Appendix

Literature review (expanded)

Brailovskaia and Margraf (1) assessed addictive Facebook use among 179 university students in Germany over one year, and found that Facebook Addiction Disorder did not predict life satisfaction and social support, but significantly predicted depression, anxiety, and stress. van den Eijnden, Koning (2) analyzed data on 538 adolescents in the Netherlands, and reported that social media disorder symptoms negatively predicted life satisfaction and social competence over a two-year period. Marttila, Koivula (3) analyzed 15-month longitudinal data on 2,021 adults in Finland, and found that problematic social media use did not directly predict life satisfaction. Nevertheless, the two-wave data indicated that problematic social media use predicted an increase in loneliness, which in turn predicted decreased life satisfaction.

Muusses, Finkenauer (4) conducted a study using data from 140-199 (using two samples) newly wed couples in the Netherlands, and reported that addictive internet use (a broader measure of internet use incl. social media) predicted decreases in happiness, increases in depression, stress, and social isolation (perceived and objective isolation) over the course of four years. Next, Vernon, Modecki (5) conducted a study on data on 874 high school students in Australia, and found that increases in problematic online social networking was positively related to increases in depression symptoms over three years. Raudsepp (6) used data on 249 adolescents in Estonia and found that problematic social media use significantly predicted increases in depressive symptoms over two years. Subsequently, in a similar study among 397 adolescent girls, Raudsepp and Kais (7) reported that increases in problematic social media use predicted increases in depression symptoms over a two-year time period. Chen, Pakpour (8) conducted an analysis on data from 318 Hong Kong University students and found that increases in problematic social media use was significantly associated with increases in

depression and anxiety symptoms over the course of nine months. Contrary to the aforementioned findings, Di Blasi, Salerno (9) conducted a study on panel data collected from 3,912 adults in Italy during the COVID-19 pandemic, and did not find evidence that problematic social media use predicted psychological distress (depression, anxiety, stress) over a three month period.

Sensitivity analysis

With regard to the sensitivity analysis (Table A1), this showed that some individual items were more significantly associated (i.e., based on statistical significance and confidence intervals) with social media addiction symptoms, and were primarily driving the association between the exposure and the outcomes. The single items that were not significantly associated with social media addiction symptoms were: PHQ items #1 (little interest or pleasure in doing things), #3 (sleeping too little or too much), #5 (poor appetite or overeating), #8 (moving or speaking slowly or restless/fidgety); SWEMWBS item #1 (feeling optimistic); UCLA-3 item #3 (isolated from others). These items, although showing the same direction of association as with their counterparts, were not significantly associated with each respective outcome. The items that were significantly associated with social media addiction symptoms may be grouped loosely into six overarching domains. These are as follows:

1) cognitive deficits (PHQ-8 item #7 and SWEMWBS item #5 and #7);

2) inhibited resilience (SWEMWBS item #4); and

3) feelings of tension (SWEMWBS item #3);

4) social disconnectedness (SWEMWBS item #6 and UCLA-3 item #1 and #2).

5) depressed mood and fatigue (PHQ-8 item #2 and #4);

6) compromised self-esteem (PHQ-8 item #6 and SWEMWBS item #2);

The results show that social media addiction symptoms are more significantly associated with specific items within the depression, mental wellbeing, and loneliness outcome scales. This analysis pertains to very subtle differences in statistical significance between BSMAS and the individual items, and it is important 1) to not overinterpret these findings, 2) to note that all estimates for the items in each scale are pointing in the same direction (regardless of statistical significance), and 3) that a larger sample size could potentially change significance estimates. This should be kept in mind when interpreting the results of the sensitivity analysis.

Table A1 Associations between social media addiction symptoms (BSMAS) and single depression (PHQ-8), mental wellbeing (SWEMWBS), and loneliness (UCLA-3) items at follow-up among Danish adults in education or employment.

	Multivariate regression		
	Coef.	**95% CI**	**p-value**
	BSMAS scale – continuous (2020)		
Depression - PHQ-8 items[a] (2021)			
- 1) Little interest or pleasure in doing things	0.003	-0.006, 0.011	0.53
- 2) Feeling down, depressed, or hopeless	0.009	0.002, 0.017	0.02
- 3) Sleeping too little or too much	0.008	-0.002, 0.018	0.10
- 4) Tired or little energy	0.011	0.002, 0.021	0.02
- 5) Poor appetite or overeating	0.007	-0.001, 0.014	0.08
- 6) Feeling bad about oneself, failure, let self and others down	0.014	0.006, 0.021	< 0.01
- 7) Trouble concentrating	0.014	0.006, 0.022	< 0.01
- 8) Moving or speaking slowly or restless/fidgety	0.005	-0.001, 0.010	0.07
Mental wellbeing - SWEMWBS items[b] (2021)			
- 1) Feeling optimistic	-0.004	-0.014, 0.006	0.43
- 2) Feeling useful	-0.010	-0.020, -0.001	0.04
- 3) Feeling relaxed	-0.012	-0.023, -0.002	0.02
- 4) Dealing with problems well	-0.011	-0.020, -0.002	0.02
- 5) Thinking clearly	-0.019	-0.028, -0.009	< 0.01
- 6) Feeling close to other people	-0.017	-0.027, -0.006	0.03
- 7) Able to make up own mind about things	-0.013	-0.022, -0.004	0.04
Loneliness - UCLA-3 items[c] (2021)			
- 1) Lack companionship	0.009	0.002, 0.017	< 0.01
- 2) Left out	0.008	0.001, 0.014	0.02
- 3) Isolated from others	0.005	-0.002, 0.011	0.14

BSMAS: Bergen Social Media Addiction Scale.
PHQ-8: Patient Health Questionnaire – 8-item scale
SWEMWBS: Short Warwick-Edinburgh Mental Well-Being Scale – 7-item scale
UCLA-3: University of California, Los Angeles – 3-item scale
[a] N=1,687. Adjusted for all PHQ-8 items at baseline.
[b] N=1,663. Adjusted for all SWEMWBS items at baseline.
[c] N=1,606. Adjusted for all UCLA-3 items at baseline.

Bi-directional associations

Table A2. Associations between depression, mental wellbeing, loneliness, network size at baseline (2020) with social media addiction symptoms at follow-up (2021) among Danish adults in education or employment.

	Linear regression		
	Coef.	**95% CI**	**p-value**
	Mental wellbeing[b] (2021)		
Depression symptoms (continuous)	0.06	0.02, 0.09	0.02
Mental wellbeing (continuous)	-0.04	-0.08, -0.01	0.02
Loneliness (continuous)	0.11	0.001. 0.21	0.049
Network size (continuous)	0.05	-0.04, 0.15	0.27

Adjusted for age (continuous), sex (binary), country of origin (binary), marital status (categorical), education (categorical), chronic conditions occupation (binary), household income (categorical), household size (categorical), and social media addiction symptoms (continuous) at baseline

References

1. Brailovskaia J, Margraf J. Facebook Addiction Disorder (FAD) among German students—A longitudinal approach. PloS one. 2017;12(12):e0189719.
2. van den Eijnden R, Koning I, Doornwaard S, van Gurp F, Ter Bogt T. The impact of heavy and disordered use of games and social media on adolescents' psychological, social, and school functioning. Journal of behavioral addictions. 2018;7(3):697-706.
3. Marttila E, Koivula A, Räsänen P. Does excessive social media use decrease subjective well-being? A longitudinal analysis of the relationship between problematic use, loneliness and life satisfaction. Telematics and Informatics. 2021;59:101556.
4. Muusses LD, Finkenauer C, Kerkhof P, Billedo CJ. A longitudinal study of the association between Compulsive Internet use and wellbeing. Computers in Human Behavior. 2014;36:21-8.
5. Vernon L, Modecki KL, Barber BL. Tracking Effects of Problematic Social Networking on Adolescent Psychopathology: The Mediating Role of Sleep Disruptions. Journal of Clinical Child & Adolescent Psychology. 2017;46(2):269-83.
6. Raudsepp L. Brief report: Problematic social media use and sleep disturbances are longitudinally associated with depressive symptoms in adolescents. Journal of adolescence. 2019;76:197-201.
7. Raudsepp L, Kais K. Longitudinal associations between problematic social media use and depressive symptoms in adolescent girls. Preventive Medicine Reports. 2019;15:100925.
8. Chen IH, Pakpour AH, Leung H, Potenza MN, Su JA, Lin CY, et al. Comparing generalized and specific problematic smartphone/internet use: Longitudinal relationships between smartphone application-based addiction and social media addiction and psychological distress. Journal of behavioral addictions. 2020;9(2):410-9.
9. Di Blasi M, Salerno L, Albano G, Caci B, Esposito G, Salcuni S, et al. A three-wave panel study on longitudinal relations between problematic social media use and psychological distress during the COVID-19 pandemic. Addictive behaviors. 2022;134:107430.