

CHAPTER 2

Social media and mental health

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Over the last two decades, the mental health of adolescents and young adults in many countries has worsened considerably (Twenge et al. 2019). Data from the US shows that the fraction of individuals aged 18–23 who reported experiencing a major depressive episode in the past year almost doubled between 2008 and 2018 (NSDUH 2019). Similarly, over the same time period, suicides became more prevalent in the US and are now the second leading cause of death for individuals aged 15–24 years old (National Center for Health Statistics 2021).

Since the increased prevalence of mental illness among adolescents and young adults coincided with the diffusion of social media, researchers, journalists and policymakers alike began to wonder whether the two phenomena might be related (Twenge and Campbell 2019). In the autumn of 2021, a series of articles in the *Wall Street Journal* alleging that Meta (previously Facebook) was aware that Instagram had a negative effect on teenage girls' body image brought the relationship between social media and mental health to the forefront of public debate (Wells et al. 2021). Soon after, the US Congress held a committee hearing on the topic.

Despite the urgent need for studies on whether social media is detrimental to mental health, causal evidence remains scarce. Most existing papers estimate correlations between social media use and mental health (Bekalu et al. 2019, Berryman et al. 2018, Dienlin et al. 2017, Kelly et al. 2018; Lin et al. 2016, Twenge and Campbell 2019). A few experiments incentivise randomly selected participants to reduce their social media use and hence do estimate causal effects, but they do not concentrate primarily on mental health (Allcott et al. 2020, 2021, Mosquera et al. 2020).¹

In a recent paper (Braghieri et al. 2022), we provide the most comprehensive causal evidence to date on the effects of social media on mental health by leveraging a unique natural experiment: the staggered roll-out of Facebook across US college campuses. Our empirical strategy allows us to estimate the short- to medium-run effects of Facebook on a rich set of mental health outcomes ranging from depression, to generalised anxiety

¹ A recent paper focuses on the causal effect of the internet – rather than social media – on mental health, and finds that access to high-speed internet increased incidence of mental disorders among young adults in Italy (Donati et al. 2022).

disorder, to anorexia.² Overall, we find that the introduction of Facebook at a college had a negative effect on student mental health, especially as far as depression and generalized anxiety disorder are concerned.

ESTIMATING THE CAUSAL EFFECT OF FACEBOOK

Our research design leverages Facebook's gradual expansion across US colleges as a natural experiment. Facebook was created by Harvard undergraduate Mark Zuckerberg in February 2004. Initially, access to the platform was limited to Harvard students. Over the subsequent two and a half years, Facebook gradually expanded to other colleges in the US and abroad until eventually, in September 2006, it opened its doors to everyone in the world above the age of 13. The staggered nature of Facebook's roll-out allows us to compare changes in student mental health in colleges that just received Facebook access to changes in student mental health in colleges still without Facebook access in a difference-in-differences approach.

Although we study the expansion of a new technology, our study is not limited to a small subset of early adopters. When Facebook became available, colleges witnessed rapid and widespread adoption among students. Based on data provided by Facebook, we estimate that, in September 2005, approximately 85% of undergraduate students in colleges with access to Facebook had an account. Not only did Facebook spread rapidly and widely in the student population; usage was also intense. In early 2006, close to three-quarters of users logged into the site at least once a day, and the average user logged in six times a day (Hass 2006).

To estimate Facebook's effects on mental health, we rely on two datasets: one contains the dates in which Facebook was introduced at 775 US colleges; the other contains individual-level survey data about student mental health from the National College Health Assessment (NCHA). The database containing the Facebook introduction dates was constructed as follows. For the first 100 colleges that received access to Facebook, we relied on the introduction dates collected and made public in previous studies (Jacobs et al. 2015, Traud et al. 2012). For the remaining colleges, we collected introduction dates using the Wayback Machine, an online archive that contains snapshots of various websites at different points in time.³ Our outcome variables come from the National College Health Assessment (NCHA), the largest and most comprehensive dataset on

2 The paper relates to an emerging literature, some of it featured in this CEPR eBook, exploiting the expansion of social media platforms to study the effects of social media on a variety of outcomes. The empirical strategy adopted in this paper is closely related to the one in Armona (2019), who leverages the staggered introduction of Facebook across U.S. colleges to study labor market outcomes more than a decade later. Enikolopov et al. (2020) and Fergusson and Molina (2020) exploit the expansion of the social media platform VK in Russia and of Facebook worldwide, respectively, to show that social media use increases protest participation. Bursztyn et al. (2019) and Müller and Schwarz (2020) exploit the expansion of VK and Twitter, respectively, and find that social media use increases the prevalence of hate crimes. Additional research on social media and political outcomes includes Enikolopov et al. (2018), Fujiwara et al. (2021), and Levy (2021). For a detailed overview, see Zhuravskaya et al. (2020). A unique feature of our setting is that it allows us to measure the effects of the sharp roll-out of the biggest social media platform in the world at a time in which very few close substitutes were available.

3 We thank Luis Armona for his collaboration in putting together the dataset containing Facebook expansion dates.

the mental health of US college students available at the time of Facebook's expansion (Leshner and Scherer 2021). We have access to the universe of responses to all NCHA survey waves administered between the spring of 2000 and the spring of 2008, the longest stretch of time around Facebook's early expansion in which the survey questionnaire did not vary. In order to allow us to carry out our analysis, the organisation administering the NCHA – the American College Health Association – generously provided us with a customised dataset that contained, together with the students' answers to the NCHA survey, a variable specifying the semester in which Facebook became available at the college attended by the survey respondent.⁴

Our main outcome variable is an index of poor mental health constructed by taking an equally weighted average of all the mental health questions in the NCHA survey inquiring about a respondent's recent past. We also analyse the effect of Facebook on three sub-indices: an index of questions about depression-related symptoms; an index of questions about other mental health conditions; and an index of questions about depression-related services, such as taking anti-depressants.

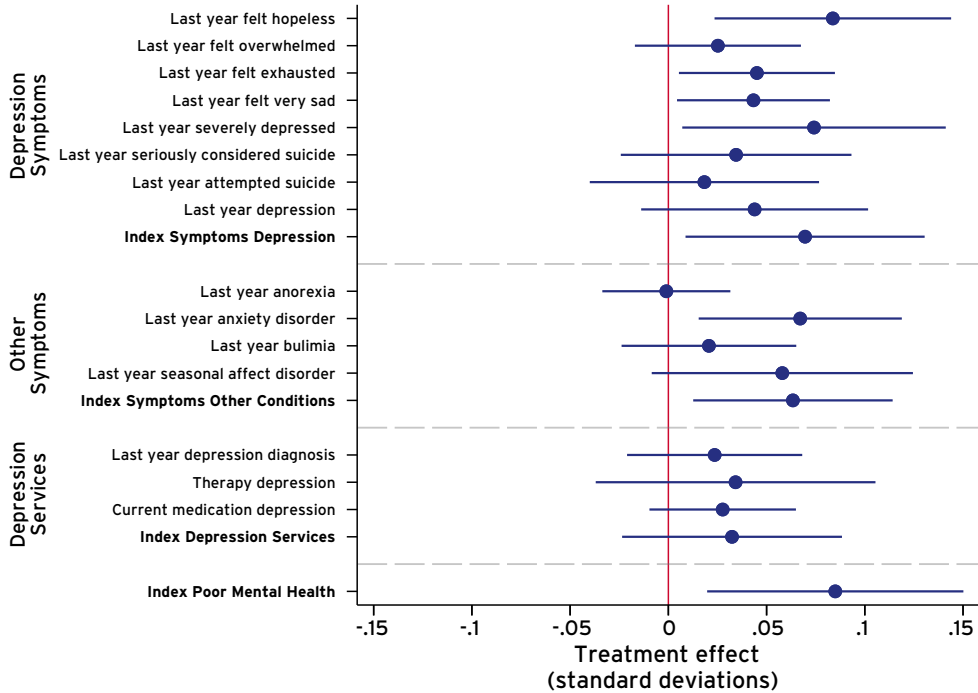
Mental health is a domain where self-reported outcomes are especially useful and self-reported symptoms are part of standard medical practice (Chan 2010). Still, the survey questions we analyse are not necessarily the questions medical professionals use in practice. Therefore, to validate that the NCHA survey questions measure mental health accurately, we conducted an original survey among more than 500 college students containing both the NCHA questions and the questions from canonical depression and generalised anxiety disorder screeners – the PHQ-9 and GAD-7, respectively – known to be highly predictive of actual medical mental illness diagnoses (Kroenke et al. 2001, Spitzer et al. 2006). We find that our index of poor mental health based on the NCHA questions is strongly correlated with the PHQ-9 and GAD-7 scores (correlation coefficients of 0.66 and 0.61 respectively), increasing our confidence that the NCHA survey is picking up the elements that feature into mental illness diagnoses.

4 For privacy reasons, our dataset does not contain college identifiers.

THE EFFECT OF FACEBOOK ON MENTAL HEALTH

Figure 1 presents the causal difference-in-differences estimates of the impact of Facebook on mental health outcomes.⁵

FIGURE 1 EFFECTS OF THE INTRODUCTION OF FACEBOOK ON STUDENT MENTAL HEALTH



The results show that the introduction of Facebook at a college had a negative impact on student mental health. The effect size on the index of poor mental health is 0.085 standard deviation units. This corresponds to approximately 84% of the difference in the index of poor mental health between students in our sample with and without credit card debt. As an alternative point of comparison, the impact of introducing Facebook at a college is around 22% of the causal effect of a sudden unemployment spell (Paul and Moser 2009).

5 Specifically, we estimate the following two-way fixed effects (TWFE) model:

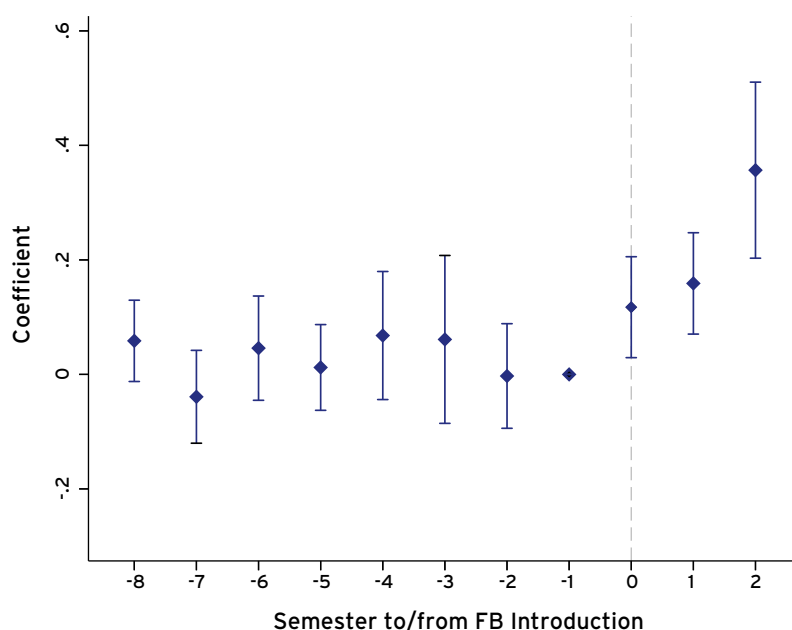
$$Y_{icgt} = \alpha_c + \delta_t + \beta \times \text{Facebook}_{gt} + \mathbf{X}_i \cdot \gamma + \mathbf{X}_c \cdot \psi + \varepsilon_{icgt}, \quad (1)$$

where Y_{icgt} represents an outcome for individual i who participated in survey wave t and attends college c that belongs to expansion group g ; α_c indicates college fixed effects; δ_t indicates survey-wave fixed effects; Facebook_{gt} is an indicator for whether, in survey wave t , Facebook was available at colleges in expansion group g ; $\mathbf{X}_i$ and $\mathbf{X}_c$ are vectors of individual-level and college-level controls, respectively. We estimate Equation (1) using OLS and cluster standard errors at the college level. We also address recent econometric concerns with staggered difference-in-differences research designs by showing robustness to the use of a variety of alternative estimators (Borusyak et al. 2021, Callaway and Sant'Anna 2021, De Chaisemartin and d'Haultfoeuille 2020, Sun and Abraham 2021).

The effects we find are strongest for depression and anxiety disorder. College-wide access to Facebook increased the number of students who reported experiencing severe depression or generalised anxiety disorder in the last year by 7% and 20%, respectively. Figure 1 shows that these estimates correspond to effects of around 0.07–0.08 in standard deviation units. This effect on severe depression is similar in magnitude to the effect observed in an experiment conducted by Allcott et al. (2020). Such similarity is striking, especially in light of the fact that the time period, survey question, target population, and empirical strategy in Allcott et al. (2020) are different from the ones in our paper. In contrast to depression and anxiety, we do not find significant effects on self-reports of anorexia and bulimia.

When estimating the effect of Facebook on mental health over time using an event-study regression, we find evidence that the effect increases as colleges are exposed to Facebook for more semesters (see Figure 2). Importantly for our empirical strategy, we do not find any significant effects or trends before Facebook is introduced at a college. The lack of pre-trends assuages potential concerns about our effect being driven by differential trends in mental health between colleges that received access to Facebook relatively early and colleges that received access relatively late.

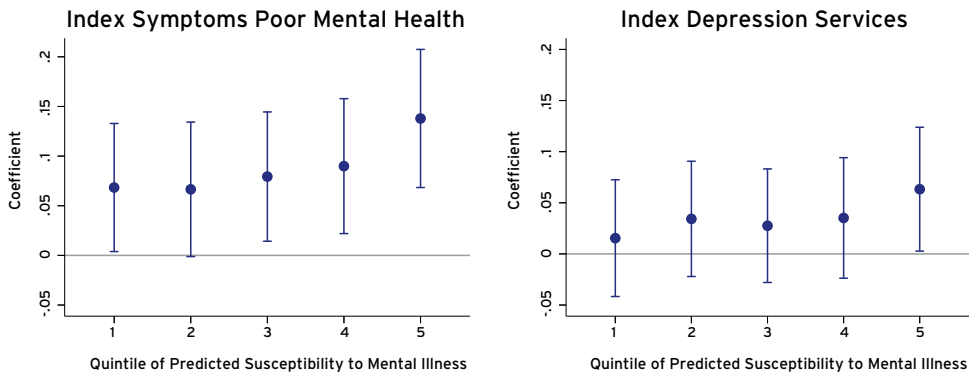
FIGURE 2 EFFECTS OF FACEBOOK ON THE INDEX OF POOR MENTAL HEALTH BASED ON DISTANCE TO/FROM FACEBOOK INTRODUCTION



Note: Constructed using Sun and Abraham's (2021) estimator.

In order to study whether the effects of Facebook are concentrated among individuals who are particularly vulnerable to mental illness or whether they impact all students, we created a measure of predicted susceptibility to mental illness using a LASSO regression and studied heterogeneous treatment effects along that measure. The LASSO regression leverages a set of individual-level immutable characteristics such as gender and age to predict whether a student reported having ever received a mental illness diagnosis. As shown in Figure 3, the effects of Facebook on the index of poor mental health impact all students, but they are especially strong among students who are predicted to be most susceptible to mental illness. Furthermore, among those students, Facebook access significantly increased the take-up of psychotherapy and anti-depressants.

FIGURE 3 HETEROGENEOUS EFFECTS BY PREDICTED SUSCEPTIBILITY TO MENTAL ILLNESS

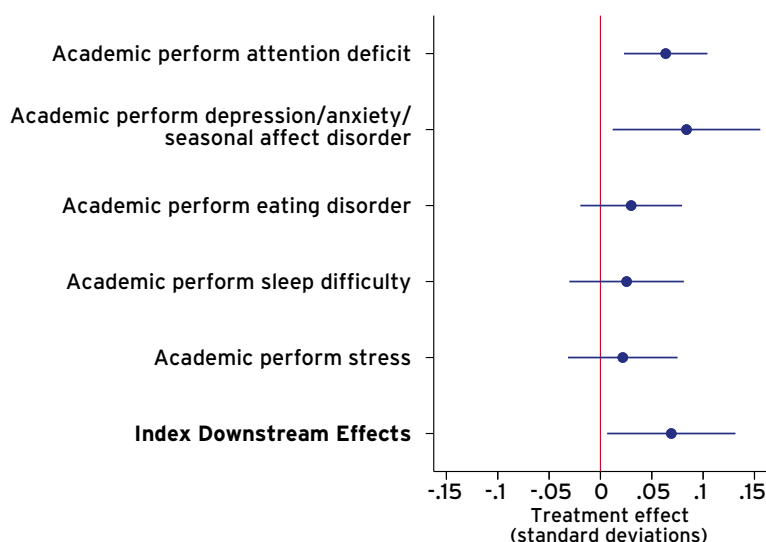


Does the effect of Facebook on mental health have negative downstream repercussions on academic performance? According to the students' reports, the answer is yes. The NCHA survey includes a host of questions asking students whether various conditions negatively affected their academic performance. We analyse all conditions related to mental health symptoms, along with an index summarising those symptoms. As shown in Figure 4, students were more likely to say that mental health issues negatively affected their academic performance after Facebook was introduced at their college. Consistent with our evidence suggesting that depression and anxiety-related disorders are the conditions most severely affected by the introduction of Facebook, we find the largest effect on a question asking about depression, anxiety and seasonal affect disorder. The number of students who reported that those conditions impaired their academic performance increased by three percentage points over a baseline of 13% as a result of the introduction of Facebook.

Robustness

Our results pass numerous robustness checks. First, we observe null effects in placebo tests on variables that in principle should not be affected by the introduction of Facebook, such as our LASSO-predicted ‘susceptibility to mental illness’ variable that is based on baseline immutable characteristics. Second, the results remain similar in modified versions of our main specifications that take into account possible concerns related to (i) the construction of our index of poor mental health, (ii) the construction of our treatment variable, (iii) particular Facebook expansion groups driving the effects, (iv) other variables unrelated to Facebook driving the effects, and (v) possible violations of the parallel trends assumption (see the online appendix in Braghieri et al. 2022 for further details).

FIGURE 4 DOWNSTREAM EFFECTS ON ACADEMIC PERFORMANCE



HOW DID FACEBOOK AFFECT MENTAL HEALTH?

So far, we have documented that Facebook access negatively affected student mental health. But what was the mechanism behind this effect? Recent scholarship identified two main channels whereby Facebook might directly affect mental health: unfavourable social comparisons (Appel et al. 2016) and disruptive internet use (Griffiths et al. 2014). Unfavourable social comparisons refers to the idea that users might use social media to compare themselves to others. To the extent that those comparisons are unfavourable, they might be detrimental to the users’ self-esteem and mental health. Disruptive internet use refers to the idea that social media might disrupt students’ ability to concentrate and to carry out their daily tasks, and lead to anxiety. Another possibility is that the

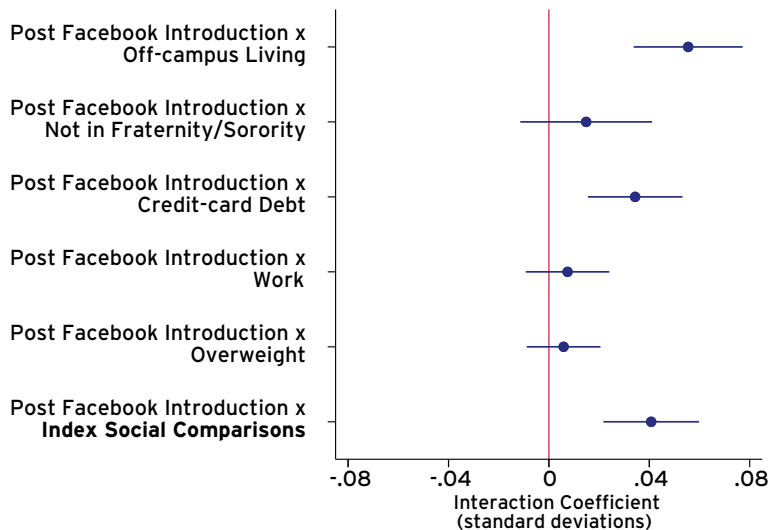
introduction of Facebook might lead to behavioural changes that, in turn, affect mental health. Overall, our evidence is most consistent with the unfavourable social comparisons channel.

Unfavourable social comparisons

We find two pieces of evidence that suggest that Facebook's effect operated through social comparison.

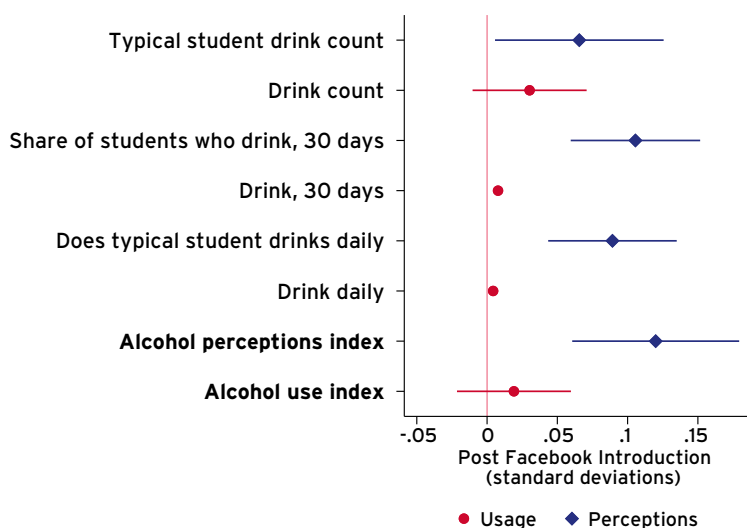
First, we focus on students who are more likely to be affected by unfavourable social comparisons: (i) students who live off-campus and are therefore less likely to participate in on-campus social life; (ii) students who have weaker offline social networks as measured by not belonging to a fraternity or sorority; (iii) students who have lower socioeconomic status as measured by carrying credit card debt or working part-time alongside studying; and (iv) students who are overweight. We aggregate these questions into an index of social comparison where respondents are considered to be at higher risk of unfavourable social comparisons if they have an above median number of the characteristics described above (e.g. they live off-campus, are overweight, and have credit card debt). Figure 5 shows that Facebook access had a more negative effect on students more likely to suffer from negative social comparisons. All the point estimates are positive and the estimates for off-campus living, credit card debt, and the index are statistically significant.

FIGURE 5 HETEROGENEOUS EFFECTS AS EVIDENCE OF UNFAVOURABLE SOCIAL COMPARISONS



Second, we test directly whether Facebook affected people's perceptions of their peers' social lives by estimating the impact of the roll-out of Facebook on students' perceptions of their peers' drinking behaviours.⁶ Figure 6 shows that the introduction of Facebook increased the perceived prevalence of alcohol consumption among college students. Based on the questions asking students about their own alcohol consumption, the figure also shows that the increase in perceived alcohol consumption does not reflect an actual increase in consumption.

FIGURE 6 EFFECTS ON ALCOHOL USE AND PERCEPTIONS AS EVIDENCE OF UNFAVORABLE SOCIAL COMPARISONS



One explanation for a discrepancy between perceptions and reality in regards to alcohol is that students might have a hard time interpreting the content they observe on social media. In particular, they might forget that what they see on social media is a curated rather than representative version of their peers' lives. Indeed, we find an even stronger effect on perceptions among students living off-campus who have to rely more heavily on social media for information about their peers' behaviours. The changing perceptions could explain the negative effect on mental health, as inflated perceptions about others' social lives might make students feel worse about their own.

⁶ At the time, content related to alcohol featured prominently on Facebook.

Alternative channels

We do not find evidence that the effect of Facebook on mental health operated through disruptive internet use. Facebook does not affect the share of students who report that the internet or video games affected their academic performance, as one would expect if Facebook were a distracting force.

We also do not find evidence that Facebook affected mental health indirectly by affecting other behaviours. Using a battery of questions in the NCHA survey, we find that Facebook did not affect drug use, assaults, sexual assaults or the answers to various questions related to relationships.

CONCLUSION

In 2021, 4.3 billion individuals had a social media account, accounting for over half the world population and over 90% of internet users (We Are Social 2021). The repercussions of the rise of social media are thus likely to be far-reaching. We leverage the staggered introduction of Facebook across US colleges and find that the introduction of Facebook at a college had a negative effect on student mental health. Evidence points to unfavourable social comparisons as the leading mechanism.

Since our identification strategy delivers estimates of the effect of Facebook in the mid-2000s, one might wonder about the extent to which our estimates speak to the effects of social media today. Over the last fifteen years, Facebook introduced a host of new features, including the newsfeed algorithm, business pages, and videos. Although we cannot estimate the effect of these new features on mental health, we believe our estimates are still relevant because the main force driving our results – unfavourable social comparisons – is still a common feature of many social media platforms today. In fact, some of the new features introduced by Facebook might have exacerbated the effects of social comparisons: the information users receive on their peers is now richer (e.g. it includes videos), it is personalised by an algorithm, and content can be accessed at any time or place using a smartphone.

We emphasise that our analysis does not aim to estimate the overall welfare effects of social media; rather, it aims to shed light on a very important component of such a welfare calculation, namely, mental health. Clearly, social media might have positive effects on other outcomes affecting welfare. Indeed, the fact that individuals keep using social media despite the negative effects on subjective wellbeing and mental health suggests that social media platforms might have benefits that compensate for such costs. Ideally, future iterations of these platforms will be able to preserve the benefits while mitigating the mental health costs.

In terms of policy implications, our evidence on mechanisms suggests that regulators can consider interventions reminding the public that social media posts are not representative of people's real lives. Such intervention could include behaviour nudges on social media platforms or be part of digital education programs.

Overall, our results are consistent with the hypothesis that social media might be partly responsible for the recent deterioration in mental health among young adults. It is up to social media platforms, regulators and future research to determine whether and how these effects can be alleviated.

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