Review

Social Media Use and adolescents' mental health and well-being: An umbrella review

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ABSTRACT

This umbrella review analyses the risks and opportunities for adolescents' mental health and well-being associated with Social Media Use (SMU) and the main risk mitigation proposals presented in systematic, scoping and narrative literature reviews and meta-analyses. Following the PRIOR guidelines, we defined inclusion and exclusion criteria for Population (10-19 years), Exposure (Social Media Use) and Outcomes (Well-being, Ill-being, Mental health) and searched articles published from January 2015 to April 2023 in four databases: Scopus, Web of Science, PsychInfo, and Pubmed. We screened titles and abstracts of 1470 publications, and after conducting the quality assessment based on the AMSTAR 2 protocol, we selected 24 articles on which we performed a thematic analysis. We highlight that the relationship between SMU and adolescents' mental health is influenced by several intervening factors: 1) individual demographic and psycho-socio characteristics, 2) individual use of Social Media (SM), and 3) SM' content and design. Furthermore, we describe the risks and opportunities associated with SMU that emerge from the reviewed articles. We discuss how the limitation to collecting SM data hinders the research on the impact of SMU and how the adoption of responsible design principles by SM platforms would contribute to introducing a societal change to achieve a population-level shift, which is harder to attain if the burden of responsible use is only attributed to individuals' choices. Finally, we discuss the opportunities brought about by upcoming regulatory frameworks, such as the EU Digital Services Act.

1. Introduction

Social Media[1] (SM) platforms allow individuals and communities to share, discuss and interact with a variety of different kinds of content (text, image, audio, video, news, editorial, user-generated, etc.) through mobile and web-based technologies (Kietzmann et al., 2011). They are an integral part of today's adolescents' lives, providing venues for identity exploration and opportunities to develop interests and skills to communicate and connect with peers and a broad audience. The scale of this global phenomenon can be understood by looking, for instance, at the statistics published by Eurostat (2022), showing that during 2022, more than 80% of European youth used the Internet daily to participate in social networks. Also, recent research by the Pew Research Center (2022) shows that more than 35% of North American teens are using at least one SM platform almost constantly, 36% say they spend too much time on SM and 54% that it would be somewhat hard to give it up. Presumably, similar trends may be found by looking at adolescents' online activity also in other regions of the world.

Adolescence is a transitional developmental period in which many biological, psychological, and social changes occur. During adolescence occurs the progressive maturation of brain areas involved in cognitive control and self-regulation (e.g. goal-directed behaviours, control of impulses, or delay of gratifications) and the parallel heightened activity in the regions involved in risk-taking and reward processing (Casey et al., 2008). Furthermore, social cognitive development magnifies the relevance of the social context and peers' social acceptance (Blakemore & Mills, 2014), making adolescents more concerned about how they are perceived by peers and the broader community and influencing their identity development process.

The notable changes that individuals experience during adolescence make them more vulnerable to risks. Remarkably, mental health disorders typically arise in adolescence, making early detection and prevention most effective when targeted at this time (Solmi et al., 2022). Given the significant online presence of adolescents, it is crucial to comprehend the potential risks and benefits of Social Media Use (SMU) on their mental health and well-being.

Scientific literature trying to elucidate this topic has exponentially increased since 2010 (Appel et al., 2020). Although related studies present conflicting evidence (Valkenburg, 2022) and are subject to methodological limitations of the primary research (Orben, 2020, Grif-

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Table 1

Keywords used in the systematic search.

Population	Adolesc* OR teen* OR student* OR child* OR girl* OR boy*
	AND
Exposure	"social?network*" OR "social media" OR Facebook OR Instagram OR Tiktok OR YouTube OR Snapchat OR WhatsApp OR WeChat OR "online platform" OR "Recommender system?"
	AND
Outcome	well?being OR happ* OR friendship OR "positive affect" OR "self?confidence" OR hope OR optimism OR "self?compassion" OR "self?forgiveness" OR satisfaction OR lonel* OR addict* OR "negative affect" OR anxiety OR depression OR "depressive symptom*" OR shame OR "psychological distress" OR stress OR "suicidal ideation" OR envy OR "self?harm" OR "self?injury" OR disorder* OR "quality of life" OR "life quality" OR "mental health" OR sleep* OR "body image" OR "self?esteem"

fioen et al., 2020), the literature suggests a small negative association between SMU and mental health (Meier & Reinecke, 2021).

In this scenario, the current umbrella review analyses not only the updated findings of recent systematic reviews and meta-analyses but also their recommendations in terms of methodological improvement of the primary research, future research and risk mitigation.

1.1. Objectives

This umbrella review aims to systematically analyse and synthesise the existing systematic literature reviews and meta-analyses that investigate the relationship between the use of Social Media and adolescents' mental health and well-being. Through this research, we aim to answer the following research questions:

RQ1. What are Social Media Use's effects on adolescents' well-being and mental health reported in systematic, scoping and narrative literature reviews and meta-analyses?

RQ2. What are the best ways forward to study this phenomenon?

RQ3. What main recommendations emerge from the scientific literature to mitigate the risk to the rights and health of adolescents?

2. Methodology

The umbrella review follows the PRIOR (Preferred Reporting Items for Overviews of Reviews) guidelines (Gates et al., 2022). Section 2.1 reports the eligibility criteria for including the reviews. Section 2.2 describes the search strategy and the selection process implemented. Afterwards, Section 2.3 reports the data collection and quality assessment procedure. Finally, we summarise the synthesis method applied in this review in Section 2.4.

2.1. Eligibility criteria

The population, exposure, outcome, and research type (PEOR) have been used to define a priori inclusion criteria. In detail, reviews have been included if fulfilling the following criteria:

Population. Following the definition of adolescence provided by the World Health Organization (WHO), we included reviews targeting individuals aged 10-19 years old. No further criteria of exclusion were set.

For reviews analysing different age cohorts, at least 70% of the participants must be aged 10-19.

Exposure. We considered reviews that study adolescents' exposure to Social Media, excluding reviews where the use of AI-enhanced tools for mental health or digital health interventions is considered. We also excluded reviews that do not allow us to differentiate Social Media Use from other online activities (e.g., gaming, gambling, or referring to "digital media use", "screen time", or "internet use").

Outcomes. Reviews analysing the impact of SMU on well-being (i.e. happiness, friendship, hope, optimism, life satisfaction), ill-being (i.e. shame, psychological distress, depressive or anxious symptoms) and mental health issues (i.e. depressive or anxiety disorder, eating disorder,

deliberate self-harm) have been included, whilst reviews considering other types of effects (e.g., on academic achievement or adherence to treatment) have been excluded.

Research type. We included systematic reviews, scoping reviews, rapid scoping reviews, narrative reviews, and meta-analyses, but not primary research and umbrella reviews.

2.2. Search strategy and selection process

In January 2023, we searched the following databases: *Scopus*, *Web of Science*, *PsychInfo*, and *Pubmed*. In order to achieve an updated sample of articles, and due to the fast-paced changes in social media, we have restricted our search to articles that were published from 2015 onwards. We created the query using a set of Medical Subject Headings (MeSH) terms, truncations, wildcards and Boolean operators, as shown in Table 1. We selected only articles published in English. In April 2023, we conducted a supplementary search of the same databases and search terms, to avoid missing relevant literature published during the first months of 2023.

After retrieving the results from the search query, the selection process started with removing duplicates. Afterwards, two authors (AS and LP) independently screened titles and abstracts to ensure methodological rigour. During this screening, the decision and motivations of relevance against the inclusion criteria have been annotated in Excel spreadsheets. In case of disagreement, decisions have been achieved through discussion.

2.3. Data collection and quality assessment

To collect data from the reviews, we created an online form filled out by AS and LP independently. A copy of the data extraction form is available in the supplementary materials. For each review, we extracted the following items:

– **Country.** Review country focus (if present) based on its inclusion criteria and the country focus of the primary studies included in the review.

– **Population demographics.** Age range and gender distribution, as specified in the review's inclusion criteria, and gender distribution of the included primary studies.

– **Population characteristics.** As specified in the inclusion criteria, e.g., general population, healthy adolescents, LGBTQIA+ adolescents.

– **Focus of review.** E.g. differentiating if the review refers to "symptoms" or "behaviours" (i.e. non-clinical) or they refer to "disorders" (i.e. clinical diagnosis).

– **Included study designs.** Correlational studies, longitudinal, qualitative studies, mixed methods, experimental or quasi-experimental, quantitative, or no filter applied.

– **Type of synthesis.** Summative synthesis, meta-analysis, qualitative evidence synthesis, or other types of synthesis.

– **Provided recommendations.** Methodological (e.g., need for longitudinal studies, proposal of a novel methodology, identified re-
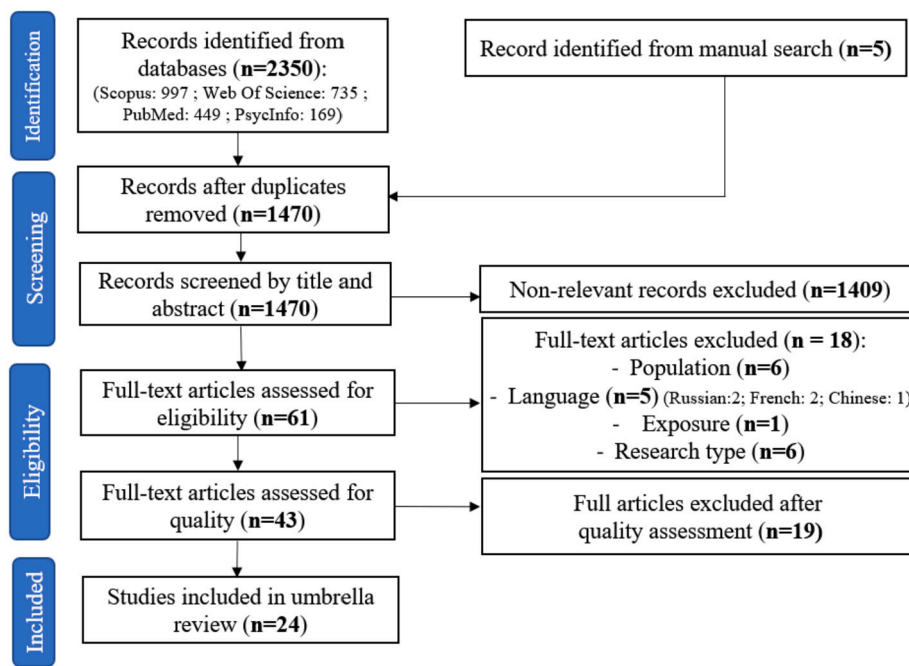
Fig. 1. PRISMA flow diagram summarising the selection process.

search gap), policy-related (e.g. regulation of SM), or other types of recommendations.

– **Sample size.**
– **Date range of search.**
– **Number of included primary research.**
– **Funding sources and conflict of interest.**

For the quality assessment process, we employed the AMSTAR 2 (A Measurement Tool to Assess Systematic Reviews) protocol (Shea et al., 2017) in order to identify low-quality reviews. The assessment focused on several characteristics of the review: use of PICO / PEOR components in developing the research questions and inclusion criteria, prior definition of the research protocol, justification of study design inclusion, use of a comprehensive search strategy, study selection and data extraction in duplicate, justification of excluded studies, detailed description of included studies, methodological considerations for meta-analysis, and disclosure of conflict of interests and funding. Using such information, we labelled the reviews as high, medium and low quality, ultimately excluding those labelled as low-quality.

We adapted part of the AMSTAR 2 checklist, originally designed for assessing only systematic reviews of randomized controlled trials (RCT) and non-randomized studies of interventions (NRSI), to assess the quality of other kinds of reviews. For instance, in the AMSTAR 2 are evaluated only the techniques for assessing the risk of bias, whilst we adapted the checklist by considering as valid also other types of assessments, such as the Mixed Methods Appraisal Tool (Hamm et al., 2015) or the SFS scoring system (Senekal et al., 2023). Also, in this case, we created an online form available in the supplementary materials, which two authors (AS and LP) filled out independently.

2.4. Synthesis method

To analyse the selected reviews, we implemented a thematic analysis (Braun & Clarke, 2006, Nowell et al., 2017), leading to a narrative synthesis of the results. A database of the included articles has been created using NVivo 12 software for qualitative analysis. The articles have been coded line by line by the first author into inductive categories according to their content. After finalising the coding of each included article, the first author implemented an iterative revision process to refine the initial categories or nodes to ensure their internal coherence and organise them into overarching themes. The iterative process of refinement of the nodes has been applied to the *results, discussion, recommendations* and *conclusions* of the selected reviews. Two authors (AS and LP) subsequently reviewed the nodes. Following discussion and agreement, the grouping into hierarchical themes and the coded content have been examined to ensure their internal coherence and organise them into overarching themes. The codebook with the categories of the thematic analysis is available in the supplementary materials.

3. Results

The literature search yielded a corpus of 2350 records from the four databases (*Scopus*: 997; *Web Of Science*: 735; *PubMed*: 449; *PsychInfo*: 169). In addition, five records found manually by the authors have been added to the corpus. After duplicate removal, screening on the title and abstract excluded 1409 of the 1470 unique papers. On reading the complete text, 18 over 61 papers have been found to be ineligible: 6 because of the target population, 5 for their language, one because of not considering exposure to social media, and finally, 6 because of the research type. Among the 43 remaining records, 19 have been labelled as low-quality after the quality assessment and excluded, ultimately leaving 24 papers eligible for the review. The flowchart in Fig. 1 summarises the process above. The supplementary search yielded 185 records, among which 92 were unique. Among those, only four records passed the title and abstract screening. Afterwards, two were excluded due to the target population, one because it has been labelled as low-quality, and one because it is not open access and the full-text was not available to the authors, leaving no additional papers eligible for the review. All the records found and details of the selection process are included in the supplementary materials.

3.1. Description of the included reviews

The reviews' main characteristics are summarised in Tables 2 and 3. Only five reviews have been published before 2020, with the majority being published from 2020 onwards. No review targets a specific country or region of the world in its inclusion criteria, whilst the number of the countries included according to the reviews' primary research

Table 2

Summary of characteristics of included reviews (part 1). NR: not reported; NS: no synthesis; NF: no filter; *: median value.

Reference	Age range	Gender (%f)	Population	No. countries	Sample size	Primary studies
Ivie et al. (2020)	11-18	NS	NF	7	92,371	12
Keles et al. (2020)	13-18	NS	NF	14	21,231	13
Chung et al. (2021)	10-19	NS	NF	8	1,225	6
Moss et al. (2023)	10-19	NR	NF	6	NS	15
Webster et al. (2021)	11-18	NS	Healthy	12	NS	29
Popat and Tarrant (2023)	13-17	NR	NF	NR	NR	24
Sarmiento et al. (2020)	12-18	NR	NF	24	NS	68
Hamm et al. (2015)	12-18	55.8	NF	6	*544	34
Varona et al. (2022)	11-17	51.0	NF	32	NS	112
Zhou and Cheng (2022)	10-19	42.7	NF	4	11,616	14
Senekal et al. (2023)	10-19	NS	NF	11	NS	20
McCrae et al. (2017)	10-18	NS	NF	9	12,646	11
Cataldo et al. (2021)	10-19	NR	NF	NR	NS	44
Course-Choi and Hammond (2021)	10-19	NS	NF	11	NS	14
Vidal et al. (2020)	10-18	NS	NF	26	NS	42
Schønning et al. (2020)	13-19	NS	NF	NR	NS	79
Vannucci et al. (2020)	12-18	51.7	NF	16	67,407	27
Sedgwick et al. (2019)	11-18	NS	NF	8	346,416	9
Nolan et al. (2017)	10-19	100	Mothers	2	NS	8
Memon et al. (2018)	13-17	NR	NF	9	NS	9
Bozzola et al. (2022)	≤18	NR	Healthy	NR	NR	68
Bottaro and Faraci (2022)	12-18	NR	NF	17	44,880	52
Liu et al. (2022)	10-19	NS	NF	15	55,340	26
Shankleman et al. (2021)	10-19	NS	Healthy	8	NS	19

Table 3

Summary of characteristics of included reviews (part 2). NR: not reported; NS: no synthesis; NF: no filter.

Reference	Main Focus	Study design	Synthesis	Search range
Ivie et al. (2020)	Depressive symptoms	Correlational	Meta-analysis	< 2020
Keles et al. (2020)	Internalizing symptoms	NF	Summative	< 2018
Chung et al. (2021)	Eating disorders	NF	Qualitative	< 2019
Moss et al. (2023)	Self-harm	NF	Qualitative	< 2021
Webster et al. (2021)	Well-being	NF	Summative	< 2018
Popat and Tarrant (2023)	Well-being	Qualitative	Qualitative	2014-2020
Sarmiento et al. (2020)	Internalizing symptoms	NF	Qualitative	< 2017
Hamm et al. (2015)	Risk factors	NF	Summative	2000-2014
Varona et al. (2022)	Risk factors	NF	Summative	2010-2021
Zhou and Cheng (2022)	Mental Health	NF	Meta-analysis	< 2020
Senekal et al. (2023)	Psychosocial development	Quantitative	Qualitative	2008-2019
McCrae et al. (2017)	Depressive symptoms	Quantitative	Meta-analysis	NR
Cataldo et al. (2021)	Psychiatric disorders	Qualitative	Summative	2006-2020
Course-Choi and Hammond (2021)	Well-being	Longitudinal	Summative	2006-2019
Vidal et al. (2020)	Depressive symptom	NF	Qualitative	2011-2019
Schønning et al. (2020)	Well-being	Qualitative	Summative	2014-2019
Vannucci et al. (2020)	Risky behaviours	Correlational	Meta-analysis	2000-2019
Sedgwick et al. (2019)	Suicide attempts	Correlational	Summative	< 2019
Nolan et al. (2017)	Online Support	NF	Summative	1995-2015
Memon et al. (2018)	Depressive symptoms	Correlational	Summative	2017-2018
Bozzola et al. (2022)	Risk factors	NF	Summative	2004-2022
Bottaro and Faraci (2022)	Well-being	NF	Summative	2002-2022
Liu et al. (2022)	Depressive symptoms	Correlational	Meta-analysis	< 2022
Shankleman et al. (2021)	Well-being	Qualitative	Qualitative	2006-2022

ranges between 2 and 32, with a median value of 10 countries. Only four reviews did not report the population country of the primary studies (Schønning et al., 2020, Cataldo et al., 2021, Popat & Tarrant, 2023, Bozzola et al., 2022). In terms of age, the most common range considered in the reviews' inclusion criteria is 10-19 (37.5% of the reviews), in line with the WHO definition of adolescence.[2]

Moreover, in all the reviews, the gender of the population has not been considered in the inclusion criteria, apart from the work by Nolan et al. (2017) which focuses on the SMU of adolescent mothers. Nevertheless, 4 out of 24 reviews report a synthesis of the gender distribution (Hamm et al. (2015): 55.6% female; Varona et al. (2022): 51.04%; Zhou and Cheng (2022): 42.7%; Vannucci et al. (2020): 51.7%). Instead, 12 reviews report the gender distribution in the primary research without

providing a synthesis, and in 7 reviews, no information about the gender distribution is included.

The sample size is reported in almost every review, apart from Popat and Tarrant (2023) and Bozzola et al. (2022). Where a synthesis is included (37.5% of reviews), the sample size ranges from 1225 to 346k adolescents, with a median value of approximately 45k. In the other cases (54% of reviews), the sample size of the primary research is specified without providing a synthesis. With regards to the population characteristics, no filtering was applied in most of the cases (20 out of 24 reviews), whilst three reviews target only healthy adolescents with no previous health conditions (Webster et al., 2021, Bozzola et al., 2022, Shankleman et al., 2021), and Nolan et al. (2017) focuses on adolescent mothers.

According to their search strategy, several reviews (37.5%) did not impose a start date in the inclusion criteria, meaning that all the works published in the searched databases were considered. One review ex-

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[2] https://www.who.int/health-topics/adolescent-health.

tended its search to works published after 1995 (Nolan et al., 2017), whilst in the other cases, the search range start was comprised between 2000 and 2017. Usually, the search time range ended the same or the previous year of the review publication. The number of included primary studies varies consistently among reviews, with a minimum of 6 and a maximum of 112 studies, with a median of 22.

The reviews' main focus encompasses a variety of topics. Non-clinical aspects of the impact of SMU on adolescents are prevalent. In particular, depressive, anxiety, and, more generally, internalising symptoms are studied in almost half of the included reviews. Deliberate self-harm and suicidality are considered in 25% of the reviews, whilst eating behaviours and body image concerns are analysed in 16% of the reviews. Other behavioural aspects such as cyberbullying, problematic SMU and risky behaviours are discussed in around one-fifth of the reviews. Lastly, only 12% of the reviews consider clinical aspects such as anxiety disorder, depressive disorder, eating disorder, non-suicidal self-injury disorder, or other psychiatric disorders.

Regarding the study design as specified in the inclusion criteria, no filter was applied in half of the reviews, whilst when established, we observed the following distribution: correlational studies (21%), qualitative studies (17%), quantitative studies (17%), longitudinal studies (8%), and experimental or quasi-experimental studies (4%). The kinds of synthesis used in the reviews are summative synthesis (50%), qualitative evidence synthesis (29%), and meta-analysis (21%).

The conclusions of the considered reviews include methodological recommendations, identifying research gaps, proposing methodologies or stressing the need for longitudinal studies. Few reviews discuss recommendations for policy-makers and SM platforms' providers, and some insights on educational consideration are presented in a small fraction of the works analysed. A detailed analysis of the recommendations provided by the reviews is reported in Section 4.4. In terms of funding, when disclosed we observe the participation of academic institutions, regional and national research centres, as well as foundations. In all the reviews, the authors stated no conflicts of interest.

3.1.1. Primary studies

Summing the primary studies of the different included reviews, we found a total number of 578 unique studies, which served as the basis for the conclusions done throughout the reviews and analysed in this work. Among those, 82% are presented in only one review, while the rest overlap among different works. The amount of overlap between primary studies varies greatly between reviews, with reviews with no overlap, e.g., in the case of the review on SMU by adolescent mothers Nolan et al. (2017), whilst other reviews analysing works that have also been considered in one or more other reviews, e.g., all the primary studies in (Ivie et al., 2020) are also included in other reviews. The average overlap of primary studies among the 24 reviews considered in this umbrella review is 42%. Most primary studies have been published in the last decade, with only 15% before 2013. The complete list of primary studies can be found in the supplementary materials.

4. Thematic analysis

We identified five main themes through the thematic analysis for answering our research questions. Our first research question aimed at investigating the effects of SMU on adolescents' mental health and well-being. We identified two broad themes that may contribute to describing this relationship:

a) **Intervening factors** that might minimise or increase the risks of SMU in terms of mental health and well-being;
b) **Opportunities and risks** associated with SMU that are described in the analysed literature.

To answer the second research question on the best way forward to study this phenomenon, we identified:

c) **Methodological recommendations** in terms of research design and data collection;
d) **Research gaps** that suggest aspects the scientific community needs to analyse to increase our understanding.

The main recommendations to minimise the risks associated with SMU, part of our third research question, include:

e) **Risk mitigation** that describes educational interventions, clinical implications for mental health practitioners and practical implications for platforms.

4.1. Intervening factors

Our analysis confirms the need for a comprehensive consideration of the relationship between Social Media Use (SMU) and mental health outcomes and well-being. This relationship's direction and strength depend on the presence of different variables, which we refer to as *intervening factor*.[3] From the literature review, we identified three different kinds of intervening factors, which we summarized in Fig. 2: 1) individual demographic and psycho-socio characteristics; 2) individual use of Social Media; and 3) platforms' content and design.

4.1.1. Individual demographic and psycho-socio characteristics

Among the characteristics of individuals that can affect their relationship with social media use and mental health outcomes, we focus on i) gender, ii) age, iii) emotional regulation skills, and iv) the quality of their supporting network.

Gender. Girls and boys seem to use SM for different reasons. Girls seem to invest more in SM for relational purposes (McCrae et al., 2017), therefore deriving both more significant benefits, for example, increased online support (Cataldo et al., 2021), and more meaningful online relationship (Zhou & Cheng, 2022) but also being more prone to adverse consequences (McCrae et al., 2017). Furthermore, girls seem to spend more time on SM. The correlation between time spent on SM and depressive symptoms is significant for both sexes, even if it is stronger for girls (Ivie et al., 2020, Liu et al., 2022, McCrae et al., 2017).

There is also stronger social pressure on girls to fit beauty standards (Senekal et al., 2023), which increases their vulnerability to negative self-appraisal, body image dissatisfaction, and self-objectification (Course-Choi & Hammond, 2021). Notably, social comparison of physical features and attractiveness (Cataldo et al., 2021, McCrae et al., 2017), exposure to unrealistic images of perfect bodies, and the use of beautifier filters to post photos on SM (Bozzola et al., 2022) seem to be associated with increased body image dissatisfaction for girls but not for boys (McCrae et al., 2017). Moreover, girls with lower self-esteem and body image concerns may use social media more frequently for selective self-presentation to fit the social expectations of beauty (Bozzola et al., 2022). In turn, some of the studies presented by Course-Choi and Hammond (2021) show that the artificially beautified images used for the presentation of an ideal self, even while receiving numerous positive feedback, may not impact positively on self-esteem or even affect it negatively due to the cognitive dissonance perceived between the authentic and the ideal self.

Girls are also the vast majority of members and promoters of pro-eating disorders online networks on SM, and exposure to this kind of content is a risk factor for normalising and adopting those kinds of behaviours (Cataldo et al., 2021). The 15 studies analysed in Sarmiento et al. (2020) show that the correlation between SMU, anxiety and social anxiety is more robust for girls than boys. Most of the studies analysed

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[3] There is a lack of agreement in the literature regarding what constitutes a *mediating* or *moderating* factor in the relationship between SMU and mental health and well-being. As a result, we use the more general term *intervening* factors.
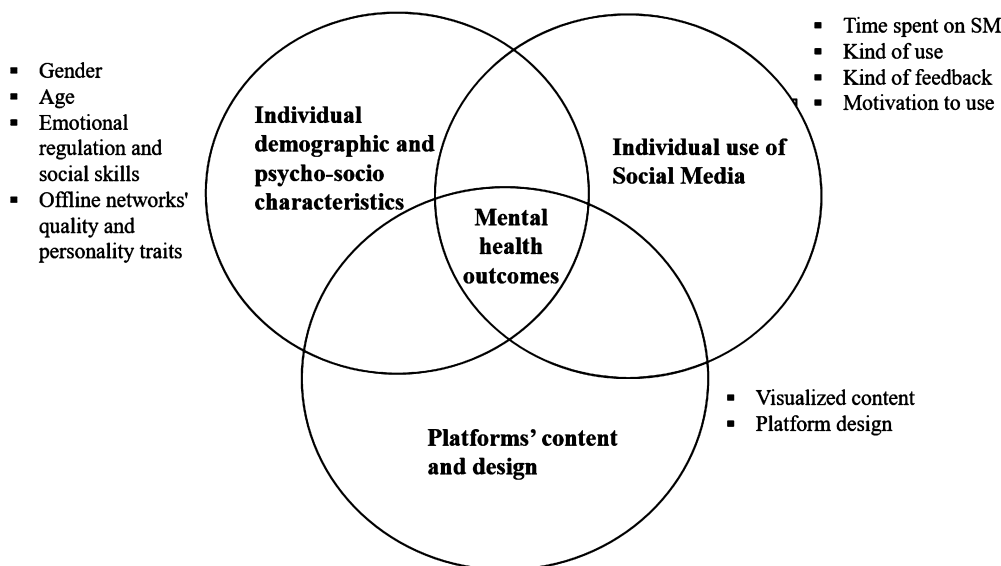
- Gender
- Age
- Emotional regulation and social skills
- Offline networks' quality and personality traits

- Time spent on SM
- Kind of use
- Kind of feedback
- Motivation to use

Individual demographic and psycho-socio characteristics

Individual use of Social Media

Mental health outcomes

Platforms' content and design

- Visualized content
- Platform design

Fig. 2. Venn diagram of the topics included in the thematic analysis.

by Hamm et al. (2015) found that girls are more likely to be bullied online, which is associated with a higher risk of depression (Liu et al., 2022).

Age. Some studies investigating the relationship between SMU and mental health showed that younger adolescents (10 to 15 years old), especially the "heavier users", are more vulnerable to developing depressive and anxious symptoms (Keles et al., 2020, Sarmiento et al., 2020). This is attributed to the more limited social and mood regulation skills in younger people (Vidal et al., 2020) and the more significant social, psychological, and biological changes in early adolescence. Heavy social media use for younger adolescents is associated with increased emotional distress and worse behavioural outcomes, which may continue for several years, as highlighted in a longitudinal study discussed by Bozzola et al. (2022).

Emotional regulation and social skills. These are considered a protecting factor against the challenges posed by SMU (Shankleman et al., 2021), particularly those related to Problematic SMU (Bottaro & Faraci, 2022) and deliberate self-harm (Moss et al., 2023). In contrast, a lack of self-regulation and increased SMU as a mood regulation strategy is considered correlated to depression in Keles et al. (2020) and Liu et al. (2022).

Offline social network and personality traits. The quality of the offline social network, feelings of loneliness, and personality traits such as introversion or extroversion are also considered variables that may function as protective or risk factors. Studies analysed by McCrae et al. (2017) support the "rich get richer" hypothesis, i.e., extroverted adolescents with good social self-esteem who perceive high-quality offline friendships would use social media to interact mainly with their friends, reinforcing the relationship and receiving increased online support. In contrast, introverted adolescents with low social self-esteem and less robust social networks would use SM to contact strangers with increased risks of receiving unwanted contacts or material.

On the other side, some share their thoughts and feelings with their online acquaintances in a way that they would not otherwise be able to communicate offline (McCrae et al., 2017), and online friendship fosters increased support that is positively correlated with well-being. Still, adolescents mostly think that "real life" friends hold greater value (Popat & Tarrant, 2023) and online interaction can be superficial and lack genuine interest (McCrae et al., 2017).

Most of the studies analysed by Sarmiento et al. (2020) found a significant relationship between adolescents' SMU and feelings of loneliness. Almost half of them considered a sense of loneliness an antecedent

to social media use, leading to increased and more intense SMU (also in Cataldo et al. (2021), Bottaro and Faraci (2022)) to communicate and establish new friendships. Adolescents who feel lonely could communicate more frequently with adults and strangers than peers, which in Senekal et al. (2023) is associated with alienation, conflict, and decreased feelings of companionship. Other studies in the same review considered loneliness as an outcome of SMU, particularly for those using SM for entertainment or identity explorations. Parental and caretaker supervision and involvement in SM that does not undermine the autonomy and privacy of youth are considered to buffering the possible adverse effects of SMU (Cataldo et al., 2021, Senekal et al., 2023, Vidal et al., 2020). Similarly, higher involvement in family and peers' in-person activity (Vidal et al., 2020) or in physical activities (Bozzola et al., 2022, Liu et al., 2022, Webster et al., 2021) is considered a protective factor.

4.1.2. Individual use of social media

Several characteristics of adolescents' individual use of SM can influence mental health outcomes and well-being. The main factors we identified in the literature are 1) time spent on SM, 2) passive versus active use, 3) the kind of feedback received, and 4) the motivation to use.

Time spent on SM. Moderate use of SM (approximately under two hours per day) is associated in some studies with greater well-being, social support, improved social relationships, and participation in social and political life (Bottaro & Faraci, 2022, Senekal et al., 2023, Vidal et al., 2020). Authors like Schønning et al. (2020) attribute the concerns for mental health associated with high time spent on SM to mainstream media, questioning if researchers are adopting this assumption as a starting point instead of trying to increase the empirical evidence on this association. This consideration is in line with the findings from Keles et al. (2020) showing no relationship between time spent on SM and depressive symptoms. However, there is a robust corpus of evidence pointing that "high social media use" (starting from above two hours per day) is associated with worsened outcomes in terms of social well-being and happiness (Bozzola et al., 2022), low self-esteem, and increased vulnerability to harassment (Senekal et al., 2023). Some adolescents report the pressure to share, stay connected and respond immediately to messages as a barrier to disconnecting and switching off SM (Shankleman et al., 2021). Higher time spent on SM is also related to poor sleep and poor body image (Webster et al., 2021), increased psychological distress, self-rated fair to poor mental health and suicidal

ideation (Memon et al., 2018, Vidal et al., 2020). In Moss et al. (2023), prolonged use by adolescents prone to deliberate self-harm is associated with normalising these behaviours. Evidence from a dose-response meta-analysis reported by (Liu et al., 2022) reveals that "adolescents with higher daily Time Spent on Social Media had a 59.6% increase in terms of the risk of depression when compared with the reference group", and continue evidencing how "[...] the risk of depression increased by 13% for each hour increase in social media use, and these associations were stronger for adolescent girls than boys; however, boys still demonstrated a significant increase in depression risk".

The displacement hypothesis is cited in several reviews as a possible explanation of the association between time spent on SM and adverse mental health outcomes (Liu et al., 2022, Popat & Tarrant, 2023, Shankleman et al., 2021, Vannucci et al., 2020). According to this hypothesis, the pressure to stay connected to SM and the time spent on it replace the time spent on health-promoting behaviours such as in-person relationships, physical activities, or other active and creative activities.

Passive vs active use. Many authors report different mental health outcomes deriving from active (i.e., posting, commenting, messaging, or liking) and passive (i.e., browsing other users' photos or scrolling through comments or feeds) use of SM. Some research shows that users with depressive symptoms, feelings of loneliness or high-stress levels increase their passive use of SM (Cataldo et al., 2021). At the same time, passive consumption of SM is associated with increased levels of social comparison, less perceived social support (Sarmiento et al., 2020), envy, depressive mood (Course-Choi & Hammond, 2021, Keles et al., 2020), and anxiety (Bottaro & Faraci, 2022). On the other side, active use is associated with increased well-being and life satisfaction, especially among girls (Bottaro & Faraci, 2022), increased perception of social support (Vidal et al., 2020) or not associated with later depressed mood (Bottaro & Faraci, 2022, Webster et al., 2021). Nevertheless, Shankleman et al. (2021) questions if the pressure to conform to perceived netiquette and reply immediately could lead to active but unhelpful communication patterns. Again, conflicting results are reported, for example, regarding the correlation between both active and passive use and increased frequency of depressed mood (Keles et al., 2020, Ivie et al., 2020).

Kind of feedback. Receiving feedback is positively or negatively associated with well-being, depending on the nature of the feedback (Webster et al., 2021). Research distinguishes three kinds of feedback associated with SMU: positive, negative and ostracism (i.e., being ignored or excluded online). Positive feedback can be interpreted as a reward and quantified as a measure of social validation and self-worth, producing increased self-acceptance and social desirability (Bottaro & Faraci, 2022). It may contribute to building a positive self-image (Shankleman et al., 2021), and to life satisfaction and subjective well-being (Webster et al., 2021). In addition, positive feedback from close friends is associated with more substantial positive effects than those received from acquaintances, and the subjective value attributed to it changes in function to individual self-esteem, i.e., adolescents with lower self-esteem could attribute increased value to it in comparison with those with high self-esteem (Course-Choi & Hammond, 2021). Seeking positive peer feedback, with the feeling of reward caused by the quantifiable number of "like" and the affordances granted by asynchronous communication, can lead to a cycle of modifying self-presentation. Selective self-presentation to seek peer validation can lead to hypervigilance (Shankleman et al., 2021) and strategies such as reducing the number of posts to minimize the risk of being judged or receiving negative feedback (Bottaro & Faraci, 2022, Popat & Tarrant, 2023), therefore limiting authentic self-expression to seek popularity (Shankleman et al., 2021). This, in turn, can negatively impact self-esteem and trigger excessive social comparison and rumination, particularly in youth with anxiety disorder (Cataldo et al., 2021).

Moreover, when adolescents publish on SM to seek peer validation or support, receiving negative feedback or ostracism can harm subjective well-being, affecting both self-acceptance and self-worth (Shankleman et al., 2021), mainly when referring to body consciousness (Bottaro & Faraci, 2022). Social media ostracism can threaten the sense of belonging and activate the Fear of Missing Out (FOMO) (Popat & Tarrant, 2023, Shankleman et al., 2021, Webster et al., 2021), which can be defined as the apprehension of missing rewarding experiences that others might be enjoying (Vidal et al., 2020).

Motivation to use. Adolescents can use SM to reach different kinds of objectives. Their motivation to use SM influences mental health and well-being outcomes. SM can be used for self-expression and online disclosure, to engage with relatives and friends, to strengthen friendships, or to expand one's social network (Webster et al., 2021), finding like-minded individuals, therefore creating online communities, and boosting a sense of belonging (Moss et al., 2023). It also can be used for entertainment, to get updated information, to get inspired or to nurture an interest or passion, or to learn about a new topic that positively affects mood (Shankleman et al., 2021). Also, providing and receiving online social support is associated with greater general mental health, life satisfaction and well-being (Zhou & Cheng, 2022). SM can also be used for social comparison, a mechanism highly involved in identity development, particularly during adolescence (Keles et al., 2020). Adolescents can engage in downward comparison (with people perceived as of lower status) or upward comparison (with people perceived as higher status), which can lead to negative self-evaluation and decreased well-being, especially when confronted with the portrayal of carefully constructed representations of the "best selves" (Bottaro & Faraci, 2022, Senekal et al., 2023). Picture-based SM can threaten self-esteem through comparison of appearance (Bozzola et al., 2022, Popat & Tarrant, 2023, Schønning et al., 2020). Access to SM can also be a strategy of mood regulation for stress management to escape boredom or emotions such as anger, loneliness, sadness, or anxiety (Shankleman et al., 2021). When this leads to increasing the time spent on SM, it can represent a risk for lower well-being (Bottaro & Faraci, 2022, Cataldo et al., 2021, Schønning et al., 2020).

4.1.3. Platforms' content and design

Social media's affordances — intended as perceived, actual, or imagined properties arising from the interaction of technology, social dynamics, and context, which both enable and limit specific uses of the platforms (Ronzhyn et al., 2023) — can also influence the relationship between SMU and mental health outcomes and well-being. The main intervening factors we identified in the literature are 1) visualised content and 2) platform' design.

Visualized content. The searched or recommended content can also positively or negatively affect well-being and mental health. Positive content hosted on SM can inspire users and promote learning about widely different topics. It can enable adolescents to get information about and engage in the promotion of political and social issues such as the *#FridaysForFuture* movement. SM can also be a place to discuss and break the stigma around mental health issues, creating a support network for those with similar diagnoses or experiences (Popat & Tarrant, 2023, Zhou & Cheng, 2022), and contributing to preventing relapse, for example, related to eating disorder (Chung et al., 2021).

At the same time, non-reliable health-related information, for example, harmful weight loss advice, can spread on SM and may promote unhealthy eating attitudes. (Bozzola et al., 2022). The involuntary exposition to distressing news (Popat & Tarrant, 2023), violent content (Hamm et al., 2015), or unwanted sexual content (Bozzola et al., 2022) can equally be a threat to well-being.

Indeed, the visualization of disturbing content can negatively affect mood and behaviour (Popat & Tarrant, 2023, Shankleman et al., 2021). For example, pro-eating disorder content is easily accessible on SM, facilitating the creation of communities around ever-changing hashtags

Table 4
Summary of opportunities and risks of SMU.

Opportunities
– Identity development
– Online social support
– Promotion of healthy behaviours
– Access to online professional support

Risks
– Association with depressive and anxious symptoms
– Problematic SMU (Social network addiction)
– Eating behaviours and body image concerns
– Deliberate self-harm and suicidality

referring to anorexic or bulimic behaviours or exalting unhealthy "thin ideals" (Bozzola et al., 2022). Similarly, the use of hashtags can redirect users toward deliberate self-harm content (Moss et al., 2023). Some research shows that more than 50% of adolescents who self-harm sought online self-injury material, such as graphic content displaying scars and self-injury equipment, before self-harm, signalling the risk of desensitization and normalization of extremely unhealthy and risky behaviours (Memon et al., 2018). Tellingly, the visualization of disturbing content raises the concern of social contagion that can result in increased rates of emulation of risky or potentially fatal behaviours such as those promoted by viral challenges (Bozzola et al., 2022, Memon et al., 2018, Moss et al., 2023, Sedgwick et al., 2019).

Platform design. Some features of the platforms' design can also influence individuals' well-being. Mainly, the reviewed articles refer to the "like mechanism" which may have an impact on self-acceptance and the perception of social status since the number of "likes" or the number of friends and followers can be interpreted as a measure of self-worth and popularity (Bottaro & Faraci, 2022), triggering excessive social comparison and rumination, and increasing anxious symptoms (Cataldo et al., 2021). It can be appreciated that the reviewed articles analyse this aspect only tangentially. Nevertheless, as we discuss in section 5.2, there is a growing body of research, both from the fields of human-computer interaction and psychology, that analyses the impact of elements of persuasive design employed in SM (but also in online video games, online gambling, online shopping and online streaming platforms) to alter users' behaviours to increase the engagement and the time spent on the platforms.

4.2. Opportunities and risks

This section describes the opportunities and risks of SMU for adolescents' mental health and well-being identified from the thematic analysis, summarized in Table 4. In terms of opportunities, the analysed reviews evidence that adolescents' identity development can benefit from SMU, thanks also to the promotion of healthy behaviours and to the access to professional and social support that can be found online. On the contrary, the association between SMU and i) depressive and anxiety symptoms, ii) problematic use and addiction, iii) eating behaviours and body image concerns, and iv) deliberate self-harm and suicidality are among the identified risks to which adolescents are subjected.

4.2.1. Opportunities

SM can offer opportunities for well-being and improved mood, producing excitement, happiness, engagement, and momentary relief from reality when used for entertainment. It can provide a "window to the world" and promote learning about innumerable topics (Shankleman et al., 2021). It can also contribute to positive mental health outcomes by facilitating identity development, creating and nurturing supportive relationships that may provide online social support, or accessing online professional help.

Identity development. SM affords multiple opportunities for self-expression (Popat & Tarrant, 2023), displaying distinctive qualities from others, developing a positive self-image, and enhancing self-esteem and sense of worth (Shankleman et al., 2021). SM also allows safe identity experimentation and authentic self-presentations, benefiting from the possibility of anonymous posting or the creation of "spam accounts" only available to close friends or open to a broad audience while disguising the identity of the owner (Popat & Tarrant, 2023, Zhou & Cheng, 2022)). Adolescents can also create private accounts as a reflexive journal for self-validation and a sense of personal growth and progress (Popat & Tarrant, 2023, Shankleman et al., 2021). Online communication can also be a safe space for selective self-disclosure, sometimes buffering the anxiety that some experience in face-to-face interaction or allowing them to share aspects of the self that they could not share in person (Senekal et al., 2023). The content generated and shared on SM (e.g., photos, text, or videos) may promote autonomy and identity development and enhance relationships with offline friends, and people met online (Chung et al., 2021).

Online social support. Social media can be a valuable tool to keep in touch with friends or family living far away, nurturing existing relationships. It also allows one to find like-minded people worldwide, sharing entertainment and interests or reflecting on experiences as a group (Shankleman et al., 2021), which can contribute to enhancing well-being (Webster et al., 2021), and to mood improvement (Memon et al., 2018). Online connections are a form of social capital that can facilitate tangible or intangible assistance (Zhou & Cheng, 2022) and contribute to reducing isolation and loneliness (Webster et al., 2021), encouraging open conversations (Popat & Tarrant, 2023), emotional and informational support (Nolan et al., 2017). SMU can improve cognitive and affective empathy and promote prosocial behaviours (Bottaro & Faraci, 2022), and seeking and receiving online social support can attenuate daily stress and depressive symptoms (Sarmiento et al., 2020, Vidal et al., 2020). In conclusion, online social support is positively associated with subjective well-being and happiness (Webster et al., 2021), life satisfaction (Shankleman et al., 2021), self-esteem, better general mental health outcomes, and lower levels of adverse outcomes such as loneliness or social anxiety (Zhou & Cheng, 2022).

Promotion of healthy behaviours and access to online professional support. Thanks to SM, young people recovering from eating disorders or Deliberate Self-harm, or in general struggling with mental health issues, can share their testimony, offer, and receive positive peer support and advice for relapse prevention (Cataldo et al., 2021, Chung et al., 2021, Memon et al., 2018). For example, some adolescents seeking help about deliberate self-harm perceived that they had more support online than offline. At the same time, the potential anonymity granted by SM can facilitate self-expression and find support (Sedgwick et al., 2019). SM can host "challenges" to improve well-being, such as posting something personally uplifting for a series of consecutive days, and offer a space to break the stigma around mental health, for example, with celebrities sharing their personal struggles (Popat & Tarrant, 2023). Online groups moderated by (mental) health care professionals can be of great value for those uncomfortable with face-to-face self-disclosure or with seeking professional help (Nolan et al., 2017, Popat & Tarrant, 2023, Senekal et al., 2023). Those groups can also provide a safe space to share feelings and receive peer support, therefore potentially being an effective platform for promoting mental health and socio-emotional competences (Popat & Tarrant, 2023).

4.2.2. Risks

Factors like high SMU, sleep disruption, negative social comparison, cyberbullying victimization or overexposure to manipulated representations of ideal bodies can increase the risk of adverse mental health and well-being outcomes. Hereafter, we will outline the main risks associated with SMU that are described in the reviewed literature.

Association with depressive symptom. The relationship between SMU and depressive symptoms is one of the most studied in the literature, partly because of the broad public interests and justifiable concerns. One-sixth of the articles in this umbrella review focus exclusively on this topic. Among those, several studies show no significant correlation between SMU and depressive symptoms (Cataldo et al., 2021, Vidal et al., 2020). Nevertheless, there is a growing consensus on the correlation between time spent on SM and the odds of adverse outcomes (McCrae et al., 2017, Sarmiento et al., 2020, Vidal et al., 2020). Notably, the two meta-analyses on this subject show a small but positive correlation between SMU and depressive symptoms (Ivie et al., 2020, Liu et al., 2022). Both meta-analyses also found high heterogeneity between primary studies, indicating substantial differences among them (e.g., the tools used to measure SMU or depressive symptoms). Moreover, such heterogeneity suggests that SMU can be associated with depressive symptoms for some, but not all, adolescents. Indeed, several factors seem to intervene in the relationship. High SMU is associated in some studies with increased odds of developing depressive symptoms (Cataldo et al., 2021, McCrae et al., 2017, Vidal et al., 2020). This risk would increase linearly for each additional hour spent on SM and with more pronounced risk for girls than boys (Liu et al., 2022).

Other studies associate depressive symptoms with increased SMU (Bottaro & Faraci, 2022, Course-Choi & Hammond, 2021, Sarmiento et al., 2020), and Vidal et al. (2020) hypothesize that the relationship is bidirectional, i.e. adolescents with a depressed mood may spend more time on SM, which in turn can lead to increasing depressive symptoms. The sleep disruption that may derive from high SMU (Keles et al., 2020, Vidal et al., 2020) can increase the risk of developing depressive symptoms and is considered a more significant risk factor than SMU in some studies (Ivie et al., 2020). Passive SMU (Cataldo et al., 2021, Course-Choi & Hammond, 2021) and negative social comparison (Cataldo et al., 2021, Vidal et al., 2020) are also associated with an increased risk of developing depressive symptoms. Being a victim of cyberbullying is considered a risk factor for developing depressive symptoms (Hamm et al., 2015, Senekal et al., 2023), which at the same time are considered a risk factor for online victimization (Vidal et al., 2020).

Association with anxious symptom. During adolescence, anxious symptoms often overlap with depressive symptoms and are conceptualized as a cause and an outcome of SMU. Anxious adolescents, particularly those suffering from social anxiety (the marked fear of being exposed to the scrutiny of others in social interactions), are considered more likely to spend more time on SM or to develop problematic SMU (Sarmiento et al., 2020). Socially anxious adolescents may use social media to establish positive online relationships, buffering the anxiety caused by in-person encounters but also increasing the frequency of avoidant behaviours. They can also use SM to forge a selective self-presentation to limit the risk of receiving unfavourable feedback, which, in turn, can activate the need to repeatedly check their previous posts (Cataldo et al., 2021), leading to excessive social comparison and increased time on SM.

Anxious symptoms may be an outcome of SMU, for instance, when a lack of feedback triggers the fear of being un-liked or excluded by peers. The Fear of Missing Out (FOMO), may partially explain the need to be constantly connected to SM and the so-called nomophobia (the fear of not being able to use the mobile phone) (Cataldo et al., 2021).

Problematic SMU (Social Network addiction). According to the analyzed literature, there is a general social concern about adolescents being "addicted" or "dependent" on SM. Problematic SMU, a detrimental use that can significantly impair a user's life, is not a recognized disorder in the official clinical classifications (i.e., DSM-5-TR and ICD-11). Varona et al. (2022) identify the need for standardized definitions, diagnosis instruments and agreed cut-off point to measure it. Several criteria need to be satisfied to conform to Problematic SMU, such as: i) the inability to control the time spent on SM, ii) conflict with other activities (e.g., causing impaired academic results or social connections),

iii) obsessive thought patterns related to SMU, iv) loss of interest in other activities, v) use of SM for mood modification, withdrawal symptoms, and relapse (Varona et al., 2022)). Problematic SMU is associated with emotional maladjustment, internalizing and externalizing symptoms and depressed mood (Vidal et al., 2020), sleep difficulties and increased risk of suffering cyberbullying (Bozzola et al., 2022).

Eating behaviours and body image concerns. Adolescents can find on SM a multitude of content promoting healthy as well as unhealthy eating behaviours. Channels encouraging eating disorders gather users around ever-changing hashtags to avoid being blocked by SM platforms and raising particular concerns. For instance, the *Pro-Ana Movement* endorses and supports dysfunctional eating behaviour, disorder maintenance and interference with recovery (Cataldo et al., 2021).

Their use correlates with a higher drive for thinness, lower self-evaluation, and perfectionism, which, in turn, correlates with eating disturbance (Bozzola et al., 2022) and stand as a risk factor, especially for teen girls. Moreover, the diffusion, normalization, and massive exposure to "perfect body posts" (Popat & Tarrant, 2023) and to "thin-ideal" imagery (Chung et al., 2021, Memon et al., 2018) mainly through photo-related activities (Schønning et al., 2020), can contribute to body image dissatisfaction, body shame (McCrae et al., 2017) higher levels of self-objectification, body image concerns and desire for cosmetic surgery (Course-Choi & Hammond, 2021).

Deliberate self-harm and suicidality. Deliberate self-harm (DSH) prevalence is unknown due to limited hospital attendance. Still, some data points toward an increase in the prevalence of DSH among adolescents (Moss et al., 2023). Moreover, suicide is the third cause of death among 15-29-year-old girls and the fourth for boys (World Health Organization, 2023). Therefore, using SM to access and post DSH content is a societal concern since it can lead to normalization, desensitization and social contagion or competition (Cataldo et al., 2021, Memon et al., 2018, Moss et al., 2023). Adolescents may share content related to DSH and suicidal ideation on SM to fulfil the need to belong to a group and to seek validation and social support. The feedback provided to this kind of content is difficult to manage, since it can offer positive support while, on the other side, it can be perceived as positive reinforcement (Moss et al., 2023). The analysis of the possible SM influence on suicidality is particularly complex due to the indirect and complex associations between the two. Moreover, there is evidence that online victimization and cyberbullying may lead to increased DSH and suicidal ideation (Hamm et al., 2015, Sedgwick et al., 2019, Vidal et al., 2020).

4.3. Ways forward

This section aims to provide recommendations to the research community, based on the findings of our umbrella review to enhance our comprehension of the relationship between SMU and adolescents' well-being and mental health, as summarized in Table 5. Our focus will be on both methodological recommendations to increase the strength of the collected scientific evidence and on perspectives for future research.

4.3.1. Methodological recommendations

Design. Most of the research conducted so far to study the relationship between social media use and mental health outcomes is cross-sectional. Therefore, it does not allow inferences on the directionality and causality of this relationship. Many authors (Cataldo et al., 2021, Schønning et al., 2020, Vannucci et al., 2020, Zhou & Cheng, 2022) underline the need to implement longitudinal research and ecological and ethical experimental design (Liu et al., 2022, Sarmiento et al., 2020, Shankleman et al., 2021) that would provide insights on the temporal nexus of the relationship. This would allow, for example, observing if SMU at time one impacts well-being or mental health measures at time two or vice versa. At the same time, longitudinal studies would allow us to explore the long-term within-person impact of SMU (Shankleman et al.,

Table 5
Summary of identified ways forward.

Methodologies	– Longitudinal design
	– Objective data collection vs self-reports
Research areas	– Platforms frequently employed by adolescents
	– Integration of psychological and computer-mediated communication theories
	– Impact of platform affordances and design
	– Short and long-term impact, mediating and moderating factors
Risk mitigation	–Educational interventions
	– Appraisal of SMU in clinical assessment and increased online presence of mental health practitioners
	– Platform preventive measures

2021). Moreover, standardized tools and protocols for higher replicability and validity of the experimental results are important (Course-Choi & Hammond, 2021, Liu et al., 2022, McCrae et al., 2017). Qualitative research is also crucial to generate theories (Shankleman et al., 2021) to understand better how adolescents describe their motivation, uses and expectations from SMU. It would also allow us to know better adolescents' coping mechanisms to face unwanted outcomes (McCrae et al., 2017) and the perceived impact on their well-being and mental health (Sarmiento et al., 2020, Schønning et al., 2020), consequently increasing the validity of the interpretation of the results.

Data collection. The vast majority of the research relies on retrospective self-reported estimations of the overall time spent on social media (or even on an estimation of "screen time") that are subject to both under-estimations and over-estimations for cognitive, affective or defensive reasons (Course-Choi & Hammond, 2021). Therefore, authors call for gathering objective data tracing online activity (Cataldo et al., 2021, Shankleman et al., 2021) or collecting data directly from the devices (Ivie et al., 2020). This would allow for collecting data on the kind of use, the received feedback, and the actions performed online, going beyond the measurement of frequency and time of use, a common limitation of many current studies (Schønning et al., 2020, Vidal et al., 2020). Authors also call for consistently using reliable and validated instruments to measure mental health outcomes since using different scales or diagnostic criteria contributes to the variability across studies (Liu et al., 2022, Sarmiento et al., 2020). In addition, to reach a more nuanced understanding of risks and opportunities associated with SMU, researchers should adopt designs that allow distinguishing the results based on gender and the different developmental stages (Bottaro & Faraci, 2022, Ivie et al., 2020, Keles et al., 2020, Moss et al., 2023) Finally, we observe an over-representation of white adolescent students living in the global North, so-called WEIRD (Western, Educated, Industrialized, Rich and Democratic) bias. Therefore, there is a need to widen the scope of the research in terms of cultural diversity and include adolescents belonging to ethnic minorities and living in the global South (Liu et al., 2022, Senekal et al., 2023) as well as consider the specific socio-cultural and historical settings in which data are collected to interpret them better (Sarmiento et al., 2020).

4.3.2. Research opportunities

Changes in SM functionalities, ways of online interactions and users' preferences occur extremely fast, representing a significant challenge for researchers to keep pace and for the development and use of validated tools to describe and measure SMU (McCrae et al., 2017). In this regard, it is remarkable that, despite adolescents having abandoned Facebook as a preferred platform (Pew Research Center, 2022), it is still the most frequently examined in the included reviews (Course-Choi & Hammond, 2021, McCrae et al., 2017, Webster et al., 2021, Varona et al., 2022, Bottaro & Faraci, 2022, Bozzola et al., 2022). Only one of the articles included in this umbrella review focused on a specific SM, Instagram (Moss et al., 2023), while the reflection on the specificities of platforms widely used, such as TikTok or Snapchat, still leaves room for a more granular analysis. Therefore, some researchers suggest that future research should not only focus on specific platforms, avoiding

generic reference to SMU, but also on specific affordances that are common across platforms and appear to be more stable than the platforms themselves (Sarmiento et al., 2020).

Future research should also build on interdisciplinary theoretical frameworks that integrate elements of developmental and clinical psychology, social media, and computer-mediated communication theories (McCrae et al., 2017, Sarmiento et al., 2020).

Regarding the *user level*, a better understanding of the relationship between SMU and mental health outcomes should differentiate between boys and girls and account for different ages and developmental stages (Bottaro & Faraci, 2022, Ivie et al., 2020, Keles et al., 2020, Shankleman et al., 2021). In addition, a more nuanced understanding of the impact of different kinds of use (e.g. passive vs. active use) and motivation to use (e.g., to connect with friends vs. as a mood regulation strategy) is still needed (Schønning et al., 2020, Vidal et al., 2020). Moreover, the influence of intervening factors to mitigate or increase the risk of an adverse mental health outcome is still to be investigated, as well as a fine grained description of mediating and mitigating factors (Keles et al., 2020, Shankleman et al., 2021). For example, future research should address the impact of socioeconomic status, the quality of parental relationships (Vidal et al., 2020), and offline social networks (Webster et al., 2021). Pre-existing mental health and psychosocial vulnerabilities (Course-Choi & Hammond, 2021, Nolan et al., 2017), the interconnection between offline and online social networks (Zhou & Cheng, 2022), the role of gender, ethnicity and culture (Shankleman et al., 2021) or the influence of peers (Chung et al., 2021) should also be further examined.

Another aspect to be further researched refers to the positive effects of SMU on adolescents' well-being and mental health, such as those derived from the opportunity to contact with others who share similar circumstances or interests (Nolan et al., 2017) or to receive online peer and professional support (Schønning et al., 2020).

At *the platform* level, the impact of specific affordances granted by SM should be further examined, such as the reward system triggered by the platforms' design (McCrae et al., 2017), the effects of the exposure to risk behaviours, and the quantifiable peer reinforcement of displaying risk behaviours online (Vannucci et al., 2020). The effects of different types of actions such as creating multiple accounts, scrolling, posting, reading (Schønning et al., 2020), (un)following, (un)tagging, as well as being (un)followed or (un)tagged (Cataldo et al., 2021) should also be carefully examined. Additionally, the impact of specific platforms on adolescents engaging in deliberate self-harm activities needs to be understood better. Furthermore, platforms that are massively used by younger generations, such as Snapchat or TikTok, are currently understudied (Chung et al., 2021).

Finally, the temporal scope seems another avenue for research, as the immediate and long-term impact of frequent SMU on neural structures (Cataldo et al., 2021) and the specific mechanisms underlying the emergence of different mental health outcomes (e.g., deliberate self-harm versus ADHD) are still to be clarified (Schønning et al., 2020).

4.4. Risk mitigation

Among the risk mitigation strategies for adolescents' mental health, the analyzed articles discuss i) educational interventions, ii) clinical implications for mental health practitioners and iii) platform preventive measures.

4.4.1. Educational interventions

Education is widely recognized as a fundamental tool to empower adolescents to benefit from the opportunities offered by SMU while buffering the adverse side effects. Educational interventions in formal, non-formal and informal settings should address the following aspects:

- **Digital competences** to promote safe, responsible, and healthy SMU and online behaviour (Popat & Tarrant, 2023). Informing about the adverse effects of excessive use and the strategies platforms employ to maximize users' engagement can also empower to healthier use.
- **Socio-emotional competences**, such as self-awareness, help increase awareness about one's motivation for SMU and its effects on mood. Self-regulation, emotional regulation techniques, self-esteem and social skills (Moss et al., 2023, Bottaro & Faraci, 2022) can provide valuable tools to manage the time spent on SM consciously and move beyond restrictive instruction of screen-time management (Shankleman et al., 2021).
- The intentional promotion of **self-acceptance** and body positivity can also help challenge the unrealistic body standards presented in SM (Popat & Tarrant, 2023).
- Educational interventions should also provide strategies to prevent and cope with **cyberbullying** due to its potentially extreme impact on mental health and well-being (Hamm et al., 2015).
- To reduce the stigma and the misinformation around mental health, **mental health literacy** could also contribute to identifying early signs of mental suffering and promote help-seeking from mental health professionals (Memon et al., 2018, Sedgwick et al., 2019).
- **(Mental) health professionals, teachers, parents and caregivers** would also benefit from evidence-based educational interventions and guidelines on the risks and opportunities of SMU and how to negotiate healthy use patterns (Liu et al., 2022, McCrae et al., 2017).

4.4.2. Clinical implications

(Mental) health practitioners should include questions on SMU in their assessment for early detection of warning signs of possible negative impacts and introduce the discussion on mental health (Vidal et al., 2020). Moreover, there is a call to offer online psychological support and to increase the presence and engagement of mental health professionals on social media, to promote reliable information on mental health, and gain youth access, particularly to those at risk of developing eating or mood disorders or self-harm behaviours (Memon et al., 2018, Moss et al., 2023).

4.4.3. Platforms' preventive measures

Platforms are also called to take dynamic and evolving measures to minimize the risks associated with using their services. Some authors of the reviewed studies suggest that the platforms should leverage their resources to detect and effectively mitigate against potential systemic risks, such as the uploading, recommendation and spread of disturbing content, particularly on suicidal ideation (McCrae et al., 2017, Sedgwick et al., 2019), pro-eating disorder, pro-self-harm Moss et al. (2023), incitation to violence and cyberbullying (Hamm et al., 2015). In addition, social media platforms should also ensure that the feature to report content not complying with their policies is readily available to users and promptly remove that kind of content. In Bottaro and Faraci (2022) and Popat and Tarrant (2023), there is support for removing the "like" feature, which is seen as promoting approval-seeking behaviour, social

comparison, and undermining self-acceptance and self-worth when desired feedback is not received.

Notably, the literature highlights the need for platforms to support users' mental health, adopt specific codes of conduct, and involve mental health specialists and young people in designing their interfaces (McCrae et al., 2017, Moss et al., 2023). It is relevant to stress that, as we discuss in section 5.2, there is an increasing reflection in the human-computer interaction area on how to employ design features that not only minimize possible harm to users but also can promote well-being. A final consideration is on using social media for advertising and digital marketing of unhealthy food or products targeting minors, which is considered a risk factor for unhealthy behaviours and should be restricted (Bozzola et al., 2022).

5. Discussion

5.1. One size doesn't fit all (adolescents nor platforms)

We have presented in Section 4.1.1 how demographic characteristics, such as gender and age, emerge as determining factors when studying the different implications of SMU. Moreover, according to a recent study by Orben et al. (2022), due to different developmental processes, higher social media use during certain windows of sensitivity that are age and sex-specific (ages 11-13 and 19 for girls and 14-15 and 19 for boys) can decrease life satisfaction one year later. Still, primary research does not always account for those fundamental differences, presenting the results in a way that does not allow differentiation for gender or age. Further distinctions are often overlooked when considering adolescents as a *general population*, limiting the generalizability of research findings. We provide a few examples of literature reviews that move in a different direction, providing insights into specific populations of adolescents.

Ghai et al. (2022) examine the research literature on social media and adolescent well-being in the Global South (Sub-Saharan Africa, Middle East and North Africa, South and Southeast Asia, China and Latin America). As evidenced while focusing on the impact of SMU on adolescent depression, despite the global nature of such phenomenon, most studies examine Global North populations (Ghai et al., 2023). Similarly, Opara and Santos (2019) centre their analysis on Latina adolescents, providing evidence of how eating disorders and body dissatisfaction may be mediated by ethnic and cultural identity, and stressing the importance of intersectional perspectives. Furthermore, sexual and gender minorities are often left aside, also due to the widespread use in research of binary gender classification (Girls/Boys), and Escobar-Viera et al. (2021) and Berger et al. (2022) provide insights on the aspects that should be considered whilst interacting with LGBTQI+ youth.

These reviews emphasise the need to conduct more inclusive research, developing a more fine-grained view of adolescents' use of social media and its impacts on their mental health and well-being. Collecting subjective data on adolescents' experience, motivation to use, and attitudes toward SMU is crucial for obtaining a deeper understanding of the possible impact on mental health. At the same time, we stress the relevance of gathering high-quality and updated at-scale data on the trends related to SMU and the mental health status of adolescents. This is particularly relevant to develop effective and tailored digital health interventions, avoiding homogeneous treatment options.

In the same way that different populations need to be studied with dedicated approaches, also social media platforms can hardly be considered a homogeneous category due to their distinct design, use, and types of interaction. Most of the reviews analysed in this research include *social media use* as a general term in their research questions. However, as we pointed out in Section 4.3.2, this often results in focusing only on a few platforms, which may not be the most frequently used by adolescents nowadays. Reviews that target specific platforms (e.g., Instagram in Moss et al. (2023), may be more informative on the effects of SMU on adolescents' mental health and, therefore, more helpful

in developing practices which may limit the possible negative impacts. Especially in an ever-changing panorama where digital platforms may emerge and decline in less than a decade, we believe that it is important to monitor the use of both the widespread and emerging social media, considering also that adolescents are often the first adopters of new technologies. Particular attention should be paid to the development of virtual worlds, often referred to as *metaverses*, and the use that adolescents will make of them, wherein new forms of social networks and social media are appearing and eventually going to appear more in the near future (Hupont et al., 2023).

5.2. Sharing responsibilities: from individuals to platforms

In addressing risk mitigation, as reported in Section 4.4, the majority of the recommendations provided in the reviewed articles focus on the relevance of implementing educational interventions to increase adolescents' capacity to self-regulate their use of SM. On the other side, for SM platforms, there are recommendations for addressing both the dissemination of disturbing content (Moss et al., 2023) and the negative effects of the "like mechanism" (Bottaro & Faraci, 2022, Popat & Tarrant, 2023). In other words, the primary locus of responsibility for healthy use of SM is put on individual users and families. At the same time, there is a limited reflection on platforms' active strategies to maximise engagement and their consequent responsibility in terms of risk mitigation (Radesky & Hiniker, 2022, Flayelle et al., 2023). Notably, as reported in Section 4.1.3, the articles included in our review analyse this aspect only tangentially.

Nevertheless, the design of SM platforms plays an essential role in shaping users' behaviour, promoting or hindering their healthy use. Researchers are increasingly analysing the use of persuasive design techniques and dark patterns that exploit principles of behavioural psychology (Owenz & Freed, 2021), to maximise users' time and engagement on SM (Griffiths, 2018) and are considered as addictive features by Montag et al. (2019).

Mildner et al. (2023) classified two broad kinds of strategies to influence users' decision-making on SM: *Governing strategies* aimed at influencing their decision-making, nudging users into desired directions and *Engaging strategies* aimed at increasing the time users spend on SM.

Among the last, they include features such as *autoplay content*, in which content automatically starts without initiation of the user; *infinite scrolling*, in which the feed loads automatically without any endpoint; *gamification*, the use of playful elements that motivate users to do something (e.g. provide additional personal data) by presenting artificial progress; *pull to refresh* to tease surprise, encouraging to check the next batch of content (Mildner et al., 2023).

Likewise, Flayelle et al. (2023) analyse how technology design can promote problematic online behaviours and identify several features designed to prolong the time spent on SM and its repeated checking. Among those is the *"like mechanism"* that provides the user with quantifiable forms of social acceptance, which is a powerful motivator for engagement, especially for adolescents; the *"double tick"* function, which indicates that a message has been received and read, that amplifies the social pressure to reply quickly, or the *"push notifications"* that prompt users to open SM to check a new message, mention or post encouraging automatic checking behaviours.

The same design elements are included in a report from 5Rights Foundation (2023), which, building on the taxonomy of commercial dark patterns published by the OECD (2022), describes features of persuasive design used in products popular among children.

Adolescents are particularly vulnerable to those kinds of persuasive design strategies, among others, due to their evolving capacities and the relevance of peers' social acceptance for the identity formation process (Owenz & Freed, 2021). Therefore, as recommended in the *Health Advisory on Social Media Use in Adolescence* issued by the American Psychological Association (2023), those specific features "should be tailored to the social and cognitive abilities and comprehension of ado-

lescent users" (p. 5). That is, as stressed by The UN General Comment 25 on children's rights in relation to the digital environment (Committee on the Rights of the Child, 2021), it should be ensured that "in all actions regarding the provision, regulation, design, management and use of the digital environment, the best interests of every child is a primary consideration" (p.3)".[4]

Moreover, researchers are starting to critically analyse the personal and societal side effects of SM's current data-driven business model (which relies on maximising users' engagement to make a profit on their digital footprint) and to discuss alternative models (Dhawan et al., 2022, Sindermann et al., 2020, Montag & Elhai, 2023). At the same time, the ethics of using manipulative design strategies (Sanchez Chamorro et al., 2023, Owenz & Freed, 2021) is being increasingly questioned, and researchers from the Human-Computer interaction field are exploring design features to support digital well-being (Roffarello et al., 2023).

An ethical design (Owenz & Freed, 2021) that considers users' best interests, particularly of vulnerable groups such as children and adolescents, would likely introduce a systemic change to achieve a population-level shift, which is harder to achieve if the burden of responsible use is only attributed to individuals' choices (Radesky et al., 2022, Montag et al., 2022).

5.3. Regulatory frameworks and research

Thanks to the worldwide effort of several research communities, it has been possible to identify the best practices, what is missing, and what should be done in future to ensure that adolescents may experience and enjoy safely social media platforms. The extensive amount of research on the impact of SMU on adolescents' mental health and well-being has been crucial for informing policy-makers and civil society about the risks and opportunities (Section 4.2) that may arise while interacting with those platforms. Nevertheless, scholars' independent research and public scrutiny, e.g., on the possible effects of specific features of persuasive design, is hindered by the lack of access to social media data, particularly after the severe restrictions of access to platforms' data via their Application Programming Interface (Bruns, 2019), and due to the lack of transparency regarding the results of the A/B test conducted by SM platforms (Sultan et al., 2023).

As the last point of discussion, we focus hereafter on how the dialogue between scientific communities and policy-makers has contributed to the emergence of legislative actions, codes of conduct, and other kinds of policy frameworks which have been informed by prior research but at the same time could be informative for future research endeavours.

The UN General Comment 25 (Committee on the Rights of the Child, 2021) invites States parties to implement "legislation, regulations, and policies to ensure compliance by businesses with their obligations to prevent their networks or online services from being used in ways that cause or contribute to violations or abuses of children's rights [...]". Moreover, States parties should "also encourage businesses to provide public information and accessible and timely advice to support children's safe and beneficial digital activities". Likewise, the recent US Surgeon General's Advisory *Social Media and Youth Mental Health* (2023), which collects and discusses evidence of the potential benefits and harms of SMU by adolescents, stresses the role that policy-makers have in ensuring that "technology companies share data relevant to the health impact of their platforms" and supporting "increased funding for future research on both the benefits and harms of social media use" (p. 15).

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[4] This Convention translates the rights derived by the Convention on the Rights of the Child (i.e. any person until 18 years) to the digital world. These are: Non-discrimination, Best interest of the child, Right to life survival and development, and Respect for the child's views. On Artificial Intelligence and the rights of the child, see also Charisi et al. (2022).

The former points are in line with the provisions taken in the recently enforced EU's Digital Service Act (DSA) (European Commission, 2022), particularly with Article 40, which specifies that Very Large Online Platforms (VLOPs) and Very Large Search Engines (VLSEs), i.e., those with more than 45 million users per month in the EU, should provide to researchers access to data, in different forms and under different procedures, for performing research that contributes to the detection, identification and understanding of systemic risks in the EU. Among the categories of identified systemic risk in the DSA, recital 83 indicates that "A fourth category of risks stems from similar concerns relating to the design, functioning or use, including through manipulation, of very large online platforms and very large online search engines with an actual or foreseeable negative effect on the protection of public health, minors and serious negative consequences to a person's physical and mental well-being, or on gender-based violence". Several of the already designated VLOPs are indeed SM platforms (Facebook, Instagram, Tik-Tok, Snapchat, X - formerly Twitter),[5] meaning that under the DSA, researchers will soon start to have more access to data to study the impact of SMU on adolescents' mental health and well-being.

The General Data Protection Regulation (GDPR) has paved the way for a new method of collecting digital data, granting SM' users the right to access their data held by the SM provider through the so-called Data Download Package and share it with researchers via data donation (Pfiffner & Friemel, 2023). Similarly, the Digital Services Act (DSA) is expected to create new opportunities for research of public interest on the potential societal risks posed by the VLOPs and the VLSEs in the European Union.

Another example of regulatory effort which takes a different form is the code of practice for online services redacted by the UK's Information Commissioner's Office (2022). Directed more generally to providers of information society services and not only to social media providers, the code discusses the main actions providers should take while processing children's data to comply with the GDPR and the Privacy and Electronic Communications Regulations (PECR). In particular, it introduces the concept of *detrimental use of data* as "[...] any use of data that is obviously detrimental to children's physical or mental health and well-being". The code also includes guidance on children's profiling based on personal data to suggest content, such as avoiding features that use personal data to manipulate human tendencies towards seeking rewards, anticipation, pleasure, or peer pressure, as we previously discussed in Section 5.2. Lastly, it is important to notice that the code of conduct also refers to the United Kingdom Chief Medical Officers (2019)'s commentary, which takes a broader approach to discussing the impact of screen-based activities on children and young people's mental health and psychosocial well-being and reviewing the existing literature.

As observed by Takhshid (2021), also in terms of regulatory actions, a significant discrepancy exists between Global North and Global South, even if in non-Western countries provisions for protecting adolescents, and more in general minors, are being developed, such as the *Guidelines for the Establishment of Minors' Modes for the Mobile Internet* redacted by the Cyberspace Administration of China (2023).

In conclusion, the examples above provide a limited, not comprehensive, and Western-centric perspective of how the dialogue between the research community and policy-makers has been instrumental, on one side, in informing current policies, on the other side, to help scholars by designing tailored measures which could help their future research endeavours.

6. Conclusions

We have presented in this work a systematic review of reviews centred on adolescents' mental health and well-being and its relation to social media use. Throughout the thematic analysis of the included reviews, we have evidenced the main intervening factors mediating the relationships between adolescents SMU, mental health and well-being, among which we have identified demographic and psycho-socio characteristics, kinds of use of SM, and the platforms' content and design. Moreover, we have highlighted several opportunities and risks for adolescents interacting with social media, stressing how positive and negative consequences should be addressed. Our study identifies the main methodological recommendations, research opportunities, and risk mitigation strategies that may help guide future research.

In conclusion, we reiterate the need for research considering specific groups of populations and specific platforms' design and mechanisms to provide more fine-grained evidence of the potential impact of SMU on adolescents' well-being. We envision a change of direction while designing risk mitigation techniques, putting the responsibility for healthy use of social media not only into the hands of adolescents and families but also making SM platforms more accountable for their engaging and governing strategies, potentially at the root of negative impacts. Together with this, it is important to raise awareness of the ongoing dialogue between research communities and policy-makers, to make research endeavours even more impactful, and to define regulations which can be helpful for future research by giving access to SM platforms' data in a transparent and fair way.

CRediT authorship contribution statement

Arianna Sala: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. **Lorenzo Porcaro:** Writing – original draft, Writing – review & editing, Formal analysis, Methodology, Validation, Visualization, Data curation. **Emilia Gómez:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Supplementary materials have been submitted.

Appendix A. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.chbr.2024.100404.

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[5] According to the designated platforms at the time of the writing of this paper. https://digital-strategy.ec.europa.eu/en/policies/dsa-vlops

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