.37)
12	0.94 (0.59 - 1.48)
13-16	0.78 (0.42 - 1.42)
<b>Gender (vs Male)</b>	
Female	1.77 (1.36 - 2.32)
<b>Ethnicity (vs White)</b>	
Non-white	0.94 (0.65 - 1.34)
Missing	1.06 (0.64 - 1.73)
<b>Social Media Use (&lt; 4 hours)</b>	
4 or more hours	0.67 (0.26 - 1.54)
Missing	0.93 (0.71 - 1.22)
<b>Father’s Mental Health (vs Non-case)</b>	
Case	1.37 (0.92 - 2.03)
Missing	0.94 (0.70 - 1.26)
<b>Mother’s Mental Health (vs Non-case)</b>	
Case	0.77 (0.55 - 1.07)
Missing	1.07 (0.71 - 1.57)
<b>Family Support (vs Not supportive)</b>	
Supportive	0.84 (0.64 - 1.10)
Missing	1.14 (0.61 - 2.06)
<b>Household Income (vs 1 Lowest income)</b>	
2	0.61 (0.41 - 0.91)
3	0.82 (0.56 - 1.23)
4	0.74 (0.50 - 1.12)
5 (Highest income)	0.50 (0.32 - 0.79)
<b>Neighbourhood Deprivation (vs 1 Least deprived)</b>	
2	0.86 (0.52 - 1.42)
3	1.36 (0.86 - 2.17)
4	1.18 (0.73 - 1.92)
5 (Most deprived)	0.99 (0.61 - 1.61)
Missing	0.78 (0.49 - 1.25)
<b>Wave of Final Life Satisfaction Score (vs Wave 3)</b>	
Wave 4	1.13 (0.65 - 1.95)
Wave 5	1.32 (0.75 - 2.37)
Wave 6	1.23 (0.66 - 2.28)
Wave 7	1.30 (0.73 - 2.33)
<b>Initial Life Satisfaction Score</b>	0.28 (0.21 - 0.36)

**Table 3: Results of 2-level dichotomous trajectory (worsening vs the rest) life satisfaction model (odds ratios with 95% credible intervals).**

	<b>‘Same vs fluctuating’ life satisfaction</b>	<b>‘Worsening vs fluctuating’ life satisfaction</b>	<b>‘Improving vs fluctuating’ life satisfaction</b>
<b>Age (vs 9&amp;10)</b>			
11	0.95 (0.74 - 1.20)	0.94 (0.68 - 1.29)	0.97 (0.52 - 1.78)
12	1.17 (0.87 - 1.57)	0.98 (0.64 - 1.49)	2.05 (1.01 - 4.16)
13-16	1.45 (1.03 - 2.06)	0.91 (0.52 - 1.60)	2.17 (0.91 - 5.13)
<b>Gender (vs Male)</b>			
Female	0.72 (0.61 - 0.85)	1.55 (1.22 - 1.98)	0.60 (0.40 - 0.90)
<b>Ethnicity (vs White)</b>			
Non-white	1.01 (0.79 - 1.28)	0.95 (0.68 - 1.32)	1.01 (0.57 - 1.77)
Missing	1.00 (0.72 - 1.38)	1.05 (0.65 - 1.66)	0.84 (0.37 - 1.77)
<b>Social Media Use (vs &lt;4 hours)</b>			
More than 4 hours	1.05 (0.63 - 1.70)	0.70 (0.29 - 1.53)	0.50 (0.13 - 1.61)
Missing	1.19 (1.01 - 1.42)	0.96 (0.75 - 1.23)	1.24 (0.82 - 1.89)
<b>Father’s Mental Health (vs Non-case)</b>			
Case	0.71 (0.53 - 0.94)	1.25 (0.87 - 1.80)	1.00 (0.53 - 1.84)
Missing	0.96 (0.80 - 1.15)	0.93 (0.71 - 1.23)	0.79 (0.50 - 1.24)
<b>Mother’s Mental Health (vs Non-case)</b>			
Case	0.92 (0.74 - 1.13)	0.76 (0.55 - 1.04)	0.78 (0.48 - 1.26)
Missing	0.99 (0.76 - 1.28)	1.06 (0.73 - 1.52)	0.91 (0.49 - 1.64)
<b>Family Support (vs Not supportive)</b>			
Supportive	1.28 (1.07 - 1.53)	0.91 (0.71 - 1.17)	1.36 (0.89 - 2.07)
Missing	1.80 (1.20 - 2.68)	1.31 (0.73 - 2.28)	1.41 (0.47 - 3.80)
<b>Household Income (vs 1 Lowest income)</b>			
2	1.10 (0.84 - 1.43)	0.63 (0.43 - 0.92)	0.80 (0.44 - 1.44)
3	1.03 (0.79 - 1.36)	0.82 (0.57 - 1.18)	0.63 (0.32 - 1.20)
4	0.95 (0.72 - 1.26)	0.74 (0.51 - 1.07)	0.89 (0.47 - 1.67)
5 (Highest income)	1.28 (0.97 - 1.70)	0.57 (0.37 - 0.86)	0.48 (0.24 - 0.97)
<b>Neighbourhood Deprivation (vs 1 Least deprived)</b>			
2	1.20 (0.89 - 1.63)	0.91 (0.57 - 1.46)	0.74 (0.36 - 1.48)
3	1.18 (0.88 - 1.59)	1.38 (0.90 - 2.12)	0.56 (0.27 - 1.15)
4	1.01 (0.73 - 1.38)	1.18 (0.75 - 1.85)	0.54 (0.25 - 1.12)
5 (Most deprived)	0.89 (0.65 - 1.22)	0.98 (0.63 - 1.54)	0.74 (0.38 - 1.46)
Missing	1.32 (1.01 - 1.73)	0.86 (0.57 - 1.31)	0.72 (0.38 - 1.37)
<b>Wave of Final Life Satisfaction Score (vs Wave 3)</b>			
Wave 4	0.76 (0.56 - 1.02)	1.07 (0.64 - 1.79)	1.91 (0.97 - 3.86)
Wave 5	0.62 (0.44 - 0.87)	1.14 (0.67 - 1.97)	0.87 (0.35 - 2.14)
Wave 6	0.53 (0.36 - 0.78)	1.06 (0.60 - 1.91)	1.50 (0.59 - 3.78)
Wave 7	0.64 (0.45 - 0.91)	1.16 (0.68 - 2.03)	1.56 (0.65 - 3.75)
<b>Initial Life Satisfaction Score</b>	0.48 (0.42 - 0.53)	0.27 (0.22 - 0.33)	2.95 (2.56 - 3.40)

**Table 4: Results of single-level multichotomous trajectory (same, worsening, improving vs fluctuating) life satisfaction model (odds ratios with 95% credible intervals).**



